Pak. J. Sci. Ind. Res. 2008 **51**(2) 103-106

Performance of Maize Cultivars for Fodder Production under Rainfed Conditions of Pothohar Tract

Zulfiqar Ali Gurmani[a]*, M. Shafiq Zahid[a], M. Imran[a] and Ashiq Saleem[b]

[a]Fodder Programme, NARC, Islamabad, Pakistan

[b]Maize, Sorghum and Millet Programme, NARC, Islamabad, Pakistan

(Received August 6, 2007; revised March 12, 2008; accepted March 16, 2008)

Abstract. For finding the forage yield potential of eight maize cultivars, the cultivars were sown in the month of July during both consecutive years 2001 and 2002 and harvested in the month of September in both the years. The cultivars differed significantly from one another with regard to plant height, number of leaves per tiller, number of plants per row, leaf area per plant, green fodder and dry matter yield. The cultivar 'Akbar' produced taller plants, with the largest leaf area and more number of leaves per tiller and consequently yielded highest amount of green as well as dry matter among all the varieties under the rainfed climatic conditions of Pothohar tract of Pakistan.

Keywords: Z*ea mays*, maize cultivars, Pothohar, agronomic characters, Pakistan, fodder yield

Introduction

Maize (*Zea mays* L.) is one of the important cereals and is cultivated for consumption of human beings and livestock both. In Pakistan maize is an important fodder and feed crop grown during summer and spring seasons both. Besides, being succulent and palatable, it can be safely fed to all types of livestock at all stages of growth without any danger of oxalic and prussic acids as compared to other summer season fodder crops like sorghum and millet. It is also the most suitable fodder crop for making silage and hay. (Muhammad *et al*., 1990).

In rainfed ecology of Pothohar region, livestock is an integral component of farming; however low fodder yield is a major limiting factor for development of this sector. The improved varieties are key-contributors in enhancing fodder productivity (Ayub *et al*., 1998). In a cultivar evaluation study, Zia and Ashraf (1980) confirmed that improved maize varieties performed better than out-dated local land races giving 37.59% higher yield as compared to the local cultivars. However, genotype x environment interaction always remained a serious problem in crop production while recommending a variety for some regions (Chaudhry *et al*., 2002; Muhammad *et al*., 1990). Genotypes can be modified by hybridization and biotech methods suitable to the particular soil and climatic conditions. Hence, breeders are always after genetic variability in crops for development of varieties suitable for diverse agro-climatic zones. Masny research workers have observed different potential of the same variety under different locations around the country under irrigated as well as rainfed conditions (Chaudhary *et al*., 2002; Ghaffar *et al*., 2002; Ayub *et al*., 2001; Muhammad *et al*., 1990; Rehman 1990). Similarly varieties of the same genetic potential responded differently under the same set of different nutrient regimes (Muhammad *et al*., 2002). However, the ideal variety is the one, which has a wider adaptation with higher yield potential (Finlay and Wilkinson, 1963). During the last 50 years, major emphasis has been placed on research and development on grain production of maize in the irrigated areas. Due to the short duration of the fodder crop and being suitable for rainfed cropping system, little has been reported regarding fodder. Hence, suitable maize cultivars having higher fodder yield for rainfed tract are required to be identified. The present study was conducted to determine the potential of different maize cultivars on the basis of desirable agronomic traits and higher fodder yield for Pothohar and allied areas having similar environmental conditions.

Materials and Methods

The present study was carried out under Fodder Research Programme at the National Agricultural Research Centre, (NARC) Islamabad during 2001 and 2002. The experiment was laid-out in a randomized complete bock design with three replications keeping a net plot size of 3m x 6m with row to row distance of 30 cm.

Eight maize cultivars were selected for the study which are mentioned in Table 1.

The crop was sown on a well-prepared seedbed with the help of a single row hand drill, using 100 kg/ha seed rate of each

*Author for correspondence

Table 1. Cultivars' names and codes

Variety name	Variety code
Konga-8043	V_1
A-8024	V_2
A-7727	V_3
A-7729	V_4
Pozarica-8121	V_5
Pozarica-8129	V_6
IZ-31	V_7
Akbar	V_8

variety in both of the years, 2001 and 2002. The standard dose of 150 kg N and 100 kg P_2O_5 per hectare was used. The whole quantity of P_2O_5 and half of N was applied before sowing while remaining half of the N was applied after three weeks of sowing. Hoeing was done twice to keep the crop free from weeds. All other agronomic practices were kept normal and uniform.

Rainfall and temperature patterns. Rainfall pattern during the growing season (July-September), in both the years, was remarkably different. The year 2001 was very wet year with 788 mm rainfall while it was 598 mm during the growing season of 2002 (Fig. 1). The average maximum temperature was 3-4°C higher in 2002 as compared to 2001. Difference was not observed in average monthly minimum temperatures of the two years.

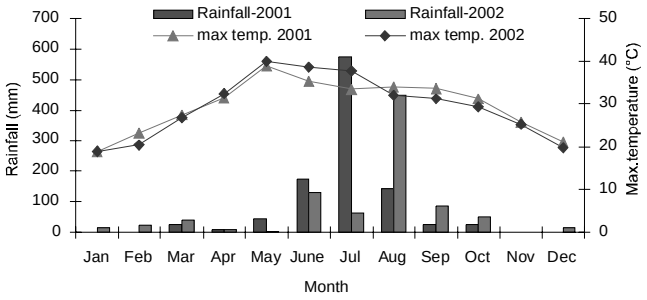

Fig.1. Rainfall and average maximum monthly temperature during 2001-2002.

The crop was harvested for green fodder yield at the 50% flowering stage during the month of September in both the years 2001and 2002. The representative green fodder samples from each variety were weighed and then dried in an oven at 60°C. After drying the samples were weighed to estimate dry matter yield per hectare. Data on agronomic traits like plant height, number of plants per 0.5 m line length, number of leaves per tiller and leaf area was also recorded at this stage, using standard procedures. The data collected for the two years was averaged and subjected to analysis using Fisher's analysis of variance technique and LSD Test at 5% probability level was applied to compare the differences among the treatment means (Steel and Torrie, 1984).

Results and Discussion

Plant height. Plant height plays a key role in determining the green fodder yield of maize crop. Maize cultivar Akbar (V_8) produced the maximum plant height (157.56 cm); however it was statistically at par with the maize cultivar IZ-31 (V_7)having 152.56 cm of plant height (Fig. 2). It was followed by Pozarica-8121 (V_5) and A-8024 (V_2) with plant heights of 149.33 and 147 cm, cm respectively. The cultivar Konga-8043 (V_1) produced significantly minimum plant height (139.89 cm) in this study. Plant height at maturity varied due to many reasons, one of those being their different genetic constitution. These results are also supported by Tariq *et al*. (1995).

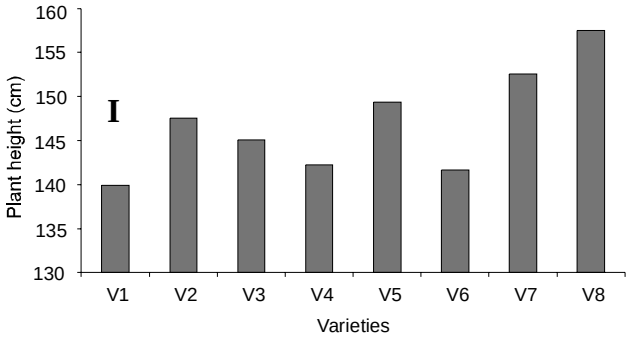

Fig.2. Varietal effect on plant height in maize crop. Error bar represents LSD (P = 0.05).

Number of leaves per tiller. Number of leaves is vital in enhancing green fodder yield of maize crop, being main organ for synthesizing food for plant through photosynthesis. The maize genotype Akbar (V_8) produced the maximum number of leaves per tiller (12.56) whereas, the cultivar A-7728 (V_3) produced significantly lowest number of leaves per tiller (Fig. 3). This might be due to genetic variability; similar variability in leaves per tiller among maize cultivars has been reported by Chaudhry *et al*. (2002).

Number of plants per 0.5 m line. The number of plants per 0.5 m length of line ranged between 7 and 9 in each cultivar and varied significantly (Fig. 4). As plant population is very much associated with the number of seed sown therefore it cannot be used as a character of any cultivar for determining the yield.

Leaf area. Leaf area gets prime importance while determining the green fodder and dry matter yields of any crop. Akbar (V_3) produced the largest leaf area (580.8 cm^2) while the cul-

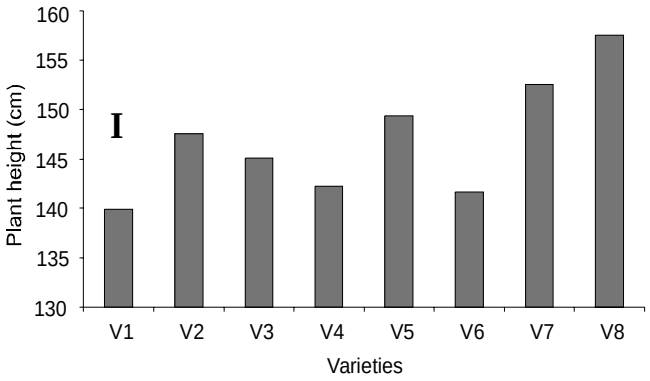

Fig.3. Varietal effect on leaves per tiller in maize crop. Error bar represents LSD (P=0.05).

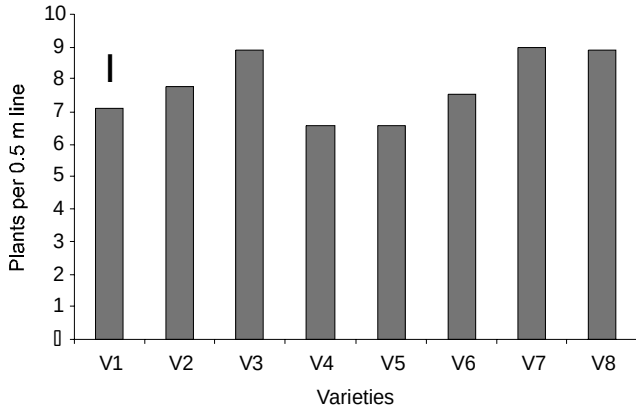

Fig. 4. Varietal effect on plants per 0.5 meter in maize crop. Error bar represents LSD (P=0.05).

tivar A-7728 (V_3) produced significantly the lowest leaf area (410.1 cm^2) during the study (Fig. 5). Similar variability in leaf area has also been reported in the study of different maize cultivars by Ayub *et al*. (2003), Chaudhry *et al*. (2002) and Ghaffar *et al*. (2002).

Green fodder yield. The maize cultivars included in the study differed significantly from one another in green fodder yield. The Cultivar Akbar (V_8) produced significantly higher green fodder yield (46.51 t/ha) than all the other cultivars tested in this study. It was followed by IZ-31 (V_7) and A-8024 (V_2) cultivars, producing 41.4 and 41.0 t/ha of green fodder, respectively (Fig. 6). Cultivar A-7729 (V_4) produced significantly lowest green fodder yield of 33.36 t/ha. These findings are in conformity with those of Taran *et al.* (1998), Abdul *et al.* (1992) and Andreev *et al.* (1984),who also reported differences in maize yield as varietals character. Higher green fodder yield by cultivar Akbar than all the other cultivars can be attributed to taller plants, which contributed to the production of more number of leaves per plant, consequently increasing the green fodder yield (Chaudhry *et al*., 2002; Ghaffar *et al.*, 2002; Mehra *et al*., 1970). Another important contributor is the leaf area, since largher leaf area plays a key role in absorption of light and ultimately more photosynthetic activity.

Dry matter yield. Dry matter is the most important component of the yield used to determine the potential of any forage crop. The result indicated that the cultivar Akbar (V_8) which produced maximum green fodder yield, also gave maximum dry matter yield of 8.93 t/ha (Fig. 7). It was closely followed by cultivar IZ-31 (V_7) with dry matter yield of 7.99 t/ha. The other follower was cultivar A-7728 (V_3) with yield of 7.43 t/ha. The maize cultivar A-7729 (V_4) was the significantly low-

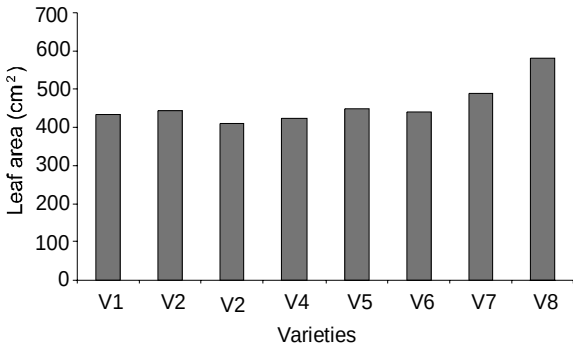

Fig. 5. Varietal effects on leaf area in maize crop. Error bar represents LSD (P = 0.05).

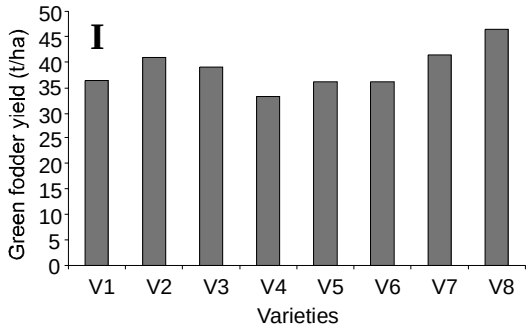

Fig. 6. Varietal effect on green fodder yield in maize crop. Error bar represents LSD (P = 0.05).

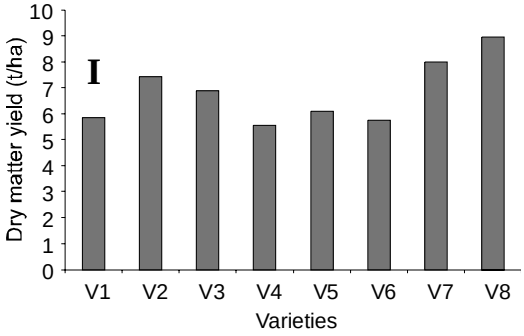

Fig. 7. Varietal effect on dry matter yield in maize crop. Error bar represents LSD (P = 0.05).

est dry matter producing cultivar yielding 5.59 t/ha of dry matter. Like green fodder yield, plant height, leaf per tiller and leaf area contri-buted towards maximum dry matter yield accumulation in cultivar Akbar. Similar results were obtained by Chaudhry *et al*. (2002), Ghaffar *et al.* (2002), Toxler *et al*. (1980) and Solanki (1977).

Conclusion

It is concluded by the study that the cultivar "Akbar" having more plant height, higher number of leaves per tiller and larger leaf area, possessed greater genetic potential for higher fodder production under the rainfed ecology of Pothohar region where it was evaluated. Hence, this cultivar is recommended for maximum production of higher fodder yield in the ecology of Pothohar region and allied areas.

References

Abdul, A., Muhammad, S., Rahman, H., Fida, M., Aziz, A., Saleem, M., Muhammad, F. 1992. Performance of maize hybrids under irrigated condition. *Sarhad J. Agric.* **8:** 509-512.

Andreev, A., Gancheva, A., Spasor, G., Vasiler, M., Angeler, A., Todoror, T.S. 1984. Studies on the yield and potential of some maize hybrids in Bulgaria. *Rastenior dni Nauki*, **24:** 17-23. (Maize Absts., **1**(5): 2345; 1985).

Ayub, M., Ahmad, R., Tanveer, A., Ahmad, I. 1998. Fodder yield and quality of four cultivars of maize (*Zea mays L.*) under different methods of sowing. *Pak. J. Biol. Sci.* **1:** 232-234.

Ayub, M., Awan, T.H., Tanveer, A., Nadeem, M.A. 2001. Studies on fodder yield and quality of maize cultivars. *Pak. J. Agric. Engg. Vet. Sci.* **17:** 28-32.

Ayub, M., Nadeem, M.A., Ahmad R., Javaid, F. 2003. Response of maize fodder to different nitrogen levels and harvesting times. *Pak. J. Life Soc. Sci.* **1:** 45-47.

Chaudhry, M.A., Ahmad, S.M., Khan, M.F., Nabi, G. 2002. Performance of Sargodha-2002. A new fodder purpose maize variety. In: *23rd All Pakistan Science Conference*, University of Agric., Faisalabad, Pakistan.

Finaly, KW., Wilkinson, G.N. 1963. The analysis of adaptation in a plant breeding programme. *Aust. J. Agric. Res.* **14:** 742-754.

Ghaffar, A., Randhawa, A.M., Khan, M.A. 2002. Performance of maize varieties for forage yield. *J. Agric. Res.* **40:** 143-147.

Mehra, K.L., Bhagmal., Katiyar, D.S. 1970. Metroglyph analysis of fodder attributes in oats. *T. Hered* **2:** 1-5.

Muhammad, D., Hussain, A., Sartaj, Bhatti, M.B. 1990. Locational differences in forage yield and quality of maize cultivars. *Pak. J. Sci. Ind. Res.*, **33:** 454-456.

Muhammad, S., Bakhat, J., Jan, M.T., Shah, W.A., Khan, N.P. 2002. Response of different maize varieties to various N P levels. *Sarhad J. Agric.* **18:** 17-25.

Rehman, S. 1990. Studies on the Growth and Yield Performance of Some New Maize Genotypes. *M.Sc. (Hons*) *Thesis*, Deptt. of Agron, University of Agric., Faisalabad, Pakistan.

Solanki, K.R. 1977. Improvement of oats for yield and quality. *Indian J. Pl. Breed* **37:** 230-234.

Steel, R.G.D., Torrie, J.H. 1984. *Principles and Procedures of Statistics: A Biomedical Approach*, pp. 172-177, 4th edition, McGraw Hill Book, Singapore.

Taran, S.A., Kakar, M.S., Bugt, R.A. 1998. Performance of maize varieties/hybrids under irrigated conditions of Balochistan. *Sarhad J. Agric.* **14:** 113-116.

Tariq, M., Ahmad, S., Kamal, N. 1995. Performance of new cultivars of maize under rainfed conditions. *Sarhad J. Agric.* **11:** 707-710.

Toxler, J., Colland, J.F., Lehmann, J., Weilenamnn, F. 1980. Borrus an oat variety for grain production and as fodder catch crop. Borus, eine Hafersorte Zur Korner-Produktion und fur den Zwischenfuttrban. *Mitteilungen for die Schweizerische Landwirtschat* **28:** 96-100.

Zia, M.S., Ashraf, M. 1980. Cultivation of maize in Attock District. *J. Agric. Res. Pakistan* **18:** 11-14.