Forage Res., **41** (4) : pp. 208-211 (2016) **http://forageresearch.in**

FORAGE MAIZE GENOTYPES PERFORMANCE FOR FODDER YIELD AND ITS ATTRIBUTES WITH QUALITY PARAMETERS AT HISAR AND ALL-INDIA LEVEL

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(Received : 16 November 2015; Accepted : 08 March 2016)

SUMMARY

Six entries of forage maize (JHM-13-1, BAIF Maize-3, AFM-3, AFM-2, PFM-7 and AFM-1) were evaluated along with two national checks viz., African Tall and J-1006 for assessing their fodder yield potential and quality parameters in trials during **kharif** 2013. The same set of entries was also tested at 21 different locations distributed in the five zones for fodder trial. Highest green fodder yield (695.7 q/ha) was recorded at Hyderabad followed by Raipur (616.6 q/ha) and Coimbatore (523.1 q/ha), whereas highest dry matter yield (129.5 q/ha) was recorded at Raipur followed by Bhubaneswar (117.2 q/ha) and Ranchi (108.9 q/ha). Highest per day production of green fodder was recorded at Bhubaneswar and Hyderabad [GFY (q/ha/day)– 10.63 and 10.03, respectively] followed by Ranchi (9.55 q/ha/day). Highest crude protein was obtained at Raipur (12.7 q/ha) followed by Coimbatore (9.3 q/ha) and Bhubaneswar (9.2 q/ha). Data revealed that southern zone represented by Hyderabad and Coimbatore gave higher green fodder yield, plant height and production efficiency thereby indicating that climatic conditions and soil types were very suitable for production of fodder maize.

Key words : Fodder yield, quality, maize

Maize (*Zea mays* L.) is a versatile crop that can be successfully grown in varied agro-ecologies ranging from sea level to high altitudes up to 3000 m. It is one of the favoured fodders as it is quick growing, high yielding and palatable. It is a vigorous but exhaustive crop as it is highly responsive to fertilizers. Regular and steady supply of fodder is essential for our livestock. High fodder yielding varieties of maize are required to meet the fodder demand as the feed alone constitutes 70 per cent of the milk production cost. Milch animals need around 40 kg of green fodder daily for better milk production and for maintaining good health of the animal. At present, our country faces a net deficit of 62.76 per cent green fodder, 23.46 per cent dry crop residues and 64 per cent concentrate feeds (Draft Report X Five Year Plan). To meet this great shortfall of green as well as dry matter, efforts should be undertaken to include maize crop for fodder also.

MATERIALS AND METHODS

Six entries of forage maize (JHM-13-1, BAIF Maize-3, AFM-3, AFM-2, PFM-7 and AFM-1) contributed by various Coordinating Centers under AICRP (FC) were evaluated along with two national checks viz., African Tall and J-1006 for assessing their fodder yield potential in trials during **kharif**-2013 at CCSHAU, Hisar. The same set of entries was also tested at 21 different locations distributed in the five zones for fodder trial (Anonymous, 2013-14).

The experiment was sown at the farm area of Forage Section, CCSHAU, Hisar in July 2013 with three replications. The plot size was kept as 4.0 x 3.0 m, with row to row distance of 30 cm. The data of green fodder yield, plant height and leaf : stem ratio were recorded at 50 per cent flowering. Data of other parameters like dry matter yield and production efficiency were recorded

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later. The samples of dry fodder were analyzed for quality parameters using standard protocols. The data so obtained were statistically analyzed. The results of the experiment are presented in Tables 1, 2 and 3.

RESULTS AND DISCUSSION

Green Fodder Yield (GFY)

At Hisar, forage maize genotypes PFM-7 and AFM-1 (Table 1) gave highest green fodder yield (GFY–284.3 and 254.6 q/ha, respectively) as compared to the best check African Tall (135.0 q/ha). However, at All-India level, the genotype AFM-3 (402.0 q/ha) showed superiority over the national check African Tall (398.8 q/ha). The mean GFY at Hisar (193.0 q/ha) was much lower than the mean GFY at All-India level (376.4 q/ha).

Location-wise performance of the varietal trial on forage maize (Table 2) revealed that the highest green fodder yield (695.7 q/ha) was recorded at Hyderabad followed by Raipur (616.6 q/ha) and Coimbatore (523.1 q/ha). The highest GFY of PFM-7 and AFM-1 was due to characters like plant height and leaf : stem ratio. Similar reports were also reported by Shashikanth *et al.* (2013).

Dry Matter Yield (DMY)

At Hisar, forage maize genotypes PFM-7 and AFM-1 (Table 1) gave highest dry matter yield (DMY–62.1 and 47.5 q/ha, respectively) as compared to the best check J–1006 (26.8 q/ha). However, at All-India level, the genotype AFM-3 (85.1 q/ha) showed superiority over the national check African Tall (75.7 q/ha). The mean DMY at Hisar (38.6 q/ha) was much lower than the mean DMY at All-India level (74.4 q/ha).

Location-wise performance of the varietal trial on forage maize (Table 2) revealed that the highest dry matter yield (129.5 q/ha) was recorded at Raipur followed by Bhubaneswar (117.2 q/ha) and Ranchi (108.9 q/ha). The highest DMY of PFM-7 and AFM-1 was due to characters like plant height and leaf : stem ratio. Similar reports were also reported by Wandera *et al.* (2000) and Vanlauwe (2004).

Production Efficiency

At Hisar, forage maize genotypes PFM-7 and AFM-1 (Table 1) gave highest per day production of green fodder (3.38 and 3.03 q/ha/day, respectively) as compared to the best check African Tall (1.61 q/ha/day). However, at All-India level, the genotype AFM-3 (6.73 q/ha/day) showed superiority over the national check African Tall (6.42 q/ha/day). The mean GFY (q/ha/day) at Hisar (2.30) was much lower than the mean GFY (q/ha/day) at All-India level (6.37 q/ha/day).

Location-wise performance of the varietal trial on forage maize (Table 2) revealed that the highest per day production of green fodder was recorded at Bhubaneswar and Hyderabad (GFY (q/ha/day–10.63 and 10.03, respectively) followed by Ranchi (9.55 q/ha/day).

TABLE 1
Performance of forage maize genotypes for fodder yield during **kharif** 2013 at CCSHAU, Hisar

Genotypes	GFY (q/ha)		DMY (q/ha)		GFY (q/ha/day)		DMY (q/ha/day)	
	Hisar	All-India (22)	Hisar	All-India (22)	Hisar	All-India (22)	Hisar	All-India (22)
JHM-13-1	171.3	375.9	33.6	76.2	2.04	6.19	0.40	1.29
BAIF Maize-3	175.9	348.6	35.1	68.5	2.09	5.97	0.42	1.29
AFM-3	189.8	402.0	39.0	85.1	2.26	6.73	0.46	1.47
AFM-2	203.7	378.3	40.4	76.0	2.43	6.65	0.48	1.37
PFM-7	284.3	358.4	62.1	70.0	3.38	6.34	0.74	1.32
AFM-1	254.6	380.9	47.5	72.5	3.03	6.48	0.57	1.34
J 1006 (N. C.)	129.6	368.2	26.8	71.6	1.54	6.17	0.32	1.31
African Tall (N. C.)	135.0	398.8	24.0	75.7	1.61	6.42	0.29	1.35
Mean	193.0	376.4	38.6	74.4	2.30	6.37	0.46	1.34
C. D. (P=0.05)	63.7		12.2					
C.V. (%)	18.7		17.9					

*Figures in parentheses indicate number of locations.

TABLE 2
Performance of forage maize genotypes for fodder yield traits and the quality parameters during **kharif** 2013 at CCSHAU, Hisar

Genotype	Plant height (cm)		Leaf : Stem ratio		Crude protein yield (q/ha)		Crude protein (%)	
	Hisar	All-India (18)	Hisar	All-India (15)	Hisar	All-India (12)	Hisar	All-India (12)
JHM-13-1	163.9	191.1	0.36	0.55	2.9	6.2	8.8	7.5
BAIF Maize-3	150.3	190.9	0.35	0.52	3.1	6.2	8.8	8.0
AFM-3	152.8	188.9	0.41	0.58	3.8	8.2	9.6	8.4
AFM-2	141.0	181.1	0.32	0.55	3.6	6.6	9.0	7.7
PFM-7	155.2	187.8	0.35	0.50	5.6	6.4	9.0	7.8
AFM-1	155.7	182.4	0.55	0.51	4.3	6.9	9.0	8.1
J 1006 (N. C.)	155.8	188.7	0.56	0.57	2.6	6.4	9.8	7.9
African Tall (N. C.)	160.9	195.6	0.54	0.58	1.8	7.7	7.5	7.9
Mean	154.5	188.3	0.43	0.54	3.5	6.8	8.9	7.9

Figures in parentheses indicate number of locations.

Almost similar results were obtained for per day production of dry matter (q/ha/day).

Plant Height

At Hisar, forage maize genotype JHM-13-1 (Table 2) gave tallest plants (163.9 cm) as compared to the best check J-1006 (160.9 cm). At All-India level also the same trend was observed. The mean plant height at Hisar (154.5 cm) was much lower than the mean plant height at All-India level (188.3 cm).

Location-wise performance of the varietal trial on forage maize (Table 3) revealed that the tallest plants (281.8 cm) were recorded at Bhubaneswar followed by Coimbatore (239.9 cm) and Palampur (228.1 cm). More height of the plants was mainly due to the high input intake by the maize plants. Similar reports are also reported by Zewdu *et al.* (2002) and Tessema *et al.* (2003).

Leaf : Stem Ratio

At Hisar, forage maize genotype AFM-1 (Table 2) gave highest leaf : stem ratio (0.55) which was at par with the best check J-1006 (0.56). At All-India level, AFM-2 gave highest leaf : stem ratio (0.58) which was at par with the best check African Tall (0.58). The mean leaf : stem ratio at Hisar (0.43) was much lower than the mean leaf : stem ratio at All-India level (0.54).

Location-wise performance of the varietal trial on forage maize (Table 3) revealed that the leaf : stem ratio of 1.04 was recorded at Bhubaneswar followed by Jorhat (0.89) and Faizabad (0.70). Leaf : stem ratio increase was mainly due to increase in the foliage that utilized the solar energy in the production of photosynthates ending in higher biomass production. Similar results were reported by Shashikanth *et al.* (2013).

Crude Protein Yield (q/ha)

At Hisar, forage maize genotypes PFM-7 and AFM-1 (Table 2) gave highest crude protein (5.6 and 4.3 q/ha, respectively) as compared to the best check J-1006 (2.6 q/ha). At All-India level, AFM-3 (8.2 q/ha) gave higher crude protein than the best check African Tall (7.7 q/ha). The mean crude protein yield at Hisar (3.5 q/ha) was much lower than the mean at All-India level (6.8 q/ha) for this character. Higher crude protein yield may be due to increased photosynthetic activities leading to higher cell division and elongation of the cells that resulted in accumulation of more photosynthates, leading to higher dry matter production which ultimately resulted in higher crude protein production. These results are also in line with the findings of Wandera *et al.* (2000).

Location-wise performance of the varietal trial on forage maize (Table 3) revealed that the highest crude protein was obtained at Raipur (12.7 q/ha) followed by Coimbatore (9.3 q/ha) and Bhubaneswar (9.2 q/ha).

Crude Protein (%)

At Hisar, forage maize genotype AFM-3 (Table 2) gave almost similar crude protein per cent (9.6) as

TABLE 3
Location-wise performance of forage maize varietal trial for fodder yield during **kharif** 2013

S. No.	Locations across the country	GFY (q/ha) (21)	DMY (q/ha) (19)	GFY (q/ha/day) (17)	DMY (q/ha/day) (14)	Plant height (cm) (18)	Leaf : stem ratio (15)	Crude protein yield (q/ha)	Crude protein (%)
1.	Palampur	443.8	86.0	7.23	0.99	228.1	0.48	8.2	9.5
2.	Srinagar	316.9	78.7	3.99	-	204.0	0.34	-	-
3.	Almora	307.3	69.0	-	-	-	-	-	-
4.	Ludhiana	453.1	94.2	6.78	1.40	184.1	0.58	6.8	7.3
5.	Hisar	193.0	38.6	2.30	0.46	154.5	0.43	3.5	8.9
6.	Udaipur	290.2	-	-	-	163.0	-	-	-
7.	Jalore	362.0	-	-	-	-	-	-	-
8.	Pantnagar	178.0	43.6	3.13	0.77	204.3	-	-	-
9.	Faizabad	86.3	24.4	1.20	0.34	97.8	0.70	1.8	7.3
10.	Bhubaneswar	517.3	117.2	10.03	2.28	281.8	1.04	9.2	7.9
11.	Ranchi	497.6	108.9	9.55	2.09	174.7	0.63	-	-
12.	Jorhat	253.9	48.7	3.93	0.75	125.0	0.89	-	-
13.	Anand	267.1	45.4	4.78	0.80	194.1	-	2.5	5.4
14.	Raipur	616.6	129.5	9.49	2.29	195.5	0.49	12.7	9.7
15.	Jabalpur	356.4	84.6	5.50	1.30	175.0	0.59	6.5	7.6
16.	Rahuri	422.1	65.6	7.05	-	190.6	0.32	4.4	6.8
17.	Jhansi	270.8	63.1	-	-	-	-	-	-
18.	Hyderabad	695.7	97.6	10.63	1.53	222.6	0.39	6.5	6.7
19.	Coimbatore	523.1	98.4	8.77	1.65	239.9	0.20	9.3	9.3
20.	Mandya	198.8	33.9	3.57	-	154.0	0.34	-	-
21.	Karaikal	408.6	87.1	-	1.43	191.2	0.39	7.4	8.5
	Average	376.4	74.4	6.37	1.34	188.3	0.54	6.8	7.9

Figures in parentheses indicate number of locations. Locations 1-3 : Hill Zone, 4-8 : North-West Zone, 9-12 : North-East Zone, 13-17 : Central Zone and 18-21 : South Zone.

compared to the best check J-1006 (9.8). At All-India level, AFM-3 and AFM-1 (8.4 and 8.1%, respectively) gave higher crude protein than the checks African Tall and J 1006 (7.9%). The mean crude protein per cent at Hisar (8.9) was much higher than the mean at All-India level (7.9%) for this character.

Location-wise performance of the varietal trial on forage maize (Table 3) revealed that the highest crude protein per cent was obtained at Raipur (9.7) followed by Palampur (9.5) and Coimbatore (9.3). Higher crude protein per cent may be due to more nitrogen accumulation and its conversion to the protein in the particular genotype.

A close look at the data reveals that southern zone represented by Hyderabad and Coimbatore gave higher green fodder yield, plant height and production efficiency thereby indicating that climatic conditions and soil types were very suitable for fodder maize.

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