Forage Res., **37** (4) : pp. 234-237 (2012)

STUDY ON FORAGE QUALITY OF VARIOUS MAIZE CULTIVARS PRODUCED UNDER DIFFERENT USE PATTERNS

M. SHANTI, D. NAGALAKSHMI[1], R. BALAJI NAIK, V. CHANDRIKA AND CH. CHIRANJEEVI

AICRP on Forage Crops
Acharya N. G. Ranga Agricultural University,
Hyderabad (A. P.), India

SUMMARY

Three varieties each of baby corn, green corn, forage maize and seed crop along with one forage national check (African Tall) were grown to study the fodder potential, yields as baby corn, green cob, fodder and grain. The quality of fodder either green or dry was also studied and the fodder of baby corn was found to be superior with respect to crude protein content, while other parameters viz., crude fibre and IVDMD were commendable. Though the fodder yields were lesser in baby corn, the revenue from baby cobs especially in urban and peri-urban areas brought higher returns. The net returns were Rs. 39,750/ha from baby corn. The economics through net returns and B : C ratio indicated baby corn > fodder crop > seed crop > green cob.

Key words : Forage quality, IVDMD, fodder, grain, maize

In Indian agriculture, maize crop has special significance due to its wide diversity as food crop and as an animal feed. Maize was cultivated in 7.83 lakh hectares with a production of 27.6 lakh tonnes in Andhra Pradesh during 2009-10 (Statistical Abstracts, A. P, 2010). In maize, diversified genotypes viz., baby corn, green ears and pop corn, seed varieties besides fodder varieties are gaining immense popularity. A study was taken up to explore the forage potential and fodder quality of maize grown under different use patterns. Baby corn and green cobs are the forms of maize in high demand especially in urban and peri-areas. Their demand has seen tremendous growth owing to corporate supermarket chains in most of the urban areas of the country. Harvested at baby corn or at green cob stage maize makes an ideal fodder often highly palatable for animals. This trial was taken up to compare the yields of economic maize, fodder yield, fodder quality and economics of maize production under different use patterns.

MATERIALS AND METHODS

A field experiment was conducted in the fields of AICRP Forage Crops, LRI, Rajendranagar during 2008-09 and 2009-10. The soil of the field was a sandy loam with low initial levels of available N, P_2O_5 and medium K_2O. Three varieties each of fodder maize (J-1006, Ganga Safed and Karvir), baby corn (Vivek-17, Vivek-11 and Baby corn-1), Green cob (Harsha, Ashwini and Maduri) and seed varieties (BH-1576, DHM-117 and a pop corn variety, Amber pop corn) were grown along with a national check for fodder maize i. e. African Tall. Varieties were grown in 5 x 4 m size plots under spacing of 45 x 20 cm and under recommended dose of fertilization (120 : 80 : 50 N : P_2O_5 : K_2O). The baby corn varieties were harvested for baby cobs from 45 days onwards and the crop was harvested for fodder after three pickings of baby corn were taken. The green cobs were harvested from 60th day onwards, however, their maturity differed with different varieties. The fodder varieties were harvested at early dough stage of the cob, while the seed crop was harvested at complete physiological maturity of seed. In all cases, the rest of the crop was used as fodder, either green or dry. The quality of fodder in terms of crude protein, crude fibre and IVDMD (*in vitro* dry matter digestibility) was analysed by standard procedures besides, recording the green fodder yield, dry matter yields and seed/cob yields. The weather during the period of study is presented in Table 1.

[1]Department of Animal Nutrition, S. V. V. U., Hyderabad.

TABLE 1
Weather parameters during crop growth period during the two years of study

Month	Temperature (°C)		R. H. (%)		Rainfall	Rainy days	Mean temp. (°C)
	Max.	Min.	I	II			
June 2008	34.5	25.0	73	45	60.3	6	29.7
July 2008	32.3	24.4	79	58	83.7	8	28.4
August 2008	29.3	23.1	89	70	506.3	15	26.2
September 2008	30.1	22.4	91	71	204.6	7	26.3
July 2009	32.0	23.4	80	57	54.0	4	27.8
August 2009	31.2	23.3	81	64	203.7	9	27.2
September 2009	31.4	22.2	90	64	136.5	8	26.8
October 2009	31.0	19.5	84	51	96.0	6	25.2

RESULTS AND DISCUSSION

Green Fodder, Dry Fodder and Cob/Seed Yields

The highest green fodder yields were recorded in the national check African Tall (193.3 q/ha), while all the other fodder varieties were on par with it. Both the green cob and baby cob varieties were on par in this regard with green fodder ranging between 78.8 and 92.8 q/ha, while lowest GFY were observed in var. Ashwini (72.5 q/ha) (Table 2). The green cob and baby corn varieties interestingly recorded almost on par GFY despite variation in their harvesting stages. There was more than a 200 per cent variation in GFY of baby corn/green cob and that of fodder varieties. Prodhan *et al.* (2007) too reported highest green fodder yield of 300 q/ha when maize was grown for baby corn. Trends observed in green fodder yields were also reflected in the dry matter yields. The DFY was highest in fodder varieties followed by those of baby corn, green cob and seed crop recording 30.1, 14.5 and 13.8 and 16.5 q/ha, respectively (average of three varieties under each use pattern). The DFY of baby corn and green cob were found to be on par in this regard. The cob yield of baby corn was about 50.5 q/ha and was closely followed by green cob (45.6 q/ha) and seed (26.38 q/ha), respectively. The high yields of baby corn could be due to their being exclusive baby corn varieties with multiple cob nature. Gurmani *et al*.

TABLE 2
Green fodder, dry fodder and seed/cob yields (q/ha) of maize grown under different use patterns

S. No.	Variety		GFY			DFY			Cob/seed yield		
			I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
1.	Fodder	J-1006	200	165	182.5	31.5	29.6	30.6	0	0	0
2.		Karvir	230	147.8	188.9	35.7	26.4	31.1	0	0	0
3.		Ganga safed	225	119.0	172	34.8	22.6	28.7	0	0	0
4.	Baby corn	Vivek-17	95	62.5	78.8	16.4	11.5	14.0	42.7	57.40	50.05
5.		Vivek-11	95	78.8	86.9	17.2	13.8	15.5	46.1	58.25	52.18
6.		Baby corn-1	115	42.5	78.8	19.6	8.4	14.0	40.3	58.35	49.33
7.	Green cob	Harsha	117	42.5	80.0	20.7	7.0	13.9	44.4	51.25	47.8
8.		Ashwini	107	37.5	72.5	16.7	6.8	11.8	39.65	46.15	42.90
9.		Maduri	132	55.0	92.8	22.4	9.2	15.8	41.70	47.90	44.6
10.	Seed crop	BH-1576	0	0	0	19.7	13.2	16.5	36.30	26.05	31.18
11.		BH-40625	0	0	0	20.2	15.1	17.7	34.05	24.55	29.3
12.		Amber popcorn	0	0	0	20.5	10.0	15.3	25.35	12.00	18.68
13.	Check	African tall	196.5	190	193.3	30.6	30.4	30.5	0	0	0
	Mean		116.3	72.4	94.3	18.6	11.6	15.1	26.97	29.38	28.2
	S. Em±				5.15			1.82			1.75
	C. D. (P=0.05)				15.03			5.29			5.11

(2008) similarly compared eight maize cultivars for fodder production and arrived at best variety. Surve and Arvadia (2012) too conducted experiments to arrive at highest green and dry fodder yields and concluded that maize and sorghum when grown as sole crops or in cropping systems produced highest green and dry fodder yields.

Quality of Fodder

The quality parameters of fodder viz., crude protein per cent, crude fibre per cent and *in vitro* dry matter digestibility (IVDMD) were also studied in the fodder harvested at different use were also analysed (Table 3). All the baby corn varieties showed their superiority in the crude protein per cent over other use patterns, though the highest CP per cent was observed in Vivek-17 (9.03%). Fodder variety Ganga Safed, green ears, Ashwini and Maduri recorded on par CP per cent with that of baby corn varieties. With respect to crude fibre all varieties irrespective of time of harvest registered values 30 to 35 which is commendable. However, varieties, J-1006, Harsha, Ashwini and Amber popcorn recorded slightly higher values of over 40 per cent. Katiyar and Singh (1999) compared two genotypes of maize for fodder quality and reported crude protein per cent varying between 3.72 and 12.82 in leaf and stem. Highest CP per cent in maize fodder was reported at age of 50 days (Amador and Boschini, 2000). This stage coincides with that of baby corn stage of crop in exclusive baby corn varieties.

The superior quality of baby corn fodder could be due to early harvest of baby corn plants in comparison to other use patterns of maize. As the age of the crop advances the nutrients of the stem would be partitioned into the cob/seed which forms the final sink of plant life. Hence, the quality of green fodder produced at different use patterns varied as baby corn> green cob > fodder varieties.

Economics

The economics of maize production under different use patterns was studied. The average of the three varieties under each use pattern was compared (Table 4). The gross and net returns and B : C ratio were higher in baby corn compared to maize grown in other use patterns. The returns from stover, seed, baby corn, green ear and seed are converted into green fodder equivalent yields. The mean equivalent yields were 592 (baby corn), 217 (green cob), 210 (seed crop) and 180 (fodder varieties), respectively. Among various cropping systems studied at Kalyani, Basu *et al*. (2009) reported baby corn to be most remunerative when grown in any crop sequence and in all seasons. The returns from baby corn production were much higher than any other maize

TABLE 3
Fodder quality of maize produced under different use patterns

S. No.	Variety		CP (%)			CF (%)			IVDMD		
			I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
1.	Fodder	J-1006	7.4	7.4	7.4	44.30	47.94	46.12	75.42	75.60	75.51
2.		Karvir	6.8	6.80	6.8	33.46	37.45	35.46	77.59	70.48	74.04
3.		Ganga safed	7.8	8.6	8.2	36.60	30.90	33.75	74.33	63.68	69.01
4.	Baby corn	Vivek-17	9.5	8.6	9.0	33.22	31.11	32.17	62.51	67.99	65.25
5.		Vivek-11	8.6	8.4	8.5	26.00	31.48	28.74	57.52	83.95	70.74
6.		Baby corn-1	8.8	8.6	8.7	32.48	34.32	33.40	81.28	70.80	76.04
7.	Green cob	Harsha	7.35	7.4	7.4	35.20	43.59	39.39	82.24	61.02	71.63
8.		Ashwini	8.1	8.3	8.2	37.74	39.48	38.61	77.55	77.45	77.50
9.		Maduri	8.0	8.0	8.0	32.24	32.95	32.60	63.72	69.81	66.77
10.	Seed crop	BH-1576	5.0	5.5	5.3	31.90	34.42	33.16	65.22	69.66	67.44
11.		BH-40625	6.0	6.0	6.0	33.98	37.07	35.53	65.52	68.76	67.14
12.		Amber pop corn	5.6	5.9	5.8	34.36	54.52	44.44	76.58	65.66	71.12
13.	Check	African tall	7.5	7.7	7.6	33.00	32.30	32.65	81.77	71.42	76.60
	Mean		7.3	7.5	7.4	35.85	37.50	35.85	72.40	70.48	71.44
	S. Em±				0.18			1.81			3.02
	C. D. (P=0.05)				0.52			5.28			8.54

TABLE 4
Economics of maize production under different use patterns

Details	Fodder maize (Mean of 3 var.)			Baby corn (Mean of 3 var.)			Green cob (Mean of 3 var.)			Seed maize (Mean of 3 var.)		
	I year	II year	Mean	I year	II year	Mean	I year	II year	Mean	I year	II year	Mean
Total cost of cultivation (Rs.)	12921	12921	12921	15633	15633	15633	15033	15033	15033	15583	15583	15583
Baby corn yield (q/ha)	-	-	-	43	58	51	-	-	-	-	-	-
Green cob yield (q/ha)	-	-	-	-	-	-	42	49	45	-	-	-
Green fodder yield (q/ha)	218	143	181	102	61	82	119	45	82	-	-	-
Seed yield (q/ha)	-	-	-	-	-	-	-	-	-	32	21	26
Stover yield (q/ha)	-	-	-	-	-	-	-	-	-	20	13	16
Income from cob/seed (Rs.)	-	-	-	43000	58000	51000	12600	14700	13500	24960	16279	20619
Income from green fodder (Rs.)	21800	14300	18100	10200	6100	8200	11900	4500	8200	-	-	-
Income from stover (Rs.)	-	-	-	-	-	-	-	-	-	500	319	410
Equivalent yield (in terms of GFY q/ha)	218	143	181	532	641	592	245	192	217	255	166	210
Gross income (Rs.)	21800	14300	18100	53200	64100	59200	24500	19200	21700	25460	16598	21029
Net income (Rs.)	8879	1379	5179	33487	46012	39750	4707	2211	3459	9877	1015	5446
B : C ratio	1.68	1.11	1.40	3.14	3.94	3.54	1.31	1.15	1.23	1.63	1.07	1.35

Cost of 1 kg N–Rs.10.87, 1 kg P_2O_5–Rs. 22.50, 1 kg K_2O–Rs. 7.83, 1kg baby corn–Rs. 10.00, 1 kg green cob–Rs. 3.00, Maize Seed 1 kg–Rs. 7.80, 1 kg green fodder–Rs. 1.00, Stover 1 kg–Rs. 00.25 (Information as per Cost of Cultivation Scheme, ANGRAU).

production. The benefit : cost ratio was 3.54 when grown as baby corn against 1.23 to 1.4 in other use patterns. The order of returns from different use patterns is as follows : Baby corn > Fodder crop > Seed crop > Green cob.

Besides baby corn provides an added advantage of clearing field within a period of two months, thereby facilitating early sowing of next crop. Hence, baby corn is an ideal form of maize especially in peri-urban areas by providing good revenue to farmer besides highly palatable fodder for his cattle.

REFERENCES

Amador, R. A. L., and F. C. Boschini, 2000 : *Agronomia Mesoamericana*, **11** : 171-177.

Basu, B., C. K. Kundu, Sanchita Mondal, Pintoo Bandopadhyay, and D. K. De, 2009 : *Indian Agriculturist*, **53** : 177-181.

Gurmani, Z. A., M. S. Zahid, M. Imran, and Ashiq Saleem 2008 : *Pak. J. Scientific and Indust. Res.*, **51** : 103-106.

Katiyar, Sultan, and Singh, P. K. 1999 : *Indian J. Anim. Sci.*, **69** : 827-829.

Prodhan, H. S., S. Bala, and P. Khoyumthem, 2007 : *Environ. and Ecol.*, **25** : 945-947.

Statistical Abstracts, A. P. 2010 : 52nd edn. issued by Directorate of Economics and Statistics, Govt. of A. P., Hyderabad.

Surve, V. H., and M. K. Arvadia, 2012 : *Int. J. Agric. Res. and Rev.*, **2** : 28-31.

Forage Res., **37** (4) : pp. 238-240 (2012)

EFFECT OF NITROGEN LEVELS ON YIELD AND QUALITY OF [*SORGHUM BICOLOR* (L.) MOENCH] SORGHUM GENOTYPES

AMINA KUMARI MEENA, PUSHPENDRA SINGH AND PUSHPA KANWAR

Department of Agronomy
Maharana Pratap University of Agriculture and Technology,
Udaipur-313 001 (Rajasthan), India

SUMMARY

A field experiment was conducted at Udaipur during **kharif** 2011 to assess N doses for sorghum genotypes. The results revealed that SSV-74 recorded maximum dry matter accumalation at 30 DAS and harvest, green as well as dry fodder yield (55.69 and 16.21 t/ha), respectively. Among nitrogen levels, application of 120 kg N/ha recorded higher dry matter accumalation at 30 DAS and harvest, HCN content at 30 DAS, green as well as dry fodder yield, net returns and B : C ratio over 40 and 80 kg N/ha. Application of 120 kg N/ha recorded 19.70, 7.89 and 20.03, 8.72 (green and dry fodder) 23.57, 9.10 and 13.93, 4.80 (net return and B : C ratio) per cent higher over 40 and 80 kg N/ha, respectively.

Key words : Nitrogen, fodder yield, quality, sorghum

In Indian agriculture, livestock plays a pivotal role in the development and progress of mankind with crop production programme as a complementary enterprise. India supports nearly 20 per cent of the world's livestock and 16.8 per cent human population with only 2.3 per cent of the world's geographical area. It is the leader in cattle (16%) and buffalo (55%) population and has the world's second largest goat (20%) and fourth largest sheep (5%) population. The livestock sector contributes Rs. 1830000 million to the annual revenue i. e. 32 per cent of the agricultural output, which is 27 per cent of total GDP. It is expected to rise to 50 per cent by 2020 (Agriculture Statistics, 2010).

In India, there is a short supply of about 38 per cent green fodder, especially during summer season. Sorghum is an important crop widely grown for grain and forage. It is fast growing, palatable, nutritious and utilized as silage and hay besides fresh feeding. The total area under cultivated fodders is 8.3 million ha on individual crop basis. Among the rainy season (**kharif**) crops, sorghum (2.6 million ha) occupies 54 per cent of the total area under fodder culitivation. The area under chari or sorghum [*Sorghum bicolor* (L.) Moench] is 26 lac ha and the productivity of green forage is 35-70 t/ha (Mal *et al.*, 2006). There is a great need to maintain regular well balanced supply of more nutritious feed and fodder for stall feeding animals, productive milch herds can be maintained, which would accelerate the growth of milk production in the state. Amongst growth factors, adequate inorganic fertilizers specially, nitrogenous and phosphates are considered to be of prime importance due to their profound impact on various aspects of growth and development of the crop. Balanced use of fertilizer has played a key role in the modernization of Indian agriculture and in making the country sufficient in fodder production for animals.

MATERIALS AND METHODS

The field experiment was conducted at Instructional Farm, Rajasthan College of Agriculure, Udaipur during **kharif** 2011 to assess appropriate nitrogen level for single cut fodder sorghum and to assess the economic viability of treatment. The experiment consisted of 12 treatment combinations, comprising four genotypes (SSV-84, SSV-74 ,CSV-19SS and HC-308) and three nitrogen levels (40, 80 and 120 kg N/ha) tested in factorial randomised block design with three replications. The experimental soil was clay loam in texture, slightly alkaline in reaction pH, low in available nitrogen (278.00 kg/ha), medium in available phosphorus and potassium (20.69 and 194.60 kg/ha). The crop was sown on 5 July 2011 with recommended seed rate of 40 kg/ha. Total rainfall (610.2 mm) was recorded during crop season. The data pertaining to growth parameters, green and dry fodder yields and HCN content at 30 DAS

of the crop were evaluated. The crop was harvested on 28 September, 2011 at 50 per cent flowering stage of the crop.

RESULTS AND DISCUSSION

Genotypes

Data presented in Table 1 reveal that maximum dry matter accumulation per plant 30 DAS and at harvest and plant height at harvest, green and dry fodder yield at 30 DAS and at harvest, net retrun and B/C ratio were recorded under SSV-74 which were found signifcantly superior over SSV-84, CSV-19SS and HC-308 and HCN content was lowest at 30 DAS. The variation in plant height of the genotypes might be related to inherent difference and their high vigour. The differential behaviour of these genotypes could also be explained solely by the variation in their genetic constituent. Dry matter production efficiency of genotype determines its potential to produce economic yield (Meena and Mann, 2007). The higher green and dry fodder yield registered by varieties SSV-74 over SSV-84, CSV-19SS and HC-308 appeared to be a resultant of remarkable improvement in plant height and dry matter accumulation. Genotype SSV-74 recorded significantly lesser HCN (130.33 ppm) content over rest of the genotypes tested. Genotype SSV-74 (Rs. 49249, 4.09) provided Rs.13589, 19791 and 14997 higher in net returns and 2.79, 2.45 and 2.85 higher in B/C ratio over varieties SSV-84, CSV-19SS and HC-308. The increases with SSV-74 were by 28.52, 47.71 and 32.43 per cent in green and 31.78, 50.37 and 30.83 per cent in dry fodder over SSV-84, CSV-19SS and HC-308, respectively.

Nitrogen Levels

It is clear from data in Table 1 that application of 120 kg N/ha recorded signifcantly higher plant height (276.92 cm), DMA 30 DAS and at harvest (5.88 and 124.49 g/plant), HCN content at 30 DAS (142.10 ppm), green and dry fodder yield (48.54 and 14.08 t/ha), net returns (Rs. 40893) and B/C (3.27 : 1) ratio over 40 and 80 kg N/ha. Application of 120 kg N/ha recorded 19.70, 7.89 and 20.03, 8.72 and 23.57, 9.10 and 13.93, 4.80 per cent higher green fodder, dry fodder, net returns and B/C ratio over 40 and 80 kg N/ha, respectively. Application of 40 kg N/ha recorded minimum HCN (131.97 ppm) content as it increased with the increase in N levels. The HCN content was maximum at germination and then continuously decreased with age 30 DAS stage, the content of dhurin correlated with the activity of two biosynthetic enzymes, CYP 79 A1 and CYP 76 E1 and with protein and mRNA level for the two enzymes. During dhurin development, the activity of CYP 79 A1 was lower than the activity of CYP 76 E1 suggesting that CYP 79 A1 catalyzes the rate limiting set up using etiolated seedling. The site of dhurin synthesis shifts from leaves to stem during plant development. In combination , the results demonstrate that dhurin (HCN)

TABLE 1
Effect of genotypes and nitrogen levels on yield and economics of forage sorghum

Treatment	Plant height (cm)	DMA (g/plant)		HCN content (ppm)	Green fodder yield (t/ha)	Dry fodder yield (t/ha)	Net returns (Rs./ha)	B/C ratio
		30 DAS	At harvest					
Genotypes								
SSV-84	260.78	5.39	112.30	130.85	43.33	12.30	35660	2.97
SSV-74	288.11	6.10	126.67	130.33	55.69	16.21	49249	4.09
CSV-19 SS	251.44	5.01	104.41	144.93	37.70	10.78	29458	2.45
HC-308	264.00	5.02	102.79	140.47	42.05	12.39	34252	2.85
S. Em±	2.87	0.09	2.89	1.44	1.35	0.41	1479.57	0.12
C. D. (P=0.05)	8.42	0.27	8.49	4.23	3.95	1.21	4339.45	0.36
Nitrogen (kg/ha)								
40	247.00	4.83	95.52	131.97	40.55	11.73	33092	2.87
80	274.33	5.43	114.22	135.86	44.99	12.95	37480	3.12
120	276.92	5.88	124.49	142.10	48.54	14.08	40893	3.27
S. Em±	2.49	0.08	2.50	1.25	1.17	0.36	1281.35	0.10
C. D. (P=0.05)	7.29	0.24	7.36	3.66	3.42	1.05	3758.07	0.32