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STUDIES ON HYBRID AND SYNTHETIC CULTIVARS OF MAIZE FOR FORAGE YIELD AND QUALITY

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Two maize hybrids viz., Cargil and Pioneer-3331, and four synthetic cultivars viz., Neelam, Sultan, Golden and Akbar were compared for forage yield and quality under field conditions. Significant differences were observed among the cultivars for growth parameters, yield and quality characteristics. Cultivar Sultan gave significantly higher green fodder yield (81:48 t ha^{-1}) than all the other cultivar. The increase in yield was mainly due to greater plant height, stem diameter and leaf area plant^{-1}. Maximum crude protein (8.53 %) and ether extractable fat (2.40 %) were noted in Pioneer-3331 and Cargil, respectively. The crude fiber and total ash percent were statistically similar for all the cultivars.

Key words: maize, forage, yield, quality, protein, fat and fiber

INTRODUCfION

Fodder scarcity is the major limiting factor for the development of livestock industry in Pakistan, as the available fodder production is approximately 52-54 % less than the actual requirement for animal (Bhatti, 1988). The human population pressure does not permit horizontal expansion in fodder production rather there is a need to reduce the area under fodder crops so that more area can be brought under food, fiber and cash crops. A viable solution for increasing fodder production could be through increasing yield per unit area, through cultivation of high yielding varieties. The yield potential and quality traits of cultivars vary significantly due to environmental factors (Roth, 1994). Balint *et at.* (1997) reported that silage of a tetraploid maize hybrid had 30 % more protein, and 25 % greater protein digestibility than a diploid hybrid. Whereas, Atlin and Hunter (1984) reported non-significant differences among maize cultivars for whole plant dry matter and in nutritional quality of forage. Amer *et al. (1986)* reported that maize cv. Ghiza-2 had the highest ether extractable fat, sugar, starch and iron, Pioneer-514 contained the highest Zn, and opaque-2 had the highest percentages of protein, lysine, potassium and calcium. Ayub *et al.* (1998) reported significant difference among the cultivars for fat, plant height, leaf area per plant, stem diameter, fresh fodder yield and ether extractable fat. On the contrary, Ayub *et al. (1999)* observed non-significant differences between Neelam and Akbar cultivars for many growth parameters except dry matter yield. Consequently, the present study was designed to find out the most suitable maize cultivar both for fodder yield and quality under Faisalabad conditions.

MATERIALS AND METHODS

The field experiment was laid out in a Randomized Complete Block Design with three replications having a net plot size of j m x 6 m at Agronomy farm, University of Agriculture, Faisalabad. The experiment comprised two hybrids (Cargil and Pioneer-3331), and four synthetic cultivars (Neelum, Sultan, Golden and Akbar). The crop was sown in 30 cm spaced rows with single row hand drill using a seed rate of 100 kg ha-! on August 4, 1998. A basal dose of 80 kg Nand 60 kg *Pps* ha^{-1} was applied at the time of seedbed preparation in the form of urea and SSP, respectively. Total number of irrigations applied were six. All the other agronomic practices were kept normal and uniform for all the treatments. The crop was harvested on October 14, 1998. The data on fodder yield, plant population, plant height, leaf area per plant stem diameter were recorded by following standard procedures. Quality parameters like crude protein, crude fibre, ether extractable fat and total ash were determined by using methods described by AOAC (1984). The data were analysed statistically by using the Fisher's analysis of variance techniques and Duncan's New Multiple Range Test (DNMRT) was employed to compare the treatment means (Steel and Torrie, 1984).

RESULTS AND .DISCUSSION

Plant height: Significant differences were recorded among the maize cultivars for plant height (Table 1). Maximum plant height (1.96 m) was observed for Sultan which was statistically similar to that of Neelum, Golden, and Akbar, The Pioneer-3331 also did not differ significantly from Neelum and Cargill. The minimum plant height (1.72 m) was observed for Cargill. Ayub *et al.* (1998) have also reported significant differences for plant height among different cultivars of maize.

Table 1. Growth and yield parameters of six maize cultivars

Cultivar	Plant height (m)	Stem diameter (an)	Leaves plant:' (No.)	Leaf area plane' (cm")	Fresh fodder (tha")	Dry matter (tha:)
Neelum	1,88 ab	1,46 b	13.67 a	4646 a	50.07 be	8.98 b
Sultan	1,96 a	1,80 a	13.00 ab	5016 a	81,48 a	13,44 a
Cargil	1,72 c	1,46 b	10.67 d	2927 b	47.22 c	8.91 b
Pioneer-3331	1,72 bc	1,46 b	12.33 bd	4698 a	54.63 be	10.53 b
Golden	1,94 a	1:39 b	11,67 cd	3507 b	61.48 b	12.26 a
Akbar	1,95 a	1,11 c	11,33 cd	2856 b	55.56 be	10.08 b

Means not sharing a letter differ significantly at P=0.05

Stem Diameter: The cultivars varied significantly from one another regarding stem diameter (Table 1). The cultivar Sultan had significantly the highest stem diameter (1.80 cm) than that of the other cultivars. The Neelum, Pioneer-3331, Cargil and Golden had statistically similar stem diameter. Minimum value for stem diameter (1.11 cm) was recorded for the cv. Akbar. These differences may be attributed to differences in genetic traits of crop plants. These results are quite in line with those of Ayub *et al. (1988).*

Number of leaves: The number of leaves per plant varied significantly among the maize cultivars. All varieties produced leaves more than 10 and less then 14 plant",' The maximum number of leaves plant" (13.67) was recorded for cultivar Neelum which were statistically at par with Sultan (13.00). The minimum number of leaves (10.67) was observed for Cargil. These differences may be attributed to differences in genetic make up of the cultivars.

Leaf area: Maximum leaf area plant (5016 cm:) was recorded for Sultan which was statistically similar with that of Neelum and Pioneer-3331. Akbar exhibited the lowest leaf area plant:' (2856 cm'jand it was statistically similar to Golden and Cargil. Ayub *et al.* (1998) observed significant differences for leaf area planet among different maize varieties (Sadaf, Sultan, Sarhad White and Golden).

Green Fodder Yield: Green fodder yield of the maize cultivars varied significantly from one another. The cv. Sultan gave significantly the highest fodder yield (81.48 t ha:') and Akbar (55.56 t ha:'). The minimum yield of fresh fodder (47.22 t ha:') was observed for Cargil. The cv. Golden was not significantly different from Neelum, Pioneer-3331 and Akbar. The differences between Neelum, Cargil, Pioneer-3331 and Akbar were also non-significant. These differences may be attributed to differences in genetic potential of the cultivars. These results are in line with those of Sencor *et al.* (1993) who reported that increasing plant density increased green fodder yield and hay yields.

Dry Matter Yield: All cultivars differed significantly for dry matter yield (Table 1). The cv. Sultan remained at par with Golden and gave significantly the highest yield (13.44 t ha:') than all the other cultivars those, in turn, had statistically similar yields. Significant differences among different maize cultivars has been reported by Roth (1994) and Ayub *et al.* (1998 & 1999).

Total Ash: All the cultivars had statistically similar ash percent and it ranged between 5.0 (Cargil) and 8.5 % for Neelum (Table 2). These results indicated that all the varieties have similar ability to absorb inorganic nutrients and utilize them.

Table 2. Quality characteristic of six maize cultivars

Cultivar	Total ash (0/0)	Ether extractable (0/0)	Crude protein (0/0)	Crude fiber (0/0)
Neelum	8,5^{NS}	2.00a	8,31ab	32.81^{NS}
Sultan	8.0^{NS}	2.00a	6.56d	33.52^{NS}
Cargil	5.0^{NS}	2,40a	7.88b	33,49^{NS}
Pioneer-3331	7.0^{NS}	1,00b	8,53a	32.60^{NS}
Golden	6.5^{NS}	1,00b	7.22c	32.83^{NS}
Akbar	8.0^{NS}	2.25a	8.09a	32.78^{NS}

Means not sharing a letter differ significantly at P=0.05

Ether Extractable Fat: The data indicated significant differences among the maize cultivars (Table 2). The Cargil remained at par with Neelum, Sultan and Akbar, gave significantly higher fat (2.4 %) than those in Pioneer-3331 and Golden. Ayub *et al.* (1998) reported significant differences among the maize cultivars (Sadaf, Sultan, Sarhad White and Golden) for ether extractable fat.

Crude Protein: All the cultivars had protein higher than 6.5 %. The cv. Neelum gave the statistically highest crude protein (8.31 %) but did not differ significantly from that ofPioneer-3331 and Akbar. The differences between Neelum and Cargil was also non-significant. The cv. 'Sultan gave significantly the lowest crude protein (6.56 0/00. These differences might be either due to differences in genetic

make up of the varieties or differences in growth size at the time of harvest. Significant differences among the maize cultivars for crude protein have been reported by Balint *et al.* (1977) and Amer *et al. (1986).*

Crude Fibre: Crude fibre is one of the most important parameters influencing the quality of fodder crops. All the cultivars have above 32 % crude fiber and differed non-significantly. The reasons for non-significant difference might be that all the cultivars were harvested almost at the same growth stage. The results are quite in line with those of Ayub *et al.* (1988 & 1999).

Conclusion: Cultivar Sultan out performed other cultivars in fresh fodder yield as well as quality due to high crude protein in feeding material and it should be preferred over other cultivars under Faisalabad conditions.

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