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Determination of Performances of Some Maize Silage Genotypes and Crop Water Consumptions: A Case Study of Turkey's Southeast Anatolia

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Abstract

This research was conducted in the second product conditions optimal silage maize varieties and plant water consumptions in order to determine in the Agricultural Research Institute of Eastern Mediterranean located in the province of Adana in Turkey's Southeast Anatolia in the field conditions in 2013 year. Founded in 4 replicates randomized block design was used in this study, 12 hybrid maize varieties as seed material. All maize varieties in the trial of 70 x 15 cm (row spacing and above) were sown in sowing. The grain harvest processing milk line in the silage corn varieties have been made in the different group was when it comes to 50%. Soil moisture monitoring is performed by gravimetric method. When adequate moisture decreases to 50% is irrigated all varieties of the same day. It can include water and irrigation water applied to 5 the total amount of irrigation water applied is an average 468 mm. Evapotranspiration (ET) values changed in some genotypes, but the lowest (481 mm) from the value Bolson genotypes were obtained from P30B74 genotype with the highest value is 541 mm. The ET values obtained in other genotypes varied between these two values. With respect to the variance analysis results are statistically significant differences between all examined characteristics in varieties were identified. The highest value in terms of herbage yield based on the findings 5640.15 kg/da P30B74 also found in the variety.

Keywords: *Second Crop Maize; Silage; Green Herbage Yield; Crop Water Consumption*

Introduction

Maize which can be assessed in human and animal nutrition, and is quite large areas of a plant, The highest yield of solar energy in providing the best use of maize grain per unit area and from a C4 plant produces a maximum dry matter[1]. Maize in human nutrition present in temperate regions largely consumed in developed countries, although animal feed conventionally used. Green grass or silage corn is used as in animal nutrition. 60% of the corn produced worldwide animal feed, directly as human food consumption 10%, 20% and 10% of the processed food is estimated to be used as seeds to other consumption. On the other hand manufacturing of other branches of industry it may be used directly or derivatives thereof. Increase in demand for processed products as well as the increasing population of this user diversity. Wellness request of the increase animal production and processing industry in the development of the demand for development emerged as the world corn production has led to continuously increasing due to factors. Maize with high energy efficiency, is not suitable for cultivation machine to harvest to planting, storage and ease of use, low loss rate, include high dry matter, the height of the digestion rate, high quality and have a delicious silage feed, it can get a high yield per unit area, easy to find the seed, it can be ensiled without the need for any additives in the world, both located one of the most preferred as silage crops in our country [2].

It reached the desired level of animal husbandry is the most important issue in our country, having failed quality cheap and plentiful forage needs can not be met on a regular basis. Is the most important cost elements in the cost of feeding livestock. Field crops as corn, which is one of the oldest cultures of human in our country and the world, because it is a highly efficient and profitable grain increasingly important in hot climates. In recent years, due to the promotion of corn production in Turkey in corn acreage and production has been remarkable increases. Besides the increase in corn acreage in our Central Anatolia and Southeast Anatolia regions, especially the share of the increase in maize production in the second product in our coastal regions, particularly the Cukurova region is huge. Cultivate multiple products in the same vegetation period (second and first crop cultivate) It can be supplied. Forage crops as the second product to meet the needs of our country's livestock forage is of great importance to train. In this sense, the cultivation of fodder crops for silage corn has come to the forefront because of the easy applicability [3]. Practices that promote corn production. development of high-yield varieties. efficient use of fertilizer and water. Its ease of mechanization and marketing is the most important cause of increased acreage and production. Intensive maize cultivation in the Mediterranean region, the Black Sea, Marmara, Aegean and has made about 60 provinces in Southeastern Anatolia. According to the research in our country silage corn production rapidly increasing in recent years and nearly was 3.36 million in corn silage production is about 15 million tonnes made in the field. per hectare yield of 4450 kg / da unless otherwise stated [4]

Today, in developed countries for many years, the number of varieties have been registered in our country for money to be offered to farmers by developing hundreds of silage corn silage varieties in the results of the study are scarce. The first year in silage yield and quality of the Breeders is despite thinking just as if they were connected to the grain yield of today's new silage quality and efficient grain corn varieties in the development of corn varieties at the same time begin to change the approach could be quality silage varieties. The selection criteria are the most important breeding varieties of corn silage energy value that is easily digestible high dry matter yield has been demonstrated in studies should be chosen as a kind of high silage varieties [5]

Dry matter content being ensiled be easy for them to have easy soluble carbohydrate content, such as corn and sorghum Sudan grass is over 30% and in the meantime is no need for any additives. Lovingly consumed by ruminant animals, maize and energy indispensable since it is a rich source of roughage. In the production of corn silage, but it is possible to obtain high yields with the cultivation of suitable varieties for each region ecology can not show the same performance in all kinds of ecology should be determined by local trial every kind of compatible to their ecology [6].

Corn silage yield and quality; climate and soil factors, altitude, time of sowing, sowing, watering and harvesting period alongside factors such as genotype is associated undoubtedly very significant [7]. Silage corn cultivation is very important for the quality of feed production using corn varieties suitable. adaptability required by the cultivation of corn silage varieties of low yield can not be obtained [8]. Manufacturer of maize varieties to choose the most appropriate to their ecology is of great importance in this regard. Additionally every year due to characteristics of hybrid corn plants of this bit must be made about production-enhancing breeding and agronomy to that operation [9]

In this study, Determining the optimum silage corn varieties in this study, the second product application located in Adana ecological conditions in Turkey's Southeastern Anatolia Region, aimed to evaluate in terms of yield components and yield of calculation and Crop water consumption of varieties

Materials and Methods

Materials

In this research, the field expirement was conducted between June and September 2013 in Turkey's Southeast Anatolia (Adana Province) in Agricultural Research Institute of Eastern Mediterranean in the second crop conditions. It is being carried out and the location where the work area is shown in Figure 1.

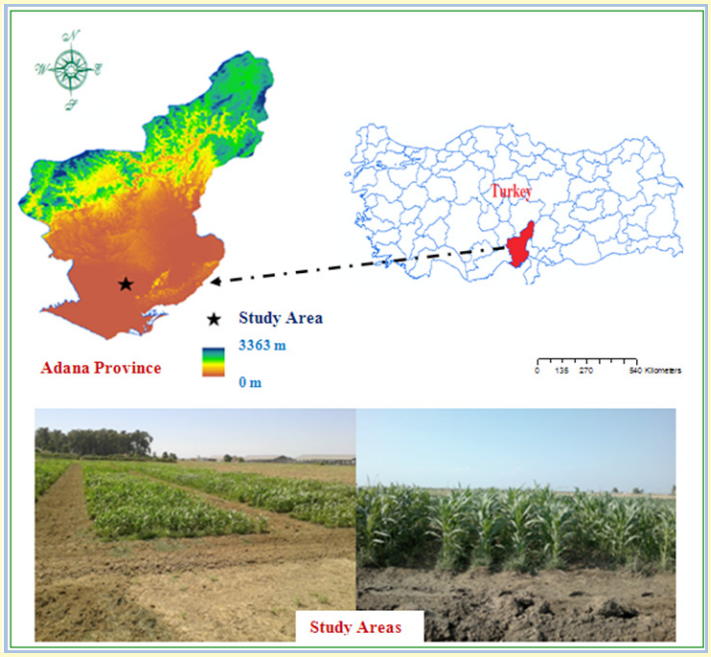

Figure 1: *Location of Study Area*

Some Soil Characteristics of the Study Area

Physical and chemical properties of the test area by examining the soil samples taken from the 0-30 cm soil layer of soil laboratory testing ground where the work was carried out determined and are presented in Table 1.

Soil Depth(cm)	Sand(%)	Silt(%)	Clay(%)	Texture Class	Bulk Density(g/cm^3)	Field Capacity(%)	Wilting Point(%)
0-30	15.1	39.0	43.2	C	1.31	30.11	16.21
30-60	10.0	47.4	41.0	SiC	1.27	30.22	16.12
60-90	10.2	54.2	33.5	SiCL	1.32	30.40	15.31

Table 1: *Some physical characteristics of the soil in study area.*

C: Clay, SiC: Silty Clay, SiCL: Silty Clay Loam

The physical and chemical properties of the soil of the field trial examined the soil pH is slightly alkaline (pH:7.9), lime content of more than (11.9%), organic matter content is very low (0.911%), salt content is 0.038%, belong to the class. The clay loam soil texture and phosphorus content can be less (P_2O_5 = 1.08 kg/da). Low soil pH (acidic) or high (alkaline) that affect the uptake of nutrients. In general the desired ideal pH value of the plants in the soil is from 6-7. The excess acid and alkaline pH values in the experimental area is located close to the borders of non-neutral 5.5-8.5. Therefore, it was an obstacle to the growth of corn in soil pH. The average quality of the irrigation water used in the study; pH: 7.2; EC = 0.390 dS/m; SAR: 0.42 and irrigation water is T2A1 class. Second class in accordance with the direction of medium quality of irrigation water salinity considering these values, less in terms of sodium is first class.

Some Climate Characteristics of Research Areas

The Mediterranean climate is observed in research area are mild and rainy winters, hot and dry summers pass. Some climate datas for the 2013 year and try to do the long years of the study area are given in Table 2.

Months	Total Rain (mm)		Weather Temperature(°C)		Humudity (%)	
	The average over the year	2013	The average over the year	2013	The average over the year	2013
May	39.18	64.8	20.76	21.83	63.91	78.71
June	15.13	7,80	24.53	24.15	64.58	74.93
July	8,64	1,20	27,02	26.53	68.18	75.39
Agust	6,44	6.0	27.53	26.99	67.84	78.13
September	15,30	22.0	25.15	23.34	62.38	74.80

Table 2: *Some Climate Datas of Adana province during the corn growing period [10].*

The high precipitation values in other months of May and September were lower than in many years. The air temperature was realized in parallel by many years, but the relative humidity around 15% more than occurred in all months. It can be said that a good period for corn of climate data. Usually 10-15 days in June and August (5 times) was prevented from entering the corn plants irrigated with water stress.

Methods

Examined features and other applications

This chapter gives a description of the leaf dataset used in the study presented in this paper. For each plant species e.g. *Tilia* sp., *Cornus* sp. and *Zea mays* L., basic variables are determined e.g., fresh weight, dry weight and water and (Chl). The DMSO (Chl) extraction method was used [11], as recommended by [2] and [18].

The experimental design was randomized complete block design with four replications pattern. Trial formed in every four ordinary parcels. Row spacing of 70 cm. row spacing of 15 cm and parcel size is set to 5m. All phosphorus fertilizer (10 kg/da P_2O_5). 28 kg / da of nitrogen is applied to the N with half the attachment. while the other half were given when the plant 40-50 cm long. Weed control. 2-4 leaf stage at a time when the plant made mechanically with anchor. once at 200 g/da was carried out using a dose of 2-4 D amine herbicide.

In the fight against the wolf stalks and cobs period in 6-8 leaves of plants. 14 day interval (twice), 30 to 50 ml/doses. an insecticide microcapsule suspension drug formulations effective contact and digestion was discarded. In addition to, proposed plant measurements and evaluation criteria in terms of plant view is used [11].

Examined features in the trial; Plant height (cm) and plant appearance (1-5). According to the scale of plant appearence, 1: very smooth plant 2: smooth plant 3: medium plant, 4: deformation plant 5; very deformation plant [16]. The number of sheets (number / plant). The number of cob (unit / plant). shank diameter (mm). Removing tasselling time (days), silage was time (days), herbage yield (kg / da). cobs / plant (%), leaf / plant (%) and the stem / plant (%) values were investigated. The most convenient and practical method of grain in the milk line for silage harvest levels were monitored. According to the number of days to maturity Temporarily these varieties or very late in the set. The best time in the milk line that grain has been harvested ½ levels.

The statistical evaluation of the data obtained in the trial JUMPER 5.0 software made using analysis of variance and LSD test program to determine the differences between groups.

Maize Genotypes

In this study, obtained from different manufacturers or 7 genotypes of maize were used as a very late and late group located 12 genotype silage corn seed material (Table 3).

S.No	Genotype name of Maizes	FAO mature group	Companies that received the seed aize
1	P30B74	750 (very late Genotype)	PIONEER Seed Company
2	P29W48	730 (very late Genotype)	PIONEER Seed Company
3	PG PASHA	650 late Genotype)	PROGEN Seed Company
4	PG 1661	700 (very late Genotype)	PROGEN Seed Company
5	KOLOSSEUS	700 (very late Genotype)	KWS Turkish agriculture Seed Company
6	KİLOWATT	700 (very late Genotype)	KWS Turkish agriculture Seed Company
7	HİDO	700 (very late Genotype)	MAYAGRO Seed Company
8	EVEREST	650 late Genotype)	MAYAGRO Seed Company
9	PL-710	620 late Genotype)	POLEN Seed Company
10	BOLSON	600 late Genotype)	POLEN Seed Company
11	OSSK-644	640 late Genotype)	TAREKS Seed Company
12	COLONIA	650 late Genotype)	AGROMAR Seed Company

Table 3: *The materials of the seed maize silage used in this study.*

Irrigation

The second crop was planted in corn silage June 17th. After planting, water is life on June 19 was given first. Soil moisture profile changes were monitored throughout the gravimetric method and moisture levels in the soil were initiated 50% thought irrigation practices. Irrigation to field capacity (FC) is made until it reaches. Located in terms of moisture% dry weight in the study in terms of depth values (mm) converted to moisture values. For this purpose, all the irrigation of 90 cm soil profile before the irrigation of issues 0-30, the dry weight of the soil samples taken from the 30-60 and 60-90 cm layer (%) is defined in terms.

Moisture content determined for each layer. It has been transformed into depth in terms of moisture content using the following equation-1.

$$d = \frac{PwxAsxD}{10} \qquad (1)$$

in equation: d; The water content in terms of depth of soil moisture (mm), The moisture content is determined for each layer (%), As; volume weight of soil (g/cm^3) ve D; The depth of the soil layer (cm).

Total water collected by the water depth 90 cm soil profile is calculated for each layer (dt) were quantified (equation-2).

dT=d(0-30)+ d(30-60) + d(60-90) (2)

The volume of water to be given to each parcel of the total amount of water (dT) Equality parcel area is calculated by multiplying by equation-3.

V=dTxA (3)

in equation: V; The volume of water to be given to parcels (L), A; parcel area (m^2), dT; Total Water Amount. The amount of water will be given to the parcel will be applied after calculating irrigation water has been passed through the meter.

For calculating the evapotranspiration. It was used for the following water balance equation-4 [12,15]

$$ET = P + I - Rf - Dp \pm \Delta S \quad (4)$$

in equation: ET; Evapotranspiration (mm), P; Rain (mm), I; Irrigation water (mm), R_f; surface flow (mm), D_p; deep percolation (mm) and ± ΔS: The difference between the root zone soil moisture storage in the period beginning with the year-end exchange or expressed in mm.

For the realization of Rf, Dp and P was adopted zero. P values were determined from rainfall gauges in the trial observation park near the Institute. ΔS values were determined from measurements of the moisture profile. Deep percolation losses will not be given for more water from the soil to field capacity in irrigation (Dp) were assumed to be zero. Also runoff values (Rf) were excluded from the calculation of junk counted. Water use efficiency (WUE), calculated as the green yield divided by seasonal evapotranspiration(ET) and irrigation water use efficiency (IWUE), calculated as green yield divided by total amount of irrigation water applied.

Results and Discussion

FAO was examined in terms of all characteristics group best results in general in sort of 700 and above are obtained. Trials also discussed plant height, plant view, stem diameter, number of cobs and leaves the differences that occur between varieties terms are given in Table 4.

Genotypes	Plant Height (cm)	cob view (1-5)	Stem diameter (mm)	Corncob number (number/plant)	Leaf Number (number/plant)
P30B74	272.5 a	1.0 a	23.50 ab	1.13 ab	14.25 a
P29W48	262.5 ab	1.0 a	20.87 bc	1.06 b-e	12.87 a-c
PG PASHA	210.1 fg	3.0 d	21.12 a-c	1.00 b-e	11.62 c
PG 1661	228.8 de	2.5 b-d	22.25 a-c	0.98 c-e	12.25 bc
KOLOSSEUS	213.8 e-g	2.8 cd	22.00 a-c	1.00 b-e	11.50 c
KILOWATT	248.8 bc	2.3 bc	24.00 ab	1.10 bc	12.12 bc
HİDO	204.0 g	3.0 d	21.62 a-c	1.05 b-e	13.25 ab
EVEREST	226.6 de	2.8 cd	22.50 a-c	1.07 b-d	12.50 bc
PL-710	246.0 c	2.0 b	22.00 a-c	0.93 e	11.87 bc
BOLSON	223.5 d-f	2.8 cd	19.25 c	0.96 de	12.37 bc
OSSK-644	239.3 cd	2.5 b-d	21.62 a-c	0.99 c-e	12.00 bc
COLONIA	233.3 cd	2.3 bc	25.00 a	1.26 a	12.12 bc
CV (%)	4,89	20,64	12,77	8,97	8,25
LSD (0,05)	16,49	0,68	4,07	0,13	1,47

Table 4: *Some plant parameters meausured in maize genotypes.*

*According to LSD test the average indicated a similar case in the same column P < 0.05 are different from each other in a statistical error limits. Scale of plant view; 1: very smooth plant 2: smooth plant 3: medium plant, 4: deformation plant, 5: very deformation plant.

The extraction time of tasselling, silage that time, stalk/plant, ear/plant, leaf/plant while rates and herbage yield of the differences arising between the terms of varieties is given in Table 5.

5% of all the features examined in terms of statistical significance varieties ($P < 0.05$) differences were found in levels.

Genotypes	Tasselling Time (day)	Silage maturation period (day)	Stem/plant (%)	Corncob / Plant (%)	Leaf /Plant (%)	The Yield of Green Grass (kg/da)
P30B74	69.25 a	82.25 a	46.13 a	35.27 e	18.58 a	5640.15 a
P29W48	66.25 b	81.00 ab	40.34 b-e	43.46 b-d	16.19 b-e	4710.95 b
PG PASHA	63.25 d-f	80.00 b-d	34.78 g	46.64 ab	18.56 a	4117.89 b-d
PG 1661	65.75 bc	80.75 bc	37.58 e-g	44.66 a-d	17.75 ab	4254.96 b-d
KOLOSSEUS	63.75 c-f	77.75 e	37.01 fg	48.58 a	14.39 e	3979.05 b-d
KILOWATT	62.75 ef	78.75 de	39.17 c-f	44.43 b-d	16.39 b-d	4225.83 b-d
HİDO	65.50 b-d	80.00 b-d	35.14 g	46.28 a-c	18.56 a	4487.85 bc
EVEREST	62.50 f	79.75 b-d	37.82 d-g	45.46 a-d	16.71 a-c	4157.54 b-d
PL-710	65.00 b-e	79.75 b-d	40.96 b-d	42.05 d	16.98 a-c	4543.50 b
BOLSON	62.75 ef	80.00 b-d	39.92 c-f	43.56 b-d	16.51 a-c	3704.74 d
OSSK-644	63.75 c-f	80.00 b-d	43.24 ab	42.24 cd	14.50 de	3794.39 cd
COLONIA	65.50 b-d	79.50 cd	42.20 bc	42.39 cd	15.40 c-e	4648.04 b
CV (%)	2,61	1,22	5,84	6,52	8,18	11,87
LSD (0,05)	2,43	1,41	3,32	4,10	1,96	743,95

Table 5: *Some plant parameters meausured in maize genotypes.*

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*According to LSD test the average indicated a similar case in the same column $P < 0.05$ are different from each.
other in a statistical error limits.

Units from the field at the highest level in terms of quality and quantity in order to achieve effective on green grass and silage corn yield grown in one of the morphological characteristics of plant height character is largely under the influence of genetic factors. Besides the genetic characteristics of a sort that the product of the growing season in maintenance (watering-anchor-fertilization) enough time and directly affects the development of the plant height do. Increase the length of the leaf area of plants. thus increasing the number of leaves and assimilation of tall corn silage varieties constitute the most naturally green option. The values obtained in this study in terms of plant height varied between 204 and 272.5 cm. The highest plant height value 272.5 cm and the lowest plant height values were obtained from the P30B74 varieties were obtained from HIDO varieties with 204 cm. The average value on the basis of all varieties of plant height (234.1 cm). Researchers have found Antalya Province in an average plant height values(234 cm) of the second crop corn silage in 2006 [14].

Different groups (4 units) of plant varieties in terms of appearance occurred. The best view was detected in P30B74 with P29W48 types according to the received data; In view of the weakest sort of HIDO and PASHA it has been identified. If the stem is located between 19.25 to 25 mm in diameter according to the kind of value. The highest values were obtained in stem diameter of 25 mm Colonia kinds. Average stem thickness value was found to be 22.14 mm. If this value; in Diyarbakir Province of Turkey in the second crop of silage corn stalk thickness than the period they identified at milk (23.8 mm) on the lower. The examination carried out for the highest value 1.26 Total number of cobs / plant varieties and still were obtained from COLONIA. In the examination of the highest value in terms of the number of sheets; In most kinds of tall varieties P30B74 14.25 units / plant has been identified [13].

Detailed evaluation of the properties; Removing tassel Time (days). Silage Up Time (days). Corn stalks/ Plant (%). Leaf / Plant (%) and the Green Forage Yield (kg/da) in terms of the highest values were obtained from P30B74 kind. Cob / Plants (%) in terms of the kind has been identified as the highest value KOLOSSEUS 48.58%. Centered on the cob/vegetable was found to be 43.75%. his value in 2006 made the second crop in the Antalya province, they cobs / plant (35%) was higher than that [14]. Average leaf / plant value (16.71%), while Diyarbakir province in which they have done in the second crop leaf / plant was lower of 21.91%. Average stem / plant value (if we look at 39.52%) value 53.5% said they have been shown to be very low [13]. The amount of water applied to the cultivars, plant and water consumption and water use efficiency are calculated and presented in Table 6.

Maize Genotypes	Irrigation (mm)	ET (mm)	Water Use Efficiency (WUE) (kg/m^3)
P30B74	468	541	10,4
P29W48	468	534	8,8
PG PASHA	468	493	8,3
PG 1661	468	502	8,4
KOLOSSEUS	468	490	8,1
KILOWATT	468	511	8,2
HİDO	468	522	8,5
EVEREST	468	516	8
PL-710	468	530	8,6
BOLSON	468	481	7,7
OSSK-644	468	489	7,6
COLONIA	468	522	8,9

Table 6: *Irrigations, crop water consumption and water use efficiency of Genotypes.*

Water use efficiency (WUE) values, the lowest (7.6 kg/m^3) value with the OSSK-644 genotype, and the highest 10.4 kg/m^3 was obtained from the P30B74 genotype. While WUE values obtained in other genotypes varied between these two values. P30B74 compared to other genotypes of the genotype of irrigation water at the optimum level we can say that using a yield genotypes. Evapotranspiration (ET) values at low (481 mm) from the value BOLSON genotypes were obtained from P30B74 genotype is highest value. The ET values obtained in other genotypes varied between these two values. WUE and the plant species and varieties of ET values, soil type, we can say that vary depending on the climate.

Silage corn is the most important element in the production of green forage yield and the most important reason for preference. The higher the neck of a plant silage maize varieties, it is the large number of leaves and leaf / plant also leads to a high rate. In addition to these, a whole cobs / plant rate the quality of the silage is a high impact in a positive way. For these reasons; P30B74 sort of conditions in which the products of the tall cultivars used in this study the highest (5640.15 kg/da) were obtained green forage yield. Average forage yield was 4355.40 kg/da. Adana ecology of these values in the second crop, province of Antalya in 2006, they found an average yield of green grass in the second crop (6345 kg/da) has been realized quite low [14].

Conclusıon

Silage corn is the most important element in the production of green forage yield and the most important reason for preference. The higher the neck of a plant silage maize varieties, it is the large number of leaves and leaf / plant also leads to a high rate. In addition to these, a whole cobs / plant rate the quality of the silage is a high impact in a positive way.

For these reasons; P30B74 sort of conditions in which the products of the tall cultivars used in this study the highest (5640.15 kg/da) were obtained green forage yield. Average forage yield 4355.40 kg/da, respectively. Adana Province's ecology of these values in the second crop, province of Antalya in 2006, they found an average yield of green grass in the second crop (6345 kg/da) has been realized quite low [14].

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