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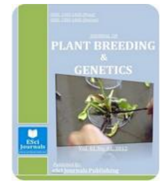

ASSESSMENT OF MAIZE GENOTYPES FOR FORAGE YIELD AND QUALITY

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A B S T R A C T

The present study was targeted to evaluate eight maize advance lines in comparison to one local check for green fodder yield potential and nutritional quality. The experiment was conducted at Fodder Research Institute, Sargodha during August 2017. The experiment was sown in a randomized complete block design with three replications having a plot size of 2.4 m x 6 m. The crop was harvested at 50% flowering stage and data regarding plant height, Number of leaves per plant, leaf length, leaf width, leaf area, leaves weight per plant, stem weight per plant, leaves to stem weight ratio, green fodder yield, dry matter percentage, crude protein and crude fibre were recorded. The results showed that the performance of the advance lines; No.1501 and MS.2010 was best among all the studied genotypes in terms of fodder yield respectively. Both genotypes exhibited a good nutritional quality.

Keywords: Maize, genotype, Forage Yield, Nutritional quality.

INTRODUCTION

Fodder crops are considered as an imperative source for the development of livestock industry all over the world including Pakistan as it provides most economical and valuable feedstuff for animals (Sarwar *et al.*, 2002). In South Asia region different fodder crops like maize, sorghum, millet and Guar are cultivated to fulfil the dietary requirements of the animals in Kharif season. Among these fodders, maize is of great importance and quite famous among dairy farmers because of some superior characters like quick growth nature, wider adaptability, high biomass, free from anti-nutritional components, high palatability and digestibility. It also holds sufficient nutritional quality as compared to other non-leguminous fodders (Mahdi *et al.*, 2011). Significant variation was observed for growth parameters, forage yield, dry matter and crude protein among the different maize cultivars whereas crude fibre was not influenced significantly (Ayub *et al.*, 2001). Fodder production is inadequate to meet the requirement of livestock population in Pakistan. Ayub *et al.* (2012) reported that genetic improvement in fodder crops is essential to ensure the substantial amount of fodder for growing population of livestock. Awan *et al.* (2001) observed significant variation among the different maize genotypes for forage quality and yield traits and also concluded that plant height, stem diameter and leaf area were the major causes to increase forage yield. Hussain *et al.* (1995) also reported that genetic changes in crops resulted wide variations in morphological and forage quality traits. Selection on the basis of high forage yield is one of the most important criteria for development of genetically improved maize varieties for fodder purpose (Allen *et al.*, 1997).

Thus, there is dire need to develop genetically improved maize variety for high forage yield and better nutritional quality. Genetic improvement in crops are mainly focused to enable the crops to survive in unexpected and inexplicable change of environmental conditions. This experiment was conducted to observe genetic variations among the maize advance lines for different forage yielding and quality traits. This study was also aimed to select maize advance lines which can provide adequate quantity of fodder with good nutritional quality in comparison to local check variety under agro-climatic condition of Sargodha. Furthermore, as the result of this study the most suitable and genetically improved advance lines may be recommended to proceed further for variety development and further approval process.

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MATERIALS AND METHODS

The present study was carried in the research area of Fodder Research Institute, Sargodha under irrigated condition during August 2017 to evaluate different maize genotypes on basis of green fodder yield and quality. The research material was comprising of following eight advance lines and one local check variety of maize.

Sr. No.	Treatments/ Entries
1	MS.2010
2	FSD.2018
3	YHM.112
4	No.1501
5	Sgd.2002 (Check)
6	C.7065
7	FSD.2020
8	MS.2015
9	YHM-113

The trial was conducted in RCBD with three replications. Plot size was 2.4 m x 6 m for each genotype. A uniform seed rate of 15 kg ha^{-1} was kept in all treatments. The recommended fertilizer dose of 90 N: 80 P kg ha^{-1} was applied at the time of seedbed preparation. The crop was planted with the help of hand drill keeping 30 cm row to row spacing.

Data Recording: Data on morphological parameters like plant height, number of leaves per plant, leaf length, leaf width, leaf area, stem diameter, leaves weight per plant, stem weight per plant, leaves to stem weight ratio were recorded by taking five plants randomly from the individual plot at 50% flowering stage and then averaged. Fifty percent area of the plot was harvested at the same stage to record green fodder yield. One kg green fodder sample at harvesting time was collected at random for estimating dry matter % from each plot. The collected samples were weighed, dried in an oven at 60 ^{o}C up to a constant weight and again weighed to calculate the dry matter % for each treatment by the following the formula:

$$Dry\ Matter\ (\%) = \frac{Dry\ weight\ of\ sample}{Fresh\ weight\ of\ sample} \times 100$$

Whereas, the forage nutritional quality parameters like crude protein and crude fibre were determined on the basis of dry matter by using procedures recommended by AOAC (1990).

Statistical Analysis: The data collected on various morphological and quality parameters were statistically analyzed through Fischer's analysis of variance technique and LSD test at 5% probability level was applied to find significance among treatment means (Steel and Torrie, 1980)(Steel et al., 1997).

RESULTS AND DISCUSSION

Fodder Yielding Traits: It is evident from table 1 that analysis of variance showed considerable difference among the maize genotypes for fodder yielding traits.

Plant height: It is one of the important growth parameters for selection of high fodder yielding maize genotypes. The data presented in table 1 showed that maize genotype No.1501 gave maximum mean value for plant height (258.63 cm) followed by MS.2010 (248.67 cm) which were statistically at par with each other. However, No. 1501 was significantly better than local check variety Sgd.2002 (233.50 cm). The difference in plant height could be due to variation in genetic make-up that results in changes in the plant height of the different genotypes (Khan *et al.*, 2007). Chaudhary *et al.* (2016) also reported a considerable varietal variation in the plant height of maize crop raised for fodder purpose.

A number of leaves per plant: It is an eminent character in relation to fodder yield. Among tested maize genotypes, MS.2010 produced a maximum number of leaves per plant (16.53) which is statistically similar to No.1501 (16.07) and significantly different from check variety Sgd.2002 (15.17). Variation among genotypes for leaves/plant could be attributed to the genetic make-up and intrinsic ability of different cultivars to access growth resources and their expression in terms of yield (Kumar and Sarlach, 2015). Chaudhary *et al.* (2016) also reported variation in leaves/plant of maize hybrids and composite raised for fodder purpose.

Leaf length: The results as shown in table 1 indicated significant difference among most of the maize genotypes for leaf length. The maximum leaf length (100.93 cm) was observed in MS.2015 which is significantly higher than No.1501 (94.63 cm), MS.2010 (93.37 cm) and local check variety Sgd.2002 (90.83 cm) while the genotypes No.1501, MS.2010 and local check Sgd.2002 are statistically similar to each other. The minimum leaf length (77.83 cm) was observed in Fsd.2018. In a study on maize, Yoseph (2005) also reported a wide range of phenotypic variation for leaf length.

Table 1. Comparison among the maize genotypes for fodder yielding traits.

Entries	Plant Height (cm)	Leaves per Plant	Leaf Length (cm)	Leaf Width (cm)	Leaf Area (cm²)	Stem Diameter (cm)	Leaves weight per plant (g)	Stem weight per plant (g)	Leaves to Stem Weight Ratio	Green Fodder Yield (t/ha)
MS.2010	248.67 AB	16.533 A	93.37 B	8.33 B	583.28 B	2.13 AB	187.57 B	622.57 A	0.301 BCD	59.23 A
FSD.2018	191.83 E	11.67 E	77.83 D	7.23 DEF	422.17 E	1.50 DE	131.67 FG	445.00 D	0.296 CD	35.17 DEF
YHM.112	198.73 DE	13.17 D	78.00 D	6.80 F	397.13 E	1.43 DE	127.00 G	393.33 E	0.324 BC	32.63 EF
No.1501	258.63 A	16.07 AB	94.63 B	9.33 A	662.09 A	1.93 ABC	206.37 A	607.17 A	0.340 B	63.53 A
Sgd.2002	233.50 BC	15.17 B	90.83 B	7.63 CD	519.57 C	1.80 BCD	161.17 CD	565.93 B	0.285 CD	46.13 BC
C.7065	200.17 DE	11.27 E	81.03 CD	6.70 F	407.42 E	1.40 DE	125.03 G	478.97 C	0.262 D	29.77 F
FSD.2020	217.77 CD	14.03 CD	84.40 C	7.47 DE	472.54 D	1.60 CDE	150.30 DE	481.93 C	0.312 BC	40.53 CD
MS.2015	226.27 BC	15.10 BC	100.93 A	8.27 BC	625.34 A	2.27 A	169.00 C	628.57 A	0.269 D	49.90 B
YHM-113	210.17 CDE	12.07 E	82.87 C	6.93 EF	431.15 E	1.30 E	143.50 EF	375.37 E	0.384 A	37.67 DE
LSD (5%)	24.06	1.08	4.54	0.646	37.03	0.410	15.48	32.47	0.040	6.38

Table 2: Comparison among the maize genotypes for fodder nutritional quality traits.

Entries	Dry Matter (%)	Crude Protein (%)	Crude Fibre (%)
MS.2010	27.07 C	8.63 C	28.16 D
FSD.2018	31.93 A	7.27 DE	29.83 C
YHM.112	18.07 G	6.80 E	25.50 E
No.1501	29.53 B	11.00 A	31.67 AB
Sgd.2002	25.10 DE	7.70 D	30.37 BC
C.7065	21.73 F	5.47 F	24.77 E
FSD.2020	23.70 E	9.23 B	32.33 A
MS.2015	25.73 CD	6.87 E	25.20 E
YHM-113	24.03 E	7.03 E	24.60 E
LSD (5%)	1.51	0.48	1.34

Leaf width: It is an important factor for enhancing crop yield and productivity as more chlorophyll contents were observed in broad leaves of maize genotypes (Aguiar *et al.*, 2003). Amongst studied genotypes, No.1501 produced maximum leaf width of 9.33 cm which is significantly higher than the local check Sgd.2002 (7.63 cm) while minimum leaf width (7.23 cm) was observed in FSD.2018. These findings are in confirmatory with those of Yoseph (2005) who also reported significant difference among the maize genotypes for leaf width.

Leaf area: Leaf area has prime importance for fodder yield. Substantial variation was observed among all the maize genotypes for leaf area (table 1). The genotype No.1501 ranked first with maximum leaf area of 662.09 cm^2 followed by MS.2015 (625.34 cm^2) which is significantly higher than local check Sgd.2002 (519.57 cm^2). However, YHM.112 produced minimum leaf area among all the genotypes. These results were found similar to Mehmood *et al.* (2003) who reported considerable variation among maize genotypes for leaf area. The higher leaf area also persuaded that the chlorophyll contents are increased that caused the increase in growth and development of crop plants (Bänziger *et al.*, 2002).

Stem diameter: The results in table 1 showed significant difference among most of the maize genotypes. MS.2015 produced maximum stem diameter (2.27 cm) followed by MS.2010 (2.13 cm) which is significantly higher than local check sgd.2002 (1.80 cm). While maize genotype YHM-113 produced minimum stem diameter with 1.30 cm mean value. Derera *et al.* (2007) also reported significant variation among different maize genotypes. The variation among the genotypes for stem diameter may be due to variation in their genetic make-up.

Leaves weight per plant: It is considered that due to higher leaf weight fresh and dry biomass of plant may be increased. The data in Table 1 showed significant difference among maize genotypes for leaves weight per plant. The genotypes No.1501 and MS.2010 gave maximum mean values of 206.37 g and 187.57 g for leaves weight per plant. However, these genotypes also produced significantly higher leaves weight per plant than the local check variety Sgd.2002 (161.17 g) while C.7065 produced lowest leaves per plant weight (125.03 g). Similar findings were also reported by other scientists (Ali *et al.*, 2013; Malik *et al.*, 2004).

Stem weight per plant: Data in table 1 revealed that significant difference was observed among most of the genotypes for stem weight. The genotype MS.2015 produced maximum stem weight (628.57 g) followed by MS.2010 (622.57 g) and No.1501 (607.17 g). The stem weight of these genotypes was statistically similar to each other while significantly higher than local check variety Sgd.2002. However, the lowest stem weight (375.37 g) was recorded in YHM-113.

Leaves to stem weight Ratio: The selection of maize genotypes on basis of leaves to stem weight ratio may be helpful in producing higher fodder yielding varieties and hence crop productivity may also be increased. It was persuaded from the data as shown in table 1 that highest leaf to stem weight ratio was recorded for YHM-113 followed by No.1501 while the lowest ratio was recorded for C.7065. Considerable variation was observed among the genotypes for the leaf to stem weight ratio. Khan *et al.* (2001) reported that higher leaf to stem weight ratio means the high accumulation of photosynthetic compounds.

Green fodder yield: Data in table 1 showed a significant difference for fodder yield among most of the genotypes. The maize genotype No.1501 produced maximum green fodder yield (63.53 t/ha) followed by MS.2010 (59.23 t/ha) while YHM.112 produced lowest green fodder yield (32.63 t/ha). The No.1501 and MS.2010 were statistically similar with each other while both significantly better than local check variety Sgd.2002 (46.13 t/ha). The difference in green fodder yields can be due to variation in the genetic make-up of genotypes. These findings are in line with the results found by Kusaksiz (2010) who reported significant differences for green forage yield among different maize cultivars.

Quality Parameters: Analysis of variance showed significant difference among the maize genotypes for quality parameters i.e. dry matter (%), crude protein and crude fibre. Awan *et al.* (2001) also reported significant difference for quality among different maize cultivars.

Dry matter (%): it is an important attribute to evaluate the quality of forage crops and it has a significant positive impact on the performance of dairy animals. The data in table 2 revealed that significant difference was found among maize genotypes. The highest dry matter percentage (31.93 %) was observed in FSD.2018 followed by No. 1501 (29.53 %) and MS.2010 (27.07 %) while check variety Sgd.2002 produced 25.10 % dry matter. The genotype YHM.112 produce lowest dry matter percentage (18.07 %). Similar results were also found by Saleem *et al.* (2007) who reported significant variation among the maize genotypes for dry matter.

Crude protein (%): Crude protein is considered as an essential component in animal feed for better animal health and productivity as well as ranch profitability. The data presented in table 2 showed significant difference among most of the maize genotypes. The No.1501 produced maximum crude protein contents (11.00 %) followed by FSD.2020 (9.23 %) and MS.2010 (8.63 %) while check variety sgd.2002 produced 7.70% crude protein. The genotype C.7065 produced lowest crude protein contents (5.47%) amongst all the tested entries. Ayub *et al.* (2001) also reported significant difference among the maize genotypes for crude protein.

Crude fibre (%): Availability of proper proportion of crude fibre in daily feed intake plays a vital role in animal health. The data in table 2 revealed that maximum crude fibre (32.33 %) was recorded in FSD.2020 followed by No.1501 (31.67 %) which were statistically similar to each other while 30.37% crude fibre was recorded in local check variety sgd.2002. The genotype YHM-113 produced lowest crude fibre (24.60%) contents amongst all the tested entries.

CONCLUSION

The study indicates that the performance of No.1501 and MS.2010 was best among all the studied genotypes in terms of fodder yield. Both these genotypes also have good nutritional value. Under the light of the present study, the maize advance lines No.1501 and MS.2010 may be recommended for further approval as variety.

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CONFLICT OF INTEREST

There is no potential conflict of interest reported by the authors in this article.

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