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The Determination of Silage Yield and Quality Traits of Candidate Maize Hybrids

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ABSTRACT

This study was conducted to determine some experimental silage yield and quality traits of maize hybrid to be improved by using hybrid breeding. This study was carried out with 15 experimental maize hybrids in 2012 and with 8 pieces in 2013 in Samsun. This study was carried out in the Randomised Complete Block Design(RCBD)with three replications. Genotypes' number of days for 50 % flowering, plant height, leaf/plant ratio, stalk/plant ratio, ear/plant ratio green forage yield and dry matter yield traits were investigated. Inadditon, the traits of silage crude protein, crude cellulose, ADF,NDF,ADL and crude protein yield were investigated. When examined traits were evaluated all together (ripening period, green forage yield, dry matter yield, and silage quality traits), TTM 2011-29, TTM 2011-28, TTM2011-36, TTM 2011-35 ve TTM 2011-7 genotypes, passed the control or involved in the same statistical group, were accepted as the promising varieties and they (TTM 2011-29, TTM 2011-28, TTM2011-36, TTM 2011-35 ve TTM 2011-7) were sent to locations to determine genotype x environment interaction for the purpose of testing within the scope of National Maize Breeding Researches.

Keywords: silage corn, ADF, NDF, maize breeding, candidate hybrid

Introduction

The food stuff demand for increasing population globally is a perceptive threat to food security.woeld over. There is no opportunity to increase present cultivated area in the world, Therefore, increasing crop productivity is important and it can be realized by making the best use of present cultivated areas (Cömertpay 2008).The most important way to increase plant yield is to develop new varieties which can give a highly productive and qualified yield. When it is considered in terms of animal production, this is the animal nutrition with low-cost but qualified feeds and the acquisition of maximum income. Traditionally, the expense of feed for animal production makes up more than half of the business expenses. For this reason, providing cheap feed is so important for business profitability. When cheap and qualified feed comes to, silage is the first thing that comes to mind. Maize is the most common material for silage production (Geren *et al*., 2003). One of the silage feed sources of quality roughage feed for animal breeding operations,matter to meet the demand of animal's living in autumn and winter when pasture, grazeland or feed plants enter the resting period. Maize and sorghum x sudan grass cross come first for silage feed plant production and in recent years plants especially producing high amount of green biomass have been preferred (Kavut *et al*., 2012). Silage maize is the most important source of roughage-succulent feed for ruminants because of its advantages as high energy, easily digestible, and involving the other feed plants mixture. Silage maize which can be cultivated in very large areas is the most important silage plant cultivated in the world particularly in USA, because of the different reasons such as its capability of producing lots of gren portions from the unit area,its suitability for silage production,its high nutritional value and deliciousness. In our country, silage maize was produced with 18.563.390 ton in 401591ha in 2014 (TÜİK, 2016). The production and cultivation area of silage maize increased approximately 210% in the last ten years (TÜİK, 2016). The main factors of this increases are the increase of the usage of high productive silage maize varieties, involving in the project of feed plant support conducted by Ministry of Food, Agriculture and Livestock, its advanced mechanization,easy storage for the product and the increase of developing silage package industry day by day. In the last 20 years there have been significant increases in improved varieties for hybrid maize breeding. The determinant for these increases is that biotechnology and phytosanitary studies have been integrated into classic breeding methods.

In our country, maize breeding projects have been conducted by Public Research Institution mainly for seed purposes till at the beginning of 2000s, when they initiated silage maize breeding researches as happened in the world in recent years. Dry matter and green forage yield should be high, the period of keeping green colour should be long and it should be easy digestable,hybrids'net energy value should be high in terms of quality yield to choose the best hybrid for silage hybrid maize. Out of 320 registered maize varieties on our country's national list, only 15 have been registered as silage suitable varieties (TTSM 2016). With the increase in silege maize cultivated areas day by day ,the demand for seed is also increasing. This research was carried out to determine the performance of silage maize candidates developed pursuant to Black Sea Region maize breeding studies,considering silage maize yield and quality factors.

Material and Method

This research was conducted in experiment area situated in Black Sea Agriculture Research Institution in Carsamba under first crop conditions in 2012,2013. Inbred lines composed of within maize breeding research Project and materials originated from the abroad were used as study materials. Crosses were made among high ability special combining pure line in 2011 considering genetic proximity-distance and silage potentials (morphological and quality traits). P31Y43, Burak, Samada-07 and Safak varieties were used as control (standard) and 15 single crosses in 2012, and 8 in 2013 were used. The experiment was carried out in Samsun which has rainy and temperate climate. Temperature, precipitation, proportional moisture averages regarding in 2012 and 2013 and long terms averages are given in Table 1. While moisture and temperature values were relatively in each cultivating season (2012,2013) but they differed from long term averages. Average temperatures were measured 1 °C higher than long term averages in both two years. Significant differences were measured for total fall and distribution of fall into months. Approximately, two times more fall was obtained in the first year of the experiment than in the second year. The soil of testing area has clayed-loamy and little alkaline. Total salt and the amount of takable phosphorus were low, but plants were rich in terms of nutrition elements and potassium and lime, but low in terms of organic matter (Table2). The experiment area was cultivated in 14 may, 2012 and 16 may, 2013. Experiments have been carried out for two years under main crop conditions using the randomized block design with three replications. Sowing was made with hands as spreading two seeds in per growing bed and every plot had four lines and plot area was 14 m^{2}. The row to row distance was 70 cm and plant to plant distance within rows was 18 cm. The length of rows was 5m. When the plants reached knee-deep (40-50 cm) in the experiment, the weak one from two plants in the growing bed was thinned. Irrigations were applied with drum irrigation systalk and earthing up was applied with hoeing regularly (Kırtok,1998)

Dressing was made as pure 8 kg phosphorus and 20 kg N/ha totally per decare according to soil analysis. All phosphorised manure and 8 kg/ha of nitrogenous manure were given at the time of sowing as bottom fertilizer, the rest of the nitrogenous fertilizer was given when the plants became 4-6 leafed (V4-V6 phase), reached approximately 40-50 cm. Two lines in the middle were harvested for green forage yield. The harvest was done at the ½ and ⅔ milk lines in other words at the early dough stage. 500 gr sample plant was kept in the oven at the 70^{0}C for 48 hours for dry matter ratios. Dry matter yield values were calculated according to dry matter ratios as being weighed when it reached to constant weight. Besides, number of days for 50 % flowering, plant height, leaf/plant ratio,stalk/plant ratio and ear/plant ratio were investigated. Phenological and morphological observations taken during the research were made based on technical order of agricultural values evaluation testings by Ministry of Food, Agriculture and Livestock (Anonymous2010). Genotypes' The silage quality parameters of genotypes were analysed viz., (ADF, NDF, ADL, raw cellulose, raw protein). These were got done in Blacksea Agricultural Research Institution analyses laboratories in respect of 2012 to determine silage yield. Data obtained from the research were subjected to the varience analysis according to (Düzgünes *et al*., 1987) using Mstat-C software, and multiple comparisons of group averages were made according to Duncan test. Years were evaluated one by one because differences became significant for all observed characters between years according to varience analysis and conclusions which were made regarding the year as factor.

Results

Statistically, differences were found significant at the level of 0.01 between genotypes in terms of the number of flowering days, plant height,first ear height, stalk/plant ratio, leaf/plant ratio, ear/plant ratio, green forage yield and dry matter yield values. Duncan groups are given in Table 3-4 belonging to investigated traits. The average flowering days of genotpes were 74 in 2012, and the earliest flowering was seen in TTM 2011-14 genotype with 69.3 days, and the latest flowering was seen in Burak Standard variety with 77.0 days (Table 3). Genotypes' flowering periods changed between 63.0 and 71.0 days, the earliest flowering was seen in TTM 2011-18 variety candidate, and the latest flowering was seen at Burak standard variety with 71.0 days as similar of the first year (Table 4). The averages of varieties' plant heights changed between 246.7 and 330.0 cm at the first year and it was measured that Burak standard variety had the longest plant height (330.0 cm), and TTM 2011-14 variety candidate had the shortest plant height (246.7 cm) (Table 3). The averages of plant heights were 308.4 cm at the second year and Burak Standard variety had the longest plant height with 351.7 cm and TTM 2011-20 candidate variety had the shortest plant height with 258.3 cm (Table 4). Variety and variety candidates' the first ear heights measured as between 98.3 and 145.0 cm and Burak Standard variety had the longest first ear height, TTM 2011-14 had the lowest first ear height (Table 3). The averages of first ear heights were 129.3 cm in 2013 and Burak Standard variety had the longest one with 161.7 cm and TTM 2011-18 genotype had the shortest one with 105.0 cm (Table 4). Stalk/plant ratios changed between 33.3% and 48.5% in 2012 and the lowest one was taken from TTM 2011-36 candidate variety with 33.3% and the highest one was taken from TTM 2011-14 candidate variety with 48.5% (Table 3). Stalk/plant ratios changed between 36.5% and 43.9% in 2013 and Burak Standard variety had the longest stalk/plant ratio as 43.9% and TTM 2011-36 genotype had the lowest as 36.5% (Table 4).Genotypes' leaf/plant ratios changed between 10.4% and 27.5% at the first year and TTM 2011-7 genotype had the lowest leaf/plant ratio as 10.4% and TTM 2011-26 genotype had the highest leaf/plant ratio as 27.5% (Table 3). Leaf/plant ratios changed between 18.3% and 19.7% at the second year and TTM 2011-9 candidate variety had the highest one as 19.7% and TTM 2011-36 genotype had the lowest one as 18.3% (Table 4). Ear/plant ratios of variety and candidate varieties changed between 36.0% and 52.5% in 2012 and the lowest one determined for TTM 2011-26 as 36.0% and the highest one for TTM 2011-36 as 52.5% (Table 3). Ear/plant ratios changed between 38.8% and 46.0% in 2013 and the highest ear/plant ratio was measured for Burak Standard variety as 38.8% and the lowest for TTM 2011-36 genotype as 46.0% (Table 4). Green forage yields changed between 4614.7 kg/da and 7443.4 kg/da and the highest yield was taken from TTM 2011-29 as 7443.4 kg/ha and the lowest from TTM 2011-14 as 4614.7 kg/da (Table 3). The values of green forage yields were measured between 4616.9 and 6187.8 kg/da in 2013 and the highest green forage yield was measured from TTM 2011-36 candidate variety as 6187.9 kg/da and the lowest from TTM 2011-20 candidate variety as 4616.9 kg/da(Table4). The averages of genotypes' yields changed between 1390 kg/da and 2298 kg/da in terms of dry matter at the first year of the experiment. The highest dry matter yield was determined from TTM 2011-29 as 2298 kg/da and the lowest one from TTM 2011-14 as 1390 kg/da (Table3). The highest dry matter yield was measured for TTM 2011-36 as 2632.1 kg/da at the second year of the experiment and the lowest one for TTM 2011-18 as 1895.7 kg/da (Table 4). Differences between genotypes were found significant statistically in terms of ADF%, raw cellulose%, NDF% and raw protein and differences between ADL% and raw protein (%) ratios were found insignificant statistically. ADF% ratios among varieties involved in the experiment changed between % 21.7-35.0 and the lowest ADF ratio was measured from TTM 2011-36 variety candidate and the highest. ADF% ratios among varieties involved in the experiment changed between% 21.7-35.0 and the lowest ADF ratio was measured from TTM 2011-36 variety candidate and the highest ADF from TTM 2011-20 variety candidate and the average of ADF% was measured as 30.2. The average of genotypes' raw cellulose ratios was measured as 28.0% and the lowest raw cellulose was measured from TTM 2011-18 genotype as 20.6% and the highest ratio from TTM 2011-30 genotype as 36.5%. ALD% ratios of variety and variety candidates changed between 1.2%-

3.1% and raw protein ratios changed between 7.3%-7.9%. NDF% ratios among varieties involved in the experiment changed between 54.2%-67.0% and the lowest NDF ratio was measured from TTM 2011-30 variety candidate and the highest NDF% from TTM 2011-35 variety candidate and the average of the experiment was measured as 59.6. Genotypes' raw protein yields changed between 126.8-171.4kg/da and the highest raw protein yield was obtained from TTM 2011-28 genotype and the lowest yield from TTM 2011-22 genotype (Table 5).

Discussion

High yield, earliness, low seed moisture have composed the basis of maize breeding studies and quality in recent years. Earliness is so important in terms of variety in cultivation period and is the most important criterion for being cultivated crop under main crop or second crop conditions. The great majority of silage maize varieties on the market are stage group temporary varieties. Earliness becomes important because the great majority of silage maize cultivating areas are cultivated as second crop. Genotypes differed from each other in terms of the duration of flowering days considering investigated genotypes and standards flowered later than candidate varieties in both two years. TTM 2011-18 and TTM 2011-36 crosses from variety candidates flowered at the earliest in both two years. (Oner *et al*., 2011) determined that the number of 50% flowering days for varieties was between 58-65 days in their study on the purpose of determining silage maize varieties' some yield and quality traits under Samsun conditions, similarly, (Ozata *et al*., 2012) determined it was between 58-64 days in their study under Samsun conditions, (Erdal *et al*., 2009) determined it was between 60-65 days in their sudy under Antalya conditions, (Sade *et al*., 2005) determined it was between 82-87 days in their study under Konya conditions. When obtained data were investigated, it can be said that genotypes studied with, were close with genotypes in the studies under Samsun and Antalya conditions in terms of flowering day numbers and they were more earlier genotypes than genotypes in the study in Konya. The average plant height was 277.6 cm in 2012 and 308.4 cm in 2013, (Erdal *et al*., 2009) obtained it was 234 cm in the first year and 273 cm in the second year for silage maize varieties in their study under Antalya conditions, (Ozata *et al*., 2012) determined the plant height of silage maize varieties changed between 235-284 cm in their study under Samsun conditions, and (Bolat *et al*., 2011) determined plant height changed between 270-283,3 cm in their study investigated the effect of chemical and microbial fertilizer applications on silage maize yield under Adana conditions. While the first experiment averages of plant height values were in harmony with other studies, the second averages were found higher than other studies. Mostly, plant height arises from variety trait, also is affected from environment conditions. The first ear height was obtained fort he first year average (119.6cm) lower than for the second year average (129.3cm). The first ear height is directly proportional with plant height and generally the height of variety is wanted as between ⅓ and ½ for breeding studies. (Oz *et al*., 2008) stated the first ear height changed between 81-100 cm and the second height changed between 68-111cm, and (Oz *et al*., 2005) the first ear height changed between 109-126 cm at the same conditions. Conclusions were obtained higher than other studies. This difference stalkmed from the differences of genotypes.

The average of experiment was 39.3% at the first year and 39.5% was in the second year in terms of stalk/plant ratios when variety and candidate varieties were investigated.On the basis of variety, the highest stalk/plant ratio was obtained from TTM 2011-14 candidate variety as 48.5% in 2012 and it was obtained from Burak Standard variety as 43.9% in 2013. When leaf/plant ratios investigated, the average of the experiment was 18.5% in 2012 and the average of the second year was 17.9%. The highest leaf/plant ratio was determined for TTM 2011-26 as 27.5% at the first year and for TTM 2011-9 as 19.7% at the second year. When the averages of ear/plant ratios were considered, the highest ratio was obtained from TTM 2011-36 candidate variety as 52.5% at the first year and from TTM 2011-20 genotype as 46.0% at the second year. (Özata *et al*., 2012) have determined that variety and candidate varieties' averages of ear/plant, stalk/plant,and leaf/plant rayios were 40.6% and 41.7% and 17.6% respectively in their study conducted under Samsun conditions. (Oner *et al*., 2011) have stated that leaf/stalk ratios changed between 26% and 43% and ear/plant ratios were changed between 33% and 41% in their study which they investigated quality and yield traits at some silage maize varieties under Samsun contitions in 2010. (Caglar *et al*., 2008) have stated leaf ratio changed between 23.4% and 20.2% and so as to ear ratio between 37.2% and 32.3% and leaf ratio changed between 39.5% and 47.6 at their study conducted under Erzurum conditions. (Geren *et al*., 2003) have stated that leaf, stalk and ear ratios for green forage changed between 34.5% and 42.7% and between 35.9% and 42.1% and between 19.6%-

27.9% respectively at their study conducted under Izmir conditions. (Iptas *et al*., 2002) have stated ear ratio changed between 32.9%-42.0% and so as to stalk ratio between 39.3%-50.1%,and leaf ratio changed between 15.3%-21.2 in their study conducted under Tokat conditions. Obtained conclusions are in harmony with the other studies. Yield (green forage) is an overemphasized selection criterion for silage maize breeding researches as good for maize breeding researches. The average of experiment variety and variety candidates was 5704kg/ha in 2012,it was 532.1 kg/ha in terms of green forage yield in the second year. The highest yield was obtained from TTM 2011-29 genotype as 7443.4kg/ha and the lowest yield from TTM 2011-14 genotype in terms of green forage yield in the first year. 8 variety candidates passed Standard in the first year. The highest yield was obtained from TTM 2011-36 variety candidate as 6187.9 kg/ha and the lowest from TTM 2011-20 genotype as 4616.9 kg/ha in the secnd year. (Ozata *et al*., 2012) determined that the averages of green forage yield changed between 3340.5-6297 kg/ha in their study conducted under Samsun conditions and (Oner *et al*., 2011) determined that they changed between 6075-7391 kg/ha in their study conducted with registered silage varieties in Samsun-Carsamba location. (Erdal *et al*., 2009) stated the average of green forage yields was 6345 kg/ha in 2006 and it was 6504 kg/ha in 2007 in their study under Antalya conditions. (Iptas *et al*., 2002) stated green forage yield changed between 6723-8799 kg/ha averagely at the experiment which they conducted in between 1996-98 under Tokat ecological and main crop conditions. (Akdemir *et al*., 1997) found that green forage yield changed between 4834-6706 kg/ha in the experiment under Bursa conditions. While conclusions were in harmony with the studies conducted in Bursa and Samsun, were lower than the other studies. Dry matter which is one of the yield traits for the production of silage maize is another overemphasized criterion. The average of dry matter yield was determined as 1806 kg/da in the first year of the experiment and as 2278.7 kg/da at the second year. (Ozata *et al*., 2012) stated dry matter yields changed between 1105-1867 kg/da in their study under Samsun conditions and (Erdal *et al*., 2009) stated the average of the first year was 2333 kg/da and the second year of it was 2227 kg/da. (Iptas2002) found dry matter yield changed between 1513.9-2076.6 kg/da in their experiment under the second crop conditions in Tokat. (Oner *et al*., 2011) determined that dry matter yield changed between 1289-2132 kg/da in their experiment conducted with registered silage varieties in Samsun-Carsamba location in 2010, (Akdeniz2004) stated dry matter yield changed between 683-1499 kg/da in the first year and between 767-1723 kg/da in the second year in their two-year study under Van ecological conditions. While obtained data were in harmony with the studies under Samsun and Van conditions and lower than studies under Tokat and Antalya conditions. The content of silage maize, raw protein, raw protein yield, ADF, NDF ratios are also determinants for the energy values of maize silage. In the study, raw protein ratio changed between 6.8-7.7% and raw protein yield changed between 117.3-171.4 kg/da. ADF ratio was averagely 30.2% and changed between 27.1-35.0 and the lowest one obtained from TTM 2011-36 variety candidate and the highest ona from TTM 2011-20 variety candidate. When NDF ratio was investigated it changed between 54.2-67.0 and the lowest one was obtained from TTM 2011-18 cross, the highest one from TTM 2011-35 variety candidate.

Raw cellulose ratio changed between 20.6-36.5% and ADL ratio changed between 1.5-2.0 % (Ozata *et al*., 2012) stated the average of raw protein yield was 6.08%, raw protein yield was 89.3%, ADF ratio was 32.2% and NDF ratio was 53.5% in their study under Samsun conditions. (Erdal *et al*., 2009) determined the average raw protein ratio changed between averagely 7.5% and raw cellulose ratio averagely 20.2% and NDF ratio as 64.0% in thier study under Antalya conditions. (Oner *et al*., 2010) stated ADF, NDF% and raw protein ratio values changed as 31-41%,49-60%, and 3.85-5.85% respectively. (Hutjens1998) determined ADF ratio changed between 21.7-40.7% and NDF ratio between 41.2-70.9 in their study investigated 86 maize varieties' silage traits in 1996 in Illinois, USA. Obtained conclusions are in harmony with the studies. To be high of silage trait is explained with being high of raw protein and being low of ADF, NDF ratios. Generally it is wanted ADF ratio is 30% or lower than it and NDF ratio is between 50-60%

Conclusion

The production and consumption of maize silage have increased commonly due to having high energy value particularly. The average of silage maize (green forage) yield for our country is 4,5 ton (TÜIK2013) and higher green forage yield was obtained from all genotypes taken to the experiment. Three traits of plant for silage maize breeding: ripening period, green forage yield and the content of dry matter at harvest are regarded as determinant during selecting. Ripening period, green forage yield and dry matter yield are affected from environment conditions significantly. Maize plant need total temperature between 2370-3000ºC as well as it differentiates for every plant.Temporal varieties can be cultivated and obtained high yields because Black Sea Region has a mild climate and generally its vegatation period is suitable. Providing, it is desired that varieties give the same yield or close to it in all regions. TTM 2011-29, TTM 2011-8 and TTM 2011-36, TTM 2011-35 and TTM 2011-7 genotypes became prominent crosses in the conclusion of study which was aimed to determine the silage yield and quality traits of silage maize variety candidates. These five variety candidates passed standards in the registration experiments in terms of dry matter yield in both two years or took part in the same statistical group. It is decided TTM2011-28, TTM2011-29 ve TTM2011-36 TM 2011-35 ve TTM 2011-7 variety candidates (for the purpose of being experienced multiple locations) will be involved in Territorial Maize Researches Silage Maize experiment to be evaluated better before varieties are given to registration and to be seen genotype x environment interaction.

Table 1. The 2012-2013 year and for many years some corn during the growing season meteorological data of Samsun *

AYLAR	Mean of Temperature (ºC)			Relative humidity (%)			Total rainfall (mm)		
	Many years	2012	2013	Many years	2012	2013	Many years	2012	2013
April	11.1	13.3	12.7	79.5	74.4	76.5	58.3	10.4	64.2
May	15.3	17.5	18.7	80.6	82.3	77.4	50.6	34.4	8.9
June	20.0	21.9	21.6	76.3	76.4	73.0	47.9	24.4	49.7
July	23.1	24.0	23.2	73.4	77.1	72.7	31.3	96.0	43.6
August	23.2	23.0	23.6	73.7	78	76.4	50.9	179.6	26.5
September	19.8	20.1	18.7	74.7	80.4	75.9	87.4	113	44.9
Mean	18.8	20.0	19.8	76.3	78.1	75.3	-	-	-
Total	-	-	-	-	-	-	326.4	457.8	237.8

* (Samsun Regional Directorate of Meteorology, 2012 ve 2013)

Table 2. Some properties of study area*

Parameter	2012	2013	
Soil texture	66.0	68.0	Clay Loam
pH	7.86	7.60	Slightly alkaline
P_2O_5 (kg da^{-1})	2.52	2.50	Very Low
K_2O (kg da^{-1})	94.0	92.0	High.....
Organic Matter (%)	1.76	1.70	Low.......
$CaCO_3$ (%)	6.76	7.50	Medium
EC (%)	0.054	0.061	Nonsaline

* (Samsun, Blacksea Agricultural Researche Institute, Soil Department Laboratory, Analyze Number:362)

Table 3. Some yield and yield characteristics of the silage maize genotypes, 2012

Genotypes	Tasseling		Plant height		First Ear height		Stalk/ Plant ratio		Leaf/ Plant ratio		Ear/plant ratio		Silage yield (kg/da)		Dry matter yield (kg/da)	
TTM2011-29	73.0	fgh	303.3	ab	126.7	a-d	40.7	cde	17.8	c-f	41.5	d-g	7443.4	a	2.298	a
TTM2011-28	76.3	ab	295.0	bcd	123.3	a-e	40.1	def	18.1	c-f	41.8	d-h	6722.9	ab	2.247	a
P31Y43 (st)	72.7	gh	296.7	bc	130.0	a-d	35.3	ıjk	22.2	bc	42.5	def	6044.8	bc	1.880	b-e
Burak (st)	77.0	a	330.0	a	145.0	a	42.6	bc	17.9	c-f	39.5	gh	5987.1	bcd	1923	b
TTM2011-20	73.0	fgh	255.0	e	110.0	def	41.8	bcd	15.4	ef	42.7	de	5963.8	cde	1.987	b
TTM2011-35	75.0	bcd	270.0	cde	131.7	a-d	38.6	fgh	15.0	efg	46.4	bc	5928.4	cde	1.905	bc
TTM2011-7	74.7	cde	256.7	e	120.0	b-f	44.3	b	10.4	g	45.4	c	5906.3	cde	1.973	b
TTM2011-36	73.3	e-h	263.3	e	113.3	c-f	33.3	k	14.2	fg	52.5	a	5862.4	cde	1.704	d-g
TTM2011-18	72.0	h	265.0	e	110.0	def	41.7	cde	16.5	def	41.9	d-g	5773.9	cde	1.848	b-e
TTM2011-9	73.3	e-h	268.3	de	120.0	b-f	34.2	jk	23.4	ab	42.4	def	5721.0	c-e	1.917	bc
Samada-07(st)	76.0	abc	296.7	bc	136.6	ab	39.0	fg	17.0	def	44.0	cd	5553.8	c-f	1.941	b
TTM2011-10	74.7	cde	248.3	e	110.0	def	39.3	efg	18.8	b-f	41.9	d-g	5543.4	c-f	1.841	b
Şafak(st)	76.3	ab	310.0	ab	135.0	abc	37.3	ghı	23.3	ab	39.3	h	5538.9	c-g	1.953	b
TTM2011-26	74.3	def	256.7	e	115.0	b-f	36.4	hıj	27.5	a	36.0	ı	5507.6	def	1.689	efg
TTM2011-30	76.0	abc	313.3	ab	131.7	a-d	40.6	c-f	19.3	b-e	40.0	fgh	5422.4	def	1.901	bcd
TTM2011-3	73.3	e-h	260.0	e	103.3	ef	39.5	d-g	16.3	def	44.2	cd	5180.1	ef	1.722	c-g
TTM2011-12	72.3	h	273.3	cde	98.4	f	38.7	fgh	20.8	bcd	40.5	e.h	4884.3	g	1.644	fg
TTM2011-22	74.0	d-g	266.7	de	115.0	b-f	34.3	jk	17.2	def	48.5	b	4778.4	g	1.613	g
TTM2011-14	69.3	ı	246.7	e	98.3	f	48.5	a	19.7	b-e	31.8	j	4614.7	g	1.390	h
Means	74.0		277.6		119.6		39.3		18.5		42.3		5704.0		1806.0	
CV(%)	1.2		6.1		11.1		3.7		8.7		3.6		6.3		7.0	
LSD (0.05)	1.6		27.7		21.8		2.5		4.9		2.5		594.0		196.0	
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Table 4. Some yield and yield properties belong to silage maize genotypes, 2013

Genotypes	Tasseling		Plant height		First Ear height		Stalk/ Plant ratio		Leaf/ Plant ratio		Ear/plant ratio		Silage yield (kg/da)		Dry matter yield (kg/da)	
TTM2011-36	65.3	b	303.3	ab	136.7	bc	36.5	g	19.3	ab	44.2	abc	6187.9	a	2632.1	a
Burak(st)	71.0	a	351.7	a	161.7	a	43.9	a	17.2	efg	38.8	g	5918.4	ab	2522.7	ab
P31Y43 (st)	66.0	b	310.0	bc	128.3	cde	39.3	cde	17.4	def	43.4	bcd	5886.8	ab	2490.6	ab
TTM2011-35	70.0	a	315.0	bc	133.3	cde	38.5	def	18.6	bc	42.8	cde	5646.7	ab	2374.2	abc
TTM2011-7	69.7	a	311.7	bc	120.0	def	36.7	fg	18.3	c	45.0	ab	5274.2	abc	2286.6	abc
TTM2011-29	70.3	a	315.0	bc	126.7	cde	41.8	b	16.7	fgh	41.4	ef	5269.0	abc	2428.7	ab
Şafak(st)	70.0	a	321.7	a	148.3	ab	40.9	bc	16.5	gh	42.6	cde	5268.1	abc	2199.2	abc
TTM2011-9	69.0	a	312.7	ab	128.3	cde	40.1	bcd	19.7	a	40.2	fg	5245.5	bc	2185.1	abc
TTM2011-28	69.7	a	301.7	bc	121.7	cde	40.4	bcd	17.9	cde	41.7	def	5116.2	bc	2171.6	abc
Samada-07 (st)	70.0	a	313.3	bc	125.0	cde	38.9	de	18.6	c	42.5	cde	4797.8	bc	2079.7	abc
TTM2011-18	63.0	c	286.7	cd	105.0	f	39.3	cde	18.0	cd	42.8	cde	4626.0	c	1895.7	c
TTM2011-20	66.0	b	258.3	d	116.7	ef	37.6	efg	16.4	h	46.0	a	4616.9	c	2078.4	bc
Means	68.3		308.4		129.3		39.5		17.9		42.6		5321.1		2278.7	
CV(%)	1.9		5.9		7.2		2.9		2.4		2.6		10.6		11.7	
LSD (0.05)	2.2		30.1		15.6		1.9		0.8		1.9		928.7		516.3	
P	**		**		**		**		**		**		**		**	

Table 5. Some guality belong to silage maize genotypes, 2012

Genotypes	ADF %		Crude cellulose (%)		ADL (%)	NDF (%)		Crude protein (%)	Crude Protein yield (kg/da)	
TTM2011-20	35.0	a	31.5	bc	1.9	62.4	bcd	7.2	143.3	bc
TTM2011-3	34.4	ab	34.2	ab	1.8	61.2	cde	7.0	120.5	e
TTM2011-30	31.9	abc	36.5	a	1.9	60.4	c-f	7.6	143.9	bc
Samada-07 (st)	31.8	a-d	31.0	bcd	1.7	61.2	cde	7.2	148.2	b
TTM2011-22	31.2	a-d	31.2	bc	1.6	66.7	ab	7.9	126.8	e
TTM2011-7	30.8	b-e	23.0	gh	1.5	59.2	d-g	7.4	146.0	bc
TTM2011-12	30.6	b-e	27.6	c-g	2.2	55.8	gh	6.8	117.3	e
TTM2011-28	30.5	b-e	26.3	efg	2.2	63.8	abc	7.6	171.4	a
Burak (st)	30.4	b-e	26.4	d-g	3.1	56.1	fgh	7.5	136.7	b-e
Şafak (st)	30.0	cde	25.3	e-h	1.2	54.4	h	7.0	149.0	b
TTM2011-14	29.6	cde	28.3	cdef	1.7	60.3	c-f	7.2	106.1	f
TTM2011-35	29.5	cde	29.3	cde	1.7	67.0	a	7.3	139.0	b-e
TTM2011-10	29.3	cde	28.8	cde	1.6	60.4	c-f	7.5	138.7	b-e
TTM2011-9	29.1	cde	23.9	fgh	1.9	56.1	fgh	7.5	143.8	bc
TTM2011-26	28.7	cde	32.1	abc	1.5	59.1	d-g	7.6	127.8	de
TTM2011-18	28.6	cde	20.6	h	1.3	54.2	h	7.4	141.8	bcd
TTM2011-29	28.3	cde	28.9	cde	2.0	58.1	d-h	7.7	177.0	a
P31Y43 (st)	27.8	de	24.8	e-h	1.2	57.3	e-h	7.2	144.7	bc
TTM2011-36	27.1	e	21.4	h	1.2	58.5	d-h	7.7	131.2	cde
Means	30.2		28.0		1.7	59.6		7.4	139.6	
CV (%)	8.10		7.55		0.40	4.54		2.36	6.38	
LSD (0.05)	4.0		4.6		-	4.6		-	14.8	
P	*		*		-	**		-	*	

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