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THE YIELD AND AGRONOMIC CHARACTERISTICS OF SILAGE MAIZE CULTIVARS GROWN UNDER KIRSEHIR ECOLOGICAL CONDITIONS

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The research was carried out under Kirsehir ecological conditions during 2016 and 2017 vegetation period with three replications according to a randomized block design. The aim of the study was to determine some agronomic characteristics of ten hybrid and one composite maize cultivars under Kirşehir ecological conditions in Turkey. Mean values of two-year data showed that plant height ranged from 234.7 to 265.7 cm, stem thickness from 27.7 to 30.8 mm, tassel emergence time from 69.8 to 79.0 days, commencement of silking time from 71.5 to 81.7 days, number of leaves from 13.5 to 16.3 leaf plant^{-1}, leaf/stem ratio from 43.7 to 61.3%, the number of cobs from 1.3 to 1.8 cob plant^{-1}, cob ratio from 38.0 to 44.6%, and cob yield from 25.2 to 39.1 tons ha^{-1}. Kerbanis, Karadeniz Yildizi and Samada-07 cultivars in Kirsehir ecological conditions yielded satisfactory results in terms of agronomic characteristics and cob yields.
Keywords: Maize cultivars, Agronomic characteristics, Yield.

INTRODUCTION

Animal production in Turkey is low despite the important potential in the country. Improper use of quality forage sources is the main reason of low animal production. Pastures and grasslands, which are the most important sources of animal nutrition, have lost their efficiencies due to continuous, intensive and irregular grazing throughout a year when no snow cover exists (Yavuz and Karadağ, 2016). Farmers do not sufficiently access to high quality forage sources. Therefore, the resulting forage gap is compensated by herbaceous wastes which are meager to meet the daily needs of animals feed. Since there is a linear relationship between feeding and animal production, lack of adequate quality forage directly affects the yield characteristics of animals. Kirsehir province has approximately 223.000 cattle, 268.000 ovine (small ruminants) and approximately 137.000 cattle units (Anonymous, 2018a). The annual quality forage requirements of these animals are about 616.000 tons. However, 40.000 tons year^{-1} of quality forage is produced from the 129.000 ha pasture. Total forage crop production in Kirsehir province based on the statistics of 2018 was 98.000 tons which was in the form of 60.000 tons of silage maize, 18.000 tons of alfalfa, 9.000 tons of sainfoin, 6.000 tons of vetch and 5.000 tons of oats, and total quality forage production was 128.000 tons (Anonymous, 2017b). Considering the required and produced forage feed, high-quality forage problem in the province is even more serious than the whole country.

High quality, abundant and inexpensive forage, needed in a short time, can be obtained from silo forage plants. Silage with high water content is used extensively in animal nutrition in recent years, which minimizes the nutrient loss in the produce (Geren, 2001). The ecological conditions of Turkey facilitate the cultivation of many forage plants suitable for silage production. Although many plants are used in silo feed production, mostly maize and sorghum species and hybrids are frequently used for silage. Since the number of silage cultivars registered in the country is quite low, the producers unconsciously cultivate seed maize cultivars as silage maize. Adaptation experiments to determine the cultivars with high silage yield and quality suitable for the region is of great importance to solve forage problem. The interest of producers on silage maize is increasing day by day due to the increasing number of livestock farms in Kirsehir province. However, the lack of information on silage maize in the region is not to be underestimated. Since cobs compose 50% of yield and 70% of quality of silage, Açıkgöz (1995), Orak and İptaş (1999) and Kuşvuran *et al.* (2015) stated that silage maize cultivars with a high number of cobs along with high yield should be preferred. Karadağ and Balmuk (2013) found that the plant height and yield of a composite (Karadeniz Yildizi) and 13 hybrid maize cultivars (Homeris, Luce, Consor, DK 626, ADV 2898, Prisca, Trojan, Simon, Bolson, Hido, Turtop, Samada07 and Mataro) ranged from 209.7 to 274.2 cm, and 9.2 to 24.4 tons ha^{-1}, respectively. Öner (2015) reported that the highest yield among 24 maize cultivars was obtained from the earliest cultivars in the study conducted at three different locations. Yilmaz *et al.* (2017) evaluated the adaptation capability of some maize cultivars under Kahramanmaraş ecological conditions. Tasseling time, plant height, cob/plant ratio and leaf/stem ratio were reported between 65 to 68 days, 246 to 299 cm, 38.2 to 44.2%, and 39.5 to 48.3%, respectively. In this study, some agronomic characteristics of maize cultivars registered and have production permissions have been investigated under Kirsehir ecological conditions.

MATERIALS AND METHODS

This research was carried out under Kırşehir ecology conditions (39° 08 'K, 34° 06' D and 1084 m height) during 2016 and 2017. Ten hybrids (Kerbanis, Motril, Atlas, Colonia, Klips, Kalusses, Kilowatt, Kalumet, Doge, Samada-07) and one composite (Karadeniz Yildizi) maize cultivars was used as material of the experiment. The soil of study area was clayey loam texture, slightly alkaline (pH 7.96), non-saline (0.02%), highly calcareous (35.29%), low in organic matter (1.09%) and available phosphorus (19 kg ha^{-1}) and rich in potassium (480 kg ha^{-1}) (Aydeniz and Brohi, 1991). Data provided by the State Meteorology Department for 2016 and 2017 and long-term averages showed that monthly average temperatures were 22.3, 22.4 and 21.0°C and total precipitations were 63.9, 34.8 and 66.4 mm, respectively (Table 1). The average temperature in both years was above the long-term averages, while the total precipitation was below the long-term total precipitation (Table 1).

The maize needs 400-7500 mm water during the vegetation period. Where the total rainfall is insufficient, the amount of water corresponding to the rainfall must be met by irrigation system (Çarpici, 2016; Kuşvuran *et al.,* 2015). The experiments were conducted on June 2, 2016 and 2017 with three replicates and designed as randomized blocks. Maize cultivars were sown in four rows at 70 cm inter row and 20 cm intra row spacings. The plot size was 2.8 m x 5 m, 14 m^2. Total phosphorus (80 kg ha^{-1} P_2O_5 as Triple Super Phosphate) and half of the nitrogen (75 kg ha^{-1} N) fertilizers were applied at the time of sowing, while the remaining half nitrogen when plant height was 45-50 cm (Erdal *et al.,* 2009; Ayaz *et al.,* 2013). Silage maize harvest was carried out in two rows outside the side effect at the dough stage (Keleş and Türk, 2018). Based on the methods applied by the researchers (Emeklier, 1987; Ergül, 2008; Özata and Kapar, 2013; Bulut, 2016; Seydoşoğlu and Saruhan, 2017) plant height, stem diameter, tasseling time, silking time, number of leaves, leaf/stem ratio, number of cobs per plant, cob ratio was recorded. Results were subjected to the analysis of variance according to the randomized block experimental design using MSTAT-C statistical software. Differences in the data were compared by the LSD method (Petersen, 1994).

RESULTS AND DISCUSSION

Plant height (cm): Plant height was significantly different (P<0.01) between cultivars and years. The effect of cultivars on plant height varied between years which caused a significant cultivars x year interaction (Table 2). Karadeniz Yildizi cultivar had the highest (268.2 cm) while Atlas cultivar had the lowest (234.7 cm) plant height. Plant height is one of the important factors that determines the production capacity of maize due to the effect on genotype and environmental interaction (Güneş and Acar, 2006). Choosing tall maize cultivars which are suitable for the region is important to obtain higher yields. The plant height (285.3 cm) in the first year was higher than the second (226.3 cm) year (Table 2). The height of maize, which is a hot season crop, increases with the increased temperature (Ileri *et al.*, 2018). The higher temperatures in July and August of the first year compared to the second year positively affected the plant height. İn the first year there were no significant differences between cultivars with respect to plant height. In the second year, the differences between the cultivars caused different interaction of the cultivar x year. Mean maize height (255.8 cm) is higher than those reported by Bulut (2016), Kuşvuran *et al.* (2015), Karadağ and Balmuk (2013) and Karadağ and Akbay (2013), while lower than found by Seydoşoğlu and Saruhan (2017). The differences in plant heights were resulted from the differences in responses of the cultivars cultivated under different environmental conditions such as soil, temperature, humidity, and rainfall. Similarly, Hallauer and Miranda (1987) stated that the difference in genetic factors of cultivars results in differences in plant height of maize cultivars.

Stem diameter (mm): Stem diameter was significantly different between cultivars (P<0.05) and years (P<0.01) (Table 2). The interaction of cultivar x year become statistically important due to the significant effect of cultivars on stem thickness. Motril had the thickest (30.8 mm), while Atlas had the thinnest (26.7 mm) variety. The variation in the stem thicknesses is due to the genetic characteristics of the cultivars used in the experiments (Atış *et al.*, 2013).

Table 1. Meteorological data of the experimental site.

Months	Mean Temperature (°C)			Total Precipitation (mm)		
	2016	2017	Long Term	2016	2017	Long Term
June	21.0	20.7	19.6	16.1	18.4	36.8
July	24.2	23.9	23.1	5.8	0.4	6.8
August	25.7	23.5	22.9	-	16.0	4.9
September	18.4	21.4	18.2	42.0	-	11,6
Mean	22.3	22.4	21.0			
Total				63.9	34.8	66.4

Table 2. Plant height and stem diameter of silage maize cultivars.

Cultivars	Plant Height (cm)			Stem Diameter (mm)		
	2016	2017	Mean	2016	2017	Mean
Kerbanis	293.7	212.9 bc++	253.3 abc++	26.3 c++	30.8	28.5 bc+
Motril	276.2	230.1 ab	253.2 abc	28.5 ab	33.1	30.8 a
Atlas	278.0	191.3 c	234.7 c	26.9 bc	30.8	28.9 abc
Karadeniz Yıldızı	290.3	246.1 a	268.2 a	28.8 ab	29.0	28.9 abc
Colonia	273.0	233.6 ab	253.3 abc	28.6 ab	29.5	29.1 abc
Klips	290.4	237.7 ab	264.0 a	28.4 ab	28.9	28.6 bc
Kalusses	290.6	239.5 ab	265.0 a	29.7 a	31.3	30.5 ab
Kilowatt	292.2	239.1 ab	265.7 a	28.3 ab	32.5	30.4 ab
Kalumet	258.5	221.3 ab	239.9 bc	26.8 bc	28.7	27.7 c
Doge	295.0	225.3 ab	260.2 a	25.0 c	32.0	28.5 bc
Samada-07	300.7	211.9 bc	256.3 ab	28.4 ab	32.1	30.2 ab
MEAN	285.3 A++	226.3 B	255.8	27.8 A++	30.8 B	29.3
LSD (%5)	Y:8.1** C:17.2 YxC:24.3* CV:5.8			Y:0.3** C:0.6 YxC: 0.8** CV:5.4		

CV: Coefficient of variation. Y: Year, C: cultivar; ++ Means followed by the same letter in the same column are statistically not significant (p<0.01); ** Means followed by the same letter in the same line are statistically not significant (p<0.01).

Significant differences were found in stem thickness values between the years. The stem thickness (27.6 mm) in the first year was greater than those of the second year (30.3 mm) (Table 2). The stem diameter is closely related to the genetic characteristics of the variety. In addition, planting time, harvest time, sowing frequency and temperature can be influenced by factors such as (Seydoşoğlu and Saruhan, 2017). Years of little temperature changes have led to the interaction of cultivar x year. A higher proportion of stems in a forage containing substances such as cellulose, hemicellulose, and lignin, which are difficult to digest, is not desirable (Soya, 2005). The stem thickness of a tall plant like maize is important to prevent bending (Kuşvuran *et al.*, 2015). The stem thickness of maize cultivars under Kızılırmak ecological conditions were reported between 20.0 and 24.5 mm (Kuşvuran *et al.*, 2015), and between 17.2 and 20.2 mm under Amik plain (Atiş *et al.*, 2013). Variation in genetic characteristics and agricultural practices have resulted in differences in stem thickness of maize plants grown at two different studies carried out under Diyarbakir ecological conditions. Seydoşoğlu and Saruhan (2017) stated that stem thickness ranged from 20.1 to 28.4 mm while Kılınç (2018) indicated that stem thickness was between 20.5 and 23.5 mm under Diyarbakır ecological conditions.

Tasseling time (day)**:** Tasseling time was significantly different between years and cultivars (P<0.01), thus the interaction of year x cultivar was also significant (P<0.01). Tasseling times of Kerbanis and Atlas cultivars were shorter while tasseling times of Doge, Klips and Kalumet cultivars were longer. The average tasseling time of the cultivars was 74.7 days (Table 3). The average temperature in June, July and August of the first year was slightly higher than the second year, therefore the tasseling time was earlier in the first year compared to the second year. Importance of year x cultivar interaction indicates that tasseling time differed between the years of the study. Therefore, Motril and Kerbanis cultivars were included within the same statistical group in the first year while placed within the different groups in the second year (Table 3). Kün and Emeklier (1987) reported that tasseling time of maize is directly related to genotype and environmental interaction, and flowering time in cool and humid weather is prolonged whereas shortened in hot and dry weather. Çölkesen *et al.* (1997) indicated that tasseling time is shortened when planting time is delayed. The tassel emergence time obtained in this study was shorter than the finding of Bulut (2016) (78.8-88.5 days), similar to Kabakci (2014) (64.7-76.7 days), and higher than those reported by Yılmaz *et al.* (2017) (65-68 days), and Balmuk (2012) (60-68 days). The differences in tasseling time may be associated with the genetic structure of cultivars used in the experiments, total rainfall and average temperature in the vegetation periods in which the experiments carried out.

Silking time (day)**:** The difference in silking time was statistically significant at 0.01 level for cultivars and year factors and year x cultivar interaction (Table 3). Kaluses, Kalumet and Doge cultivars were late silking cultivars, while the earliest silking was commenced in Atlas cultivar. The average commencement of silking time for the cultivars was 77.0 days (Table 3). The tasseling emergence time and silking commencement time of cultivars were similar to each other and this similarity is observed in the statistical ranking of the cultivars. Han (2016) also stated the similarities between the times for emergence of tassels and commencement of silks which were also appeared earlier in the first year. The higher total temperature in the first year of the study led to the early appearance of the cob silks and emergence of tasseling. Atlas and Karadeniz Yıldızı cultivars were included in the similar statistical groups in the first year but grouped within different

Table 3. Tasseling time and silking time of silage maize cultivars.

Cultivars	Tasseling Time (day)			Silking Time (day)		
	2016	2017	Mean	2016	2017	Mean
Kerbanis	70.3 e ++	69.3 d++	69.8 f++	72.0 f++	71.0 d++	71.5 e ++
Motril	71.0 de	73.7 b	72.3 de	74.7 d	75.7 bc	75.2 d
Atlas	70.3 e	70.0 d	70.2 f	71.7 f	71.7 d	71.7 e
Karadeniz Yıldızı	71.3 de	74.3 b	72.8 d	73.0 ef	76.0 bc	74.5 d
Colonia	72.0 d	71.7 c	71.8 e	74.0 de	74.7 c	74.3 d
Klips	78.3 ab	79.3 a	78.8 ab	79.7 b	81.7 a	80.7 b
Kalusses	78.3 ab	79.0 a	78.7 ab	81.7 a	81.7 a	81.7 a
Kilowatt	76.3 c	78.3 a	77.3 c	77.7 c	81.0 a	79.3 c
Kalumet	77.3 bc	79.0 a	78.2 b	80.7 ab	82.0 a	81.3 ab
Doge	79.3 a	78.7 a	79.0 a	81.3 a	81.3 a	81.3 ab
Samada-07	71.7 d	73.7 b	72.7 d	73.7 de	76.3 b	75.0 d
MEAN	74.2 B++	75.2	74.7	76.4 B++	77.5 A++	77.0
LSD (%5)	Y:0.3** C:0.7 YxC: 1.0** CV:0.8			Y:0.4** C:0.9 YxC: 1.2** CV:0.9		

CV: Coefficient of variation. Y: Year, C: cultivar; ++ Means followed by the same letter in the same column are statistically not significant (p<0.01); ** Means followed by the same letter in the same line are statistically not significant (p<0.01)

Table 4. Number of leaves and leaf/stem ratio of silage maize cultivars.

Cultivars	Number of Leaves (leaf/plant)			Leaf/Stem Ratio (%)		
	2016	2017	Mean	2016	2017	Mean
Kerbanis	15.3 a-d++	14.2 ef++	14.8 cde++	53.8 abc++	51.1 bcd++	52.4 bc++
Motril	14.7 bcde	13.6 f	14.2 ef	46.5 bcd	51.1 bcd	48.8 bcd
Atlas	14.5 cde	12.5 g	13.5 g	61.6 a	60.9 a	61.3 a
Karadeniz Yıldızı	15.8 ab	15.2 bcd	15.5 b	46.3 bcd	42.6 d	44.5 de
Colonia	14.2 de	15.8 ab	15.0 bcd	54.9 ab	48.0 d	51.5 bc
Klips	13.6 e	15.7 abc	14.7 de	43.0 d	44.3 d	43.7 e
Kalusses	15.5 abc	15.1 b-e	15.3 bc	57.2 a	45.1 d	51.2 bc
Kilowatt	15.1 a-d	14.4 def	14.8 cde	63.3 a	58.0 ab	60.7 a
Kalumet	13.5 e	13.7 f	13.6 fg	61.8 a	57.2 abc	59.5 a
Doge	15.5 a-d	14.8 cde	15.1 bcd	58.0 a	49.1 cd	53.5 b
Samada-07	16.0 a	16.5 a	16.3 a	44.3 cd	50.2 bcd	47.3 cde
MEAN	14.9 A++	14.7 B	14.8	53.7 A++	50.7 B	52.2
LSD (%5)	Y:43.8** C:93.0 YxC: 131.5** CV:3.2			Y:2.2** C:4.7 YxC:6.6** CV:7.7		

CV: Coefficient of variation. Y: Year, C: cultivar; ++ Means followed by the same letter in the same column are statistically not significant (p<0.01); ** Means followed by the same letter in the same line are statistically not significant (p<0.01)

statistical groups in the second year. The silking commencement time was less than the silking commencement time reported by Akbay (2012) (76.3-91.3 days) and Bulut (2016) (81.8-91.5 days); however, more than those reported by Balmuk (2012) (63-71 days) and Kabakci (2014) (65.7 - 75.7 days). The differences in tasseling may be attributed as genetic characteristics of varieties used and the total rainfall and temperature differences in the vegetation periods.

***Number of leaves (leaf/plant)*:** The difference in the number of leaves between cultivars and years ($P<0.01$) was statistically significant which caused an important year x cultivar interaction (Table 4). Samada-07 cultivar had the highest number of leaves, while Atlas and Kalumet cultivars had a lower number of leaves than the rest of the cultivars (Table 4). Klips and Kalumet cultivars were in the same statistical group for the first year; however, were placed at the different groups in the second year of the study. Variation in number of leaves in Kips and Kalumet cultivars in years led to the importance of year x cultivar interaction (Table 4). The number of leaves for the main and second crop silage maize cultivars grown in different ecological conditions of Turkey was reported as 9.8 to 11.6 leaves/plant (Kabakci, 2014), 13.80 to 15.80 leaves/plant (Güneş and Acar, 2006), 10.2-12.0 leaves/plant (Bulut, 2016), 15.0 to 15.2 (Taş *et al.*, 2016) and 2.9 to 7.3 leaves/plant (Karadavut *et al.*, 2017). The number of leaves similar to the plant height in cultivars depend on the genetic structure; however, variation in the number of leaves significantly affects the silage quality and the feeding value (Hallauer and Miranda, 1987). Silage

Table 5. Number of cobs per plant and cob ratio of silage maize cultivars.

Cultivars	**Number of Cobs per Plant (cob/plant)**			**Cob Ratio (%)**		
	2016	**2017**	**Mean**	**2016**	**2017**	**Mean**
Kerbanis	1.6 abc++	1.6 a-d++	1.6 a-d++	42.7 abc++	41.7 abc++	42.2 bc++
Motril	1.4 bcd	1.9 ab	1.7 abc	38.3 c	38.2 c	38.3 e
Atlas	1.5 a-d	1.4 b-e	1.5 cde	40.7 abc	39.7 bc	40.2 cde
Karadeniz Yıldızı	1.6 a-d	1.5 b-e	1.6 b-e	44.7 a	44.6 a	44.6 a
Colonia	1.6 abc	1.7 abc	1.7 ab	38.4 c	38.3 c	38.3 e
Klips	1.3 d	1.4 cde	1.3 e	38.4 c	37.6 c	38.0 e
Kalusses	1.4 bcd	1.4 b-e	1.4 de	39.2 bc	38.6 c	38.9 e
Kilowatt	1.5 a-d	1.3 de	1.4 e	39.0 c	38.1 c	38.6 e
Kalumet	1.3 cd	1.5 b-e	1.4 cde	39.5 bc	39.2 bc	39.4 de
Doge	1.8 a	1.2 e	1.5 cde	41.8 abc	41.2 abc	41.5 bcd
Samada-07	1.7 ab	2.0 a	1.8 a	43.8 ab	43.1 ab	43.5 ab
MEAN	1.5	1.5	1.5	40.6	40.0	40.3
LSD (%5)	Y:0.1 C:0.2 YxC: 0.3** CV:10.9			Y:1.0 C:2.2 YxC: 3.0 CV:4.7		

CV: Coefficient of variation. Y: Year, C: cultivar; ++ Means followed by the same letter in the same column are statistically not significant ($p<0.01$); ** Means followed by the same letter in the same line are statistically not significant ($p<0.01$)

quality increases proportionally to increase in the number of leaves (Ergül, 2008).

***Leaf/stem ratio (%)*:** The leaf/stem ratio was significantly different between years and cultivars (P<0.01); thus, the year x cultivar interaction was also significant (P<0.01). Atlas, Kilowatt and Kalumet cultivars were included in high and Klips, Karadeniz Yıldızı and Samada-07 cultivars were in the low leaf/stem ratio statistical group (Table 4). The leaf/stem ratio in the first year (53.7%) was higher than the second year (50.7%) as in the number of leaves per plant. The difference in leaf/stem ratio is probably resulted from the diversity in the genetic structures of varieties as well as the differences in the environmental factors (temperature, precipitation, etc.) of the experimental years and the reactions of the varieties to the differences (Ileri *et al.*, 2018). Atlas and Kalusses cultivars were in the same statistical group in the first year whereas placed in different groups in the second year (Table 4). The high percentage of leaf in forages is a desired indicator of the digestibility and consumability of the herb. Leafy plants are preferred by animals. The leaves are more delicious than the stems, therefore, animals consume the leaves first and then the less delicious stems. Higher cellulose ratio causes low leaf/stem ratio which decreases the consumption of forage by animals. Heath *et al*. (1985) indicated that high-quality silage contains higher cob, leaf/stem ratio, and crude protein ratio and low lignin. The studies conducted under various ecological conditions indicated that the leaf/stem ratio significantly varies depending on ecological conditions and genetic characteristics of the cultivars. Average two-year leaf/stem ratio ranged from 42.3 to 61.3%. The leaf/stem ratio values were reported varying from 38.6 to 66.0% in Tekirdağ (Moralar, 2011), 26 to 43% in Samsun (Öner *et al*., 2011) and 41.5 to 50.7% in Tokat ecological conditions (Günen, 2016).

***Number of cobs per plant (cob/plant)*:** The number of cobs per plant significantly varied between cultivars (P<0.01), and therefore cultivars x year interaction was also significantly different (P<0.01). The highest number of the cobs per plant was obtained by Samada-07 cultivar with 1.8 cobs, while the lowest number of cobs was obtained with Klips cultivar with 1.3 cobs (Table 5). The temperature difference between the years have influenced the number of cobs per plant. The difference between years caused year x cultivar interaction to be important. The number of cobs per plant was reported as 1.3 (Öztürk *et al.*, 2008), 1.2 to 1.9 (Kuşvuran *et al.,* 2015), 1.2 to 1.9 (Bulut, 2016) and 0.97 to 1.04 (Kılınç *et al.,* 2018). The differences in the number of cobs reported by researchers can be attributed to the ecological conditions, the genetic characteristics of varieties and the agricultural applications (fertilizer, irrigation, tillage, weed management). Orak and İptaş (1999) reported that the number of cobs had a direct effect on the silage quality and increase the nutritional value of the silage since 70% of the feed value of the silage maize is attributed to the cobs. Therefore, the producers should prefer varieties with large and abundant cobs.

***Cob ratio (%)*:** Significant differences (P<0.01) were determined in cob ratios of the cultivars. Karadeniz Yıldızı and Samada-07 cultivars were placed in the highest cob ratio group while the cultivars other than Karadeniz Yıldızı, Samada-07, Kerbanis and Doge were included in low cob/plant ratio group (Table 5). The cob ratio has been reported between 33.2 and 43.4% in Kahramanmaras (Yılmaz *et al.*, 2017), 29-40% in Antalya (Erdal *et al*., 2009) and 27.3-45.0% in Diyarbakir conditions (Atakul *et al.,* 2016). The cob/plant ratio is directly proportional to the silage quality. The silage of maize cultivars with high cob/plant ratio or abundant cobs are considered high-quality (Yılmaz *et al.*, 2017).

Table 6. Cob yield of silage maize cultivars.

Cultivars	Cob Yield (tons/ha)		
	2016	2017	Mean
Kerbanis	38.5 a++	36.8 ab++	37.6 a++
Motril	25.6 f	24.9 g	25.2 f
Atlas	36.5 abc	31.6 de	34.1 bc
Karadeniz Yıldızı	38.2 ab	37.7 a	38.0 a
Colonia	29.4 def	28.5 f	28.9 e
Klips	28.5 ef	27.5 fg	28.0 e
Kalusses	34.4 abcd	33.7 cd	34.1 bc
Kilowatt	31.1 cde	29.4 ef	30.2 de
Kalumet	32.7 bcde	32.0 cde	32.4 cd
Doge	35.4 abc	34.6 bc	35.0 b
Samada-07	39.2 a	38.9 a	39.1 a
MEAN	33.6 A++	32.3 B	33.0
LSD (%5)	Y:1.1* C:2.3 YxC: 3.3 CV: 5.8		

CV: Coefficient of variation. Y: Year, C: cultivar; ++ Means followed by the same letter in the same column are statistically not significant (p<0.01); * Means followed by the same letter in the same line are statistically not significant (p<0.05)

***Cob yield (tons/ha)*:** The difference in the cob yield was significantly important at 0.01 level of for the cultivars and the difference between the years was significant at 0.05 level (Table 6). The lowest cob yield was obtained from Motril cultivar, while the Kerbanis, Karadeniz Yıldızı and Samada-07 cultivars were included in high cob yielding group. The two-year mean cob yield of maize cultivars was 33.0 tons ha^{-1} (Table 6). The high temperature of the first year caused higher mean cob yield compared to the second year. Similarly, Ileri *et al.* (2018) reported that maize plants accumulate higher assimilation products in the generative components by regulating the assimilation mechanism in warmer conditions. Thus, maize increases the cob yield by producing larger cobs. The maize yield reported by Karadağ and Akbay (2013) was higher than the mean maize yield of the study, while maize yield of Karadağ and Akbay (2013) and Günen (2016) were lower than the mean maize yield. The ecological conditions of the experimental sites, particularly the effect of climatic factors such as precipitation and temperature, and the differences in the genetic materials used caused the differences in maize yields.

***Conclusion*:** The highest yield per unit area can be obtained by using the maize cultivars with high genetic potentials. In Turkey, many silage cultivars along with seed cultivars, which have commercial production permission, are used for maize silage production. The leaves, stem and cob ratios of a maize cultivar should be at the desired level to have a good silage performance. Cultivars with high leaf and cob ratios have high silage qualities. Considering the agronomic data and the cob yield for the desired silage quality, Kerbanis, Karadeniz Yıldızı, and Samada-07 cultivars are suitable for Kırşehir and similar ecologies.

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