Journal of Applied Biological Sciences 10 (1): 01-07, 2016
ISSN: 1307-1130, E-ISSN: 2146-0108, www.nobel.gen.tr

A study on adaptation of some maize cultivar in Middle Kızılırmak Basin**

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** This study has been supported by Çankırı Karatekin University BAP Unit.

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Received: December 20, 2015
Accepted: February 02, 2016

Abstract

This study was conducted in Çankırı Karatekin University, Kızılırmak Vocational High School, Research and Application Field, in 2012 and 2013. The aim of the study is examining the growth of different field plants in fields where paddy is grown continuously, and ensuring the alternation of these crops with paddy. 15 dent corn types were used in the study, and the experiments were conducted according to the random blocks design with three replicates. According to the results obtained after two years, statistically significant differences were observed in terms of characteristics of the maize cultivars except for the first ear height. The grain yield values of the cultivars varied between 899-1193 kg/da; the flowering times varied between 70.8-74.7 days; the plant height varied between 269-298 cm; the first ear heights varied between 95-117 cm; the moisture of the grains at harvest varied between 21.1-26.6%; the grain/ear rate values varied between 81.8-86.8%; the ear length values varied between 20.5-24.6 cm; and the maturation times varied between 123-128 days. According to these results, it is possible to claim that mazie cultivation can easily be performed in Middle Kızılırmak Basin.

Keywords: Middle Kızılırmak Basin, dent maize, adaptation

INTRODUCTION

Today, the demands of the consumers have reached different dimensions, and the safety of the foods are being questioned. For this reason, the certification of the foods from field to the fork by unbiased and independent organizations at various stages has become important. The types of the agriculture that is being performed by protecting the environment, human and animal health, protecting the natural sources, and by ensuring sustainable and traceable food security is called as the "Good Farming". Instead of the production methods that threaten human health and the future, and increase the environmental pollution, the new production techniques that comply with the nature and that have the least risks in terms of environment and health are adopted nowadays. The agricultural practices that aim excessive benefit and only high profit and yield have influenced the health of the living organisms on earth, and have led to negative influences on ecological balance [5]. Monoculture agriculture system, chemicals, hormones, incorrect irrigation and similar practices cause negative influences on the ecosystem.

Transferring the agricultural fields, water sources and other natural sources to the next generation without polluting and destroying them, and ensuring a sustainable agricultural development have become a necessity in today's world. The alternation system must be applied in fields in order to produce healthy food with high added-value and for marketing purposes, and for increasing the income levels of the producers. The alternation system is not widely applied in paddy cultivation. For this reason, the diseases and the insects increase day by day and the quality of the products decrease.

The mostly-cultivated plant in irrigable lands in Kızılırmak County in the city of Çankırı is the paddy plant. It has been determined that in some fields only paddy has been cultivated for 30 years. This situation causes the agriculture lands to become disrupted after some time.

The use of the corn in industry has increased when compared with the other grains and it is still continuing to increase. The most important reasons of this are; the high yield from a certain unit of area, the cultivation technique, the harvest, transportation and storing processes being easier than the other products. The use of corn as a kind of fuel in recent years has increased the need for this plant.

Due to the different climate and soil structures of the regions, the yield of the corn types may also vary. The improvement of the high hybrid or composite cultivars, forming source populations, that agree with the ecological conditions of the regions is important. With the improvement studies, the new genotypes which have high yield in various climate and soil conditions replacing the old and low-yield ones will be beneficial for the economy of the region and the country. For these purposes, it is necessary to know the factors that are influential on the yield, their influence levels, and the relations between them [2; 3].

Corn is one of the plants that are made most use of in the alternation system because it may be cultivated in a wide ecological area and is a hoe-plant. Although its best conditioned areas vary according to its types, generally these areas cover the ones that do not have the risk of frost for 120 days and that have a 2100-2200 ^{0}C or more temperature sum [8; 9]. In addition, in some areas in Turkey (like Sakarya and Düzce), it is a high-yielding plant that can reach 2 tons/decare grain

yield. Some of the hybrid types give around 13-15 tons yield from one decare for the purpose of wet grass silage [13; 14].

Öz et al. [16] conducted a study for two years to develop the corn types that could comply with the conditions in Samsun and Konya, and used 7 genotypes in 2006, and 15 genotypes in 2007. After the analyses, they reported that the grain yield varied between 949-1.258 kg/da in 2006, and between 575-1.088 kg/da in 2007 in Samsun conditions; the silking values varied between 71-75 days in the first year, and between 62-66 days in the second year; the plant height varied between 245-292 cm in the first year, and between 240-280 cm in the second year; the first ear height varied between 81-100 cm in the first year, and between 68-111 cm in the second year; the grain moisture at harvest varied between 22.2-27.3% in the first year, and between 16.3-24.8% in the second year; and the grain/ear ratio varied between 78-85% in the first year, and between 80-88% in the second year.

Öktem and Öktem [11] conducted a study to determine the genotypes that have high yield with low grain moisture at harvest in Harran Plain conditions, and reported that they used 26 dent hybrid corn genotypes for two years and found out that the grain yield varied between 811 and 1636 kg/da; the grain moisture at harvest varied between 13.4 and 27.2%; the plant height varied between 193.9 and 332.9 cm; and the first ear height varied between 84.6 and 152.4 cm.

Tezel and Aksoyak [21] conducted a study and assessed the performances of the single hybrid corn genotypes developed in Konya conditions and examined the flowering time, plant height, first ear height, grain moisture at harvest, and grain yield properties. After the analyses they reported that the flowering time of the corn genotypes varied between 72.0-75.7 days, the first ear heights varied between 101.0-148.0 cm, the plant height varied between 258.0- 338 cm, the grain moisture at harvest varied between 15.1-23.3%, and the grain yield varied between 616–1375 kg/da.

Sayaslan et al. [20] conducted a study in Tokat, Adana, Samsun and Sakarya and examined the yield, yield factors, the grain physical properties, chemical compounds and wet-grinding qualities, and some agronomical properties of 15 hybrid dent corn types in main crop conditions. They reported that the properties showed different values in different regions.

MATERIAL AND METHODS

In this study, the adaptation of some corn cultivars, which are used in Turkey in production, have been examined. This study was conducted in Çankırı Karatekin University, Kızılırmak Vocational High School, Research and Application Field between 2012 and 2013 vegetation period.

It is observed that both the study years and other years in the long run show differences in terms of average temperature in corn cultivation period. In the second year of the study, the average temperature in May, when the planting and germination of corn occurs, was higher than that of the previous year and that of the long years. The average temperature was found to be close to the long years in the second year of the study. There was a certain amount of difference between the study years and the long years in terms of relative moisture values. In terms of average precipitation, it is observed that there are differences in the plant cultivation period; the average precipitation is lower than the long year's precipitation values.

The soil in the study area is slightly alkaline-medium level alkaline, with heavy and medium level thin structure, has low-level salt or no salt in some parts, slightly calcareous and in some parts calcareous at medium level, poor in beneficial phosphorus at poor or medium level; and the structure is calcareous loamy sand.

15 cultivars (1-Ada 9516, 2- Shemal, 3-Helen, 4-P31G98 5-89-May-70, 6-Bora, 7-Prestige, 8-As-71, 9-Karadeniz Yıldızı (the Black Sea Star), 10-Samada-07, 11-MF714, 12- Korimbos, 13-Doge, 14-Kuadro and 15-Jeff) were used in the study. The experiments were conducted in 3 replicates with random blocks design. 4 rows were formed in 5 m parcels, the distance between the rows were 70 cm, and the tops of the rows were 20 cm. the planting of the seeds were performed by hand, and the fertilizer was applied to the soil as 10 kg pure nitrogen and 6 kg phosphorus per decare. When the plants were 45-50 cm, 10 kg/da pure nitrogen was applied to the soil. After the plants were sown, they were watered for 2 years because the moisture of the soil and the precipitation were insufficient, and thus the plants were made to germinate. In addition, during the growth period, the plants were watered for 3 times in both years. Weeding was applied twice; firstly, 2 weeks after the plants were germinated (about 4-5 leaves period); and secondly, when they were knee-length (about 45-50 cm). In calculating the grain yield, the whole of the 2 rows in one parcel (7 m^2) was harvested, and moisture correction was performed. The yield factors and other agronomical observations were performed on 10 plants in the parcel. The observations were performed according to İptaş et al. [6] and Öz et al. [13].

Flowering time (day): It was recorded as the days from the sowing of the seeds until the flowering of 75% of the plants in the parcel.

Plant height (cm): It was recorded as the length from the surface of the ground until the top with corn silk in cm.

Ear height (cm): It was recorded as the length in cm from the surface of the ground until the first ear.

Grain moisture at harvest (%): It was determined with the moisture meter by separating the grains from the inflorescence in 10 corn ears.

Grain/ear ratio (%): It was determined by weighing in the scale by separating the grains from the inflorescence in 10 corn ears.

Ear length (cm): It was determined by measuring 10 corn ears taken from each parcel with a ruler.

Maturating time (days): It was recorded as the days from the sowing until the harvest maturity time of the plants in the parcel.

Grain yield (kg/da): It was calculated with the harvest of the whole of the two rows (7 m^2) in the middle of each parcel.

The yield was measured by making correction over the grain moisture recorded in grain yield calculation according to 15% moisture level. The obtained data were analyzed according to the random blocks experimental design.

FINDINGS AND DISCUSSION

The variance analyses results of the grain yields of the corn cultivars and some yield factors over years are given in Table 1. The influence of the years on the characteristics other than grain yield were found to be important in the study. The influence of the types on the characteristics except the first ear height were found to be important ($p<0.01$). In the combined analyses of the two years, the difference between the grain yield, flowering time, grain moisture at harvest and the length of the ear were found to be statistically significant

in terms of year x variety interaction ($p<0.01$), and it was found to be not significant in terms of other characteristics.

Table 1. Summary of ANOVA for examined variables in corn varieties

Variation sources	Year	Variety	Year x variety	CV
Flowering time	**	**	**	0.93
Plant height	**	**	ns	3.62
First ear height	**	ns	ns	10.8
Grain/ear ratio	**	**	ns	2.34
Harvest grain moisture	ns	**	**	4.94
Maturating time	**	**	ns	1.11
Ear length	**	**	**	5.45
Grain yield	*	**	**	11.19

*, **: Indicates significance at 0.05 and at 0.01 respectively CV: Coefficient of variation ns: not significant

Flowering time

The flowering time values of the types that were included in the study are given in Table 2. In both study years and with the combined analyses, the difference between the types in terms of flowering times was found statistically significant ($p<0.01$). The types flowered on the 72.4th day in the first year, and on the 73.6th day in the second year. The Jeff flowered the earliest in the first year, and the Bora types flowered the earliest in the second year; and the MF714 type flowered the latest in the first year, and the P31G98 and Samada-07 types flowered the last in the second year. After the joint analyses, it was observed that the Bora types flowered the earliest, and the Samada-07 types flowered the last.

Although flowering depends on the types, the types have the property of flowering at different times in different places. The warm days after the extraction shorten the flowering times of the plants [7]. The relative moisture and temperature influence the anthesis and the fertilization [4]. Our findings are higher than the values reported by some other authors interested in the same field [12; 17]. The reasons for this may stem from the variety of the types, and the elevation of the area where we conducted the study being higher than that in the other studies area. However, our values are close to the values reported by some other studies [15; 16].

Plant height

The differences between the cultivars in terms of plant height were not significant in the first year of the study, and were significant in the second year and in the combined analyses ($p<0.01$) (Table 2). The plant heights in the first year varied between 263 and 283 cm (average 273 cm), and between 275 and 313 cm (in average 289 cm) in the second year. 16 cm higher values were observed in the second year when compared with the first year. The reasons for this may be the cultivation and the climate conditions. In the second year of the study, cultivars Samada-07 and P31G98 had the highest plant heights. At the end of the combined analyses, the plain height values varied between 269-298 cm (in average 281 cm). According to the average of the two years, the highest plant height was observed in cultivar Samada-07, and the lowest plant height was observed in Helen types.

Plant height is under the influence of mostly the genetic factors and this characteristics influence the total yield of the plant [1]. The types may gain more height in better environmental conditions. Öz and Kapar [12] conducted a study to develop hybrid corn types that complied with Samsun conditions, and reported that the genotype heights varied between 251-282 cm. Öz et al. [16] conducted a study in Samsun and Konya conditions and reported that the plant heights varied between 245-292 cm in the first year, and between 240-280 cm in the second year. Öktem and Öktem [11] conducted a study in Harran Plain and reported that the plant heights varied between 193.9 and 332.9 cm, Özata et al. [17] conducted a study on dent hybrid corns in Samsun conditions, and reported that the plant heights varied between 255.8-335.8 cm. Our findings in this study show parallelism with these findings (except for the [17]).

First ear height

The difference between the cultivars in terms of the ear height in the first year and in the combined analyses were not found to be significant; however these values were found to be significant in the second year ($p<0.01$) (Table 3). The ear height values varied between 80-110 cm in the first year (in average 97.4 cm). In the second year, the lowest values were observed in cultivars Helen and Bora, and the highest values were observed in the Samada-07 cultivar. The average of the second year was measured as111.6 cm. In terms of the first ear heights, the values were observed to be higher than the first year, which is parallel to the plant height values. According to the combined analyses and the average, it was determined that the ear heights of the types varied between 95 cm and 117 cm (in average 104.5 cm).

The first ear height is also under the influence of the genetic factors like it is the case in plant height, and this property influences the total yield of the plants [1]. The height of the ear is also important in terms of facilitating the harvest with machines. Our findings show similarity with some of the findings of the previous authors [11; 16 and 17].

Grain moisture at harvest

The differences between the cultivars in terms of grain moisture at harvest were found to be significant in both years and in combined analyses (the first year $p<0.05$, the second year and the combined analyses $p<0.01$) (Table 3). The moisture values of the first year in the study varied between 22.0 and 25.5%, and the lowest moisture value was observed in cultivar Shemal. The MF714, Doge and Presstige cultivars had the highest moisture values in the first year. In the second year and in the combined analyses, the highest moisture values were observed in the cultivar Samada-07. The Bora cultivars had the lowest moisture value both in the second year and in the combined analyses. The average moisture values of the cultivars in the first year were 23.7%, 24% in the second year, and 23.9% in the combined analyses.

The grain moisture is related with the climate conditions, and shows changes according to the length of the vegetation period, and the temperature and the precipitation in the growth period. In regions like the Black Sea Region where the precipitation rate is high in harvest period, and in regions where growth period is limited, the moisture of the grains at harvest become important. For this reason, the types that lose their moisture fast are more suitable to be grown in these areas. According to our findings, the moisture values show that the types used in our study can be cultivated in the study area with great ease, and they can be harvested easily with machinery. Our findings show similarity with the findings of the previous studies conducted in different areas [11; 12; 17 and 23].

Table 2. Mean data and statistical groups of dent maize cultivars for flowering time and plant height

Cultivars	Flowering time (day)			Plant height (cm)		
	2012	2013	Mean	2012	2013	Mean
89MAY70	73,3 ac	71.7 cd	72.5 ef	272	285 bd	278 cf
ADA 9516	72,0 df	74.7 ab	73.3 cd	283	292 b	288 ac
AS71	73,7 ab	74.7 ab	74.2 ab	257	286 bd	271 ef
Bora	71,0 f	70.7 d	70.8 g	270	283 bd	277 cf
Doge	73,0 ad	73.7 b	73.3 cd	272	287 bd	279 cf
Helen	72,7 be	74.7 ab	73.7 bd	263	275 d	269 f
Jeff	69,0 g	74.7 ab	71.8 f	275	295 b	285 bc
Korimbos	72,7 be	71.3 cd	72.0 f	277	290 b	283 cd
Kuadro	71,7 ef	74.7 ab	73.2 de	277	277 cd	277 cf
K.Yıldızı	72,7 b	74.7 ab	73.7 bd	277	286 bd	281 ce
MF714	74,0 a	72.0 c	73.0 de	265	290 b	278 cf
P31G98	73,0 ad	75.0 a	74.0 ac	282	310 a	296 ab
Presstige	72,0 df	74.7 ab	73.3 cd	270	275 d	273 df
Samada-07	73,7 ab	75.7 a	74.7 a	283	313 a	298 a
Shemal	72,3 ce	72.0 c	72.2 f	280	288	284 bd
Mean	72.4	73.6	73.1	273	289	281
CV (%)	0,95**	0.95**	0.93**	4,02 öd	2.62**	3.62**

Means followed by the same letter in the same column are not significantly different. CV: Coefficient of variation

Table 3. Mean data and statistical groups of dent maize cultivars for first ear height and grain moisture at harvest

Cultivars	First ear height (cm)			Grain moisture at harvest (%)		
	2012	2013	Mean	2012	2013	Mean
89MAY70	80,0	110.0 bd	95.0	22,5 bc	21.4 f	22.0 gh
ADA 9516	96,7	116.7 ac	106.7	24,7 ab	23.6 de	24.1 de
AS71	101,7	113.3 bd	107.5	23,4 ac	25.2 c	24.3 cd
Bora	95,0	105.0 d	100.0	22,6 bc	19.7 g	21.1 h
Doge	90,0	118.3 ab	104.0	25,5 a	25.6 c	25.5 ac
Helen	91,7	105.0 d	98.3	23,4 ac	25.4 c	24.4 bd
Jeff	88,3	110.0 bd	99.2	22,4 bc	26.2 bc	24.3 cd
Korimbos	105,0	113.3 bd	109.2	24,2 ac	21.6 f	22.9 eg
Kuadro	103,3	110.0 bd	106.7	23,6 ac	25.0 cd	24.3 cd
K.Yıldızı	88,3	110.0 bd	99.2	22,6 bc	23.6 de	23.1 dg
MF714	105,0	111.7 ac	108.3	25,5 a	22.7 ef	24.1 de
P31G98	105,0	108.3 cd	106.7	23,9 ac	27.6 ab	25.7 ab
Presstige	100,0	111.7 bd	105.8	25,1 a	19.6 g	22.4 fh
Samada-07	110,0	124.0 a	117.0	24,5 ab	28.7 a	26.6 a
Shemal	101,7	106.7 d	104.2	22,0 c	24.7 cd	23.4 df
Mean	97.4	111.6	104.5	23.7	24.0	23.9
CV (%)	15,80 öd	4.73**	10.8 ns	5,78*	4.04**	4.94**

Means followed by the same letter in the same column are not significantly different. CV: Coefficient of variation ns:not significant

Grain/ear ratio

The grain/ear ratio of the cultivars used in the study are given in Table 4. The grain/ear ratio varied between 81.3% and 87.7% in the first year of the study; and the differences between the types were not found to be statistically significant. In the second year and in the combined analyses, the difference between the types were found to be significant ($p<0.01$). The highest value was observed in the cultivar Helen with (85.4% and 86.8%) in the second year and in the combined analyses. The lowest value was observed in cultivar Presstige in the second year, and cultivasr Doge and MF714 had the lowest values in the combined analyses. The average of the cultivars was 85.5% in the first year, and 82.5% in the second year, and the average of both years was 84.0%.

The grain/ear ratio is a genetic characteristics influencing the yield of the cultivars; and if this rate is high, it is reflected positively to the grain yield. The transportation of the nutrients produced during the development period of the plant is various in different types. Our findings show similarity to the findings of the studies conducted by other authors [12 and 17].

Grain yield

The grain yield values of the cultivars that were included in the study are given in Table 4, and the differences between

the types in the second year were not found to be statistically significant. The differences between the types were found to be significant in the first year and in the cultivars values of both years ($p<0.01$). The average values of the types in the first year was recorded as 1009 kg/da; in the second year, as 1063 kg/da; and the average yield of both years was recorded as 1036 kg/da. The lowest yield among the types was observed in cultivar Bora with 767 kg/da, and the highest yield was observed in cultivars P31G98 (1266 kg/da) and Samada-07 (1231 kg/da). The grain yield in the second year varied between 936 and 1120 kg/da. In the combined analyses of both years, the grain yield values varied between 899 kg/da and1193 kg/da, and the highest value was observed in cultivars Samada-07.

The difference of the genotypes in the corn plant cause that the yield obtained from per area is also different. The adaptability of the grains to the environment and the stability values being high influence the grain yield. It is possible to claim that in different corn genotypes, the grain yields per unit is related with the genetic factors and this is an expected result. The grain yield values obtained in our study are similar to the ones obtained in the studies [12; 16; 17 and 21], and slightly lower than the ones reported in [11 and 23]. The reason of this may be due to the difference in the cultivars and in the study area.

Ear length

The data obtained with the measurements on 10 ears taken from each parcel are given in Table 5. The differences observed in statistical analyses obtained with the combined analyses and the data of both years among the cultivars was found to be significant. According to the first year results, the longest ear (22.4 cm) was observed in cultivar Samada-07, and the shortest ear (19.9 cm) was observed in cultivars AS71 and Bora. In the second year, the shortest ear value was observed in cultivar Bora as it was the case in the first year; however, the highest ear value was observed in the cultivar MF714. After the combined analyses of both years, it was observed that the shortest ear was in cultivar Bora (19.1 cm), and the longest ear was observed in cultivars MF714 and Karadeniz Yıldızı (the Black Sea Star) (24.0 and 24.6 cm, respectively). The average of the first year was 20.8 cm, the second year 23.4 cm, and the average of both years was 22.1 cm.

The ear length in corn is an important yield component, and as the length increases so does the number of the grain in the ears. However, it is not possible to claim that the number of the ears per plant, the diameter of the ear, the number of the rows in the ear, the length of the ear and the size of the grains in hybrid corn types alone influence the grain yield [8]. The size of the ear is controlled by the length and diameter of the ear, and the weight of the ear is controlled by the number and the weight of the grains [19]. The findings obtained in this study are similar to the results reported by the authors of the study [20], and higher than the study in [22]. The differences between the ear lengths stem from the genotype characteristics of the types.

Maturating time

The duration in which the plants were mature for harvest was recorded and the maturating time was determined. This duration was recorded as 120 and 125 days (in average 123 days) for the first year among the types (Table 5). The types that maturated the earliest in the first year were the cultivars ADA9516, Bora, Jeff, Kuadro and Presstige. The cultivars Korimbos, MF714, P31G98 and Samada-07 maturated the latest. This duration was recorded as 125 and 131 days for the second year among the varieties (Table 5). The types that maturated the earliest in the second year were the varieties ADA9516 and Jeff. The cultivars 89MAY70, AS71, Doge, Helen, Korimbos, Karadeniz Yıldızı (the Black Sea Star), MF714, P31G98 and Samada-07 maturated the latest. The average values of the two years were between 124 and 128 days.

The most important factor that influences the maturity time is the characteristics of the cultivar. It was reported that the maturity times of the plants might vary between 6-19

Table 4. Mean data and statistical groups of dent maize cultivars for grain / ear rate and grain yield

Cultivars	Grain / ear rate (%)			Grain yield (kg/da)		
	2012	2013	Mean	2012	2013	Mean
89MAY70	86,7	84.1 ab	85.5 ad	806 ef	1073	940 ef
ADA 9516	84,0	82.4 cd	83.2 eg	986 be	1032	1009 cf
AS71	85,3	82.0 ce	83.7 bg	963 bf	1063	1013 cf
Bora	87,7	84.0 ab	85.8 ab	767 f	1052	899 f
Doge	81,3	83.0 bc	82.0 g	1163 ab	991	1077 ad
Helen	88,3	85.4 a	86.8 a	866 df	1096	981 cf
Jeff	87,0	81.9 ce	84.4 bf	1108 ac	1112	1110 ac
Korimbos	85,3	81.9 ce	83.5 cg	1060 ad	1020	1040 be
Kuadro	84,3	80.9 ef	82.7 eg	1098 ac	1047	1072 ae
K.Yıldızı	86,7	83.0 bc	84.8 ae	1233 a	1114	1173 ab
MF714	83,0	80.9 ef	81.8 g	921 cf	1103	1012 cf
P31G98	87,3	84.3 ab	85.7 ac	1266 a	1120	1170 ab
Presstige	85,0	80.3 f	82.6 fg	867 df	936	902 f
Samada-07	85,7	81.3 df	83.4 cg	1231 a	1110	1193 a
Shemal	85,0	81.9 ce	83.4 cg	843 ef	1071	957 df
Mean	85,5	82.5	84.0	1009	1063	1036
CV (%)	3,20öd	1.06**	2.34**	12,55**	8.52 ns	11.19**

Means followed by the same letter in the same column are not significantly different. CV: Coefficient of variation ns: not significant

Table 5. Mean data and statistical groups of dent maize cultivars for ear length and maturating time

Cultivars	Ear length (cm)			Maturating time (day)		
	2012	2013	Mean	2012	2013	Mean
89MAY70	20,4 de	22.7 ce	21.6 bc	123 ab	131 a	127 a
ADA 9516	21,8 ac	22.8 ce	22.3 b	120 c	125 c	123 c
AS71	19,9 e	21.2 e	20.5 c	123 ab	131 a	127 a
Bora	19,9 e	18.3 f	19.1 d	120 c	127 b	124 b
Doge	20,3 de	24.5 cd	22.4 b	123 ab	131 a	127 a
Helen	20,1 de	24.3 cd	22.2 b	123 ab	131 a	127 a
Jeff	20,3 de	24.7 bc	22.5 b	120 c	125 c	123 c
Korimbos	21,0 cd	23.2 ce	22.1 b	125 a	131 a	128 a
Kuadro	21,1 bd	23.2 ce	22.1 b	120 c	127 b	124 b
K.Yıldızı	22,1 ab	27.2 ab	24.6 a	123 ab	131 a	127 a
MF714	20,7 ce	27.3 a	24.0 a	125 a	131 a	128 a
P31G98	20,8 ce	24.4 cd	22.6 b	125 a	131 a	128 a
Presstige	20,6 de	22.0 de	21.3 bc	120 c	127 b	124 b
Samada-07	22,4 a	21.3 e	21.9 bc	125 a	131 a	128 a
Shemal	20,6 de	23.3 ce	22.0 b	122 bc	127 b	124 b
Mean	20,8	23.4	22.1	123	129	126
CV (%)	3,13**	6.51**	5.45**	14,83**	0.69**	11.10**

Means followed by the same letter in the same column are not significantly different. CV: Coefficient of variation

days depending on the environmental conditions [18]. The flowering and maturating times may be longer or shorter under the influence of the environment together with the characteristics of the plants [10 and 18]. Determining the varieties that reach the maturity time in the most proper period for the regions will ensure that the harvest with machinery will be applied and in proper moisture in the grains and decrease the losses in harvest [23]. Our findings are similar to those reported in the study [20] and the findings obtained in Samsun and Tokat locations, and higher than those reported in the studies that were conducted in Adana and Sakarya locations.

CONCLUSION

The highest value in terms of the grain yield and dry matter yield was observed in cultivar SAMADA-07 among the corn types according to the two-year average values. This shows that this type is proper for cultivating in the area for silage and grain purposes. The cultivars P31G98 and the composite Karadeniz Yıldızı (the Black Sea Star) follow this type in terms of grain yield and dry matter yield.

In the light of these findings it has been determined in the study that the corn may be cultivated successfully as the main crop in Çankırı İli, Kızılırmak County in Middle Kızılırmak Basin for grain purposes. In the fields where paddy is cultivated in an intense manner in watery areas, the alternation of the fields with such different crops as corn will be beneficial. In the near future, the fields that will be opened in the area must be taken into consideration and similar studies must be conducted with different materials.

REFERENCES

[1] Angelov K. 1994. Correlations between grain yield and certain plant and ear characteristics in maize hybrids. Field Crop. Abstr. Vol. 47: 133.

[2] Dudley J.W. and R. H. Moll, 1969. Interpretation and use of estimates of heritability and genetic variances in plant breeding. Crop Sci. 9: 257-261.

[3] Hallauer A. R. and J. B. Miranda, 1988. Quantitative Genetics In Maize Breeding. Iowa State Univ. Press, Ames.

[4] Emeklier H. Y. 1997. Erkenci hibrid mısır çeşitlerinin verim ve fenotipik özellikleri üzerine araştırmalar. Ankara Üniv. Ziraat Fakültesi Yay., No:1493, Bilimsel Araştırma ve İncelemeler: 817, Ankara.

[5] İlbaş A. İ., 2009. Organik Tarım İlkeler ve Ulusal Mevzuat. Eflatun Yayınevi, Genel Yayın No:11, Ankara.

[6] İptaş S., A. Öz, A. Boz. 2002. Tokat-Kazova Koşullarında 1. ürün silajlık mısır yetiştirme olanakları. Ankara Üniv. Ziraat Fak. Tarım Bilimleri Dergisi, Sayı: 8(4) 267-273.

[7] Kapar H. ve A. Öz, 2006. Bazı Mısır Çeşitlerinin Orta Karadeniz Bölgesinde Performanslarının Belirlenmesi. OMÜ Zir. Fak. Dergisi, 21(2):147-153.

[8] Kırtok Y., 1998. Mısır Üretimi ve Kullanımı. Kocaoluk basım ve yayınevi. İstanbul.

[9] Kün E. 1994. Tahıllar II. Ankara Üniv. Ziraat Fak. Yayınları, Yayın No: 1360, Ankara.

[10] Kün, E. ve Emeklier, Y. (1987). İklim faktörleri bakımından Türkiye"de mısır üretiminin geliştirilmesi. Problemler ve Çözüm Yolları Sempzym. (s. 1-9), Ankara.

[11] Öktem, A., Öktem, A.G., 2009. Bazı atdişi hibrit mısır (*Zea mays* L. *indentata*) genotiplerinin Harran Ovası koşullarında performanslarının belirlenmesi. Harran Üniversitesi Ziraat Fakültesi Dergisi, 13(2):49-58.

[12] Öz A ve H. Kapar, 2003. Samsun koşullarında geliştirilen çeşit adayı mısırların verim öğelerinin belirlenmesi ve stabilite analizi. Ankara Üniv., Zir. Fak., Tarım Bilimleri Dergisi, Cilt:9 (4), 454-459.

[13] Öz A, H. Kapar ve A. Üstün, 2003. Türkiye'de üretimi yapılan bazı mısır çeşitlerinin discriminant ve cluster analizleri ile farklılıklarının belirlenmesi. GOÜ. Ziraat Fakültesi Dergisi, 20 (2), 115-121.

[14] Öz A., H. Kapar, M. Tezel, A. Üstün, 2010. Silajlık Mısır Çeşidi Islahı Üzerine Bir Araştırma. Türkiye VIII. Tarla Bitkileri Kongresi, 19-22 Ekim 2009 Hatay, Cilt:1. 875-879.

[15] Öz A, S. Yanıkoğlu, H. Kapar, A. Balcı, Y. Yılmaz ve M. Çalışkan, 2005. Samsun ve Sakarya koşullarında geliştirilen ümitvar mısırların verim, bazı verim unsurları ve verim stabilitesinin belirlenmesi. Türkiye 6.Tarla Bitkileri Kongresi, 5-9 Eylül 2005, Antalya.

[16] Öz A, Tezel M, Kapar H ve Üstün A (2008). Samsun ve Konya şartlarına uygun mısır çeşitlerinin geliştirilmesi üzerine bir araştırma. Ülkesel Tahıl Sempozyumu, 2-5 Haziran 2008, Konya, 137-146.

[17] Özata E, H.H. Geçit, A. Öz, S. Ünver İkincikarakaya, 2013. Atdişi Hibrit Mısır Adaylarının Ana Ürün Koşullarında Performanslarının Belirlenmesi. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi (**3:1), 91-98.**

[18] Precheur R. J., J. Doran, D. Schacht, C. Renk, M. Haddix and J. Davlin, 2006. Evaluation of Sweet Corn Varieties at Two Grower Locations in Ohio. Vegetable Research Reports http://vegnet.osu.edu/~vegnet/index.html

[19] Sade B., S. Soylu ve Ç. Palta, 2005. Melez mısır çeşitlerinde tane verimi ve verim unsurları arasındaki ilişkilerin korelasyon, path ve faktör analizi yöntemleri ile değerlendirilmesi. Türkiye VI. Tarla Bitkileri Kongresi (s. 989-994), Antalya.

[20] Sayaslan A., A. C. Ülger, M. A. Sakin, A. ÖZ ve A. Duman, 2010. Farklı Bölgelerde Ana Ürün Koşullarında Yetiştirilen Melez Atdişi Mısır (*Zea mays indentata* L.) Çeşitlerinin Verim ve Yaş Öğütme Kalitesinin Belirlenmesi. TÜBİTAK 107O800 nolu proje Sonuç Raporu.

[21] Tezel M. ve Ş. Aksoyak, 2008. Konya koşullarında bazı tek melez mısır genotiplerinin performanslarının belirlenmesi. Bitkisel Araştırma Dergisi 2: 1–4.

[22] Turgut İ ve A. Duman, 2004. Mısırda (Zea mays indentata Sturt.) Kombinasyon Yeteneği ve Melez Gücü Üzerine Araştırmalar. Ulud. Üniv. Zir. Fak. Derg., (2004) 18(1): 129-143.

[23] Vartanlı S. ve H. Y. Emeklier, 2007. Ankara koşullarında hibrit mısır çeşitlerinin verim ve kalite özelliklerinin belirlenmesi. Ankara Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi, 13 (3): 195-202.