

## Assessment of unexploited maize (*Zea mays* L.) germplasm and its utilization in heterosis for forage traits

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Maize (*Zea mays* L.) is an important cereal fodder crop because of its high yielding, palatable and nutritious qualities. It is utilized in the form of grains, green fodder, silage, stover and pasturage. Green fodder provides adequate energy and proteins for growth of animal and milk production. Maize originated in Central America and attained widespread geographical distribution with substantial genetic diversity in maize accessions in India. The richness of diversity is more in the tribal dominated areas where subsistence farming is being practiced. In India the genetic improvement in forage maize however could not make headway and the gap still remain to be filled up through development of improved forage varieties in this crop. Efforts were made by BAIF Development Research Foundation to collect sixty five unexploited local germplasm of maize from the tribal areas of Maharashtra, Gujarat and Jharkhand. An attempt was made to quantify the magnitude of variability for forage traits in these accessions so as to select the appropriate parents for creation of hybrids and also to assess the performance of hybrids for identification of the most heterotic cross combinations to use them in developing composite varieties for high yield and quality of fodder.

The germplasm accessions were made genetically pure by performing selfing programme for three generations during 2002-03 and further evaluated for ten different characters at BAIF's Central Research station, Urulikanchan. Seven accessions were selected as parents for crossing and five hybrids were created involving African Tall (A.T.) by manual pollination during *kharif* 2004. A total of 13 entries consisting of five hybrids, seven parents and national check variety A.T. were grown during *rabi* 2004-05 in a randomized complete

block design (RCBD) with three replications. Data were recorded for days to 50% flowering, plant height, stem diameter, leaf breadth, total leaf area per plant, green fodder yield (GFY), dry matter yield (DMY) and crude protein yield (CPY) from five randomly selected plants in each replication. Heterosis over national check variety was calculated as per Rai [1].

Sixty five accessions of maize showed a surprising range of variation for all the ten forage traits studied. The days to 50 % flowering ranged from 37 to 75 days indicating scope for developing early hybrids. Green fodder yield per plant ranged from 318 to 985 g and so is the case with dry matter percentage. Percentage of crude protein at 50% flowering stage revealed a very wide range (6.13 - 13.90%) which could be used for developing hybrids /composites of high protein content. Based on the values for economic traits of fodder, seven accessions were selected for developing inbred lines.

Among the five hybrids, hybrid A.T. x 102 showed its superiority for stem diameter, leaf breadth, total leaf area, GFY, DMY, CPY per plant and per day productivity for green fodder, dry matter and crude protein (Table 1). The other hybrid 109 x 102 performed superior over A.T. for per day productivity of green fodder, dry matter and crude protein. Besides, hybrid 150 x 137 was found better for CPY per plant, per day productivity for green fodder, dry matter and crude protein over A.T. Negative heterosis was desirable for days to 50% flowering and highest negative heterosis for days to 50 % flowering was found in hybrids 109 x 102 (-26.83%) and 150 x 137 (-26.82%) (Table 2). Chattopadhyay and Dhiman [2] and Nagda *et al.* [3] also found significant negative heterosis for days to silking in most of the crosses of maize.

**Table 1.** Mean performance of hybrids, parents and check variety for different characters in forage maize

S.No.	Hybrids/parents	Days to 50% flowering	Plant height (cm)	Stem dia. (cm)	Leaf breadth (cm)	Total leaf area/ (cm <sup>2</sup> )	Green fodder yield/ plant (g)	Dry matter yield/ plant (g)	Crude protein yield/ plant (g)	Per day productivity of green fodder (g/ plant)	Per day productivity of dry matter (g/ plant)	Per day productivity of crude protein (g/ plant)
1	109 x 102	60.00	219.07	2.39	9.80	16993	1337.00	233.83	19.54	22.28	3.90	0.33
2	112 x 102	74.00	209.73	2.53	9.73	15303	1242.33	227.87	23.18	16.79	3.08	0.31
3	146 x 102	74.00	204.13	2.57	10.73	16148	970.00	181.17	15.10	13.11	2.45	0.20
4	AT x 102	82.00	252.87	2.68	12.13	19388	1633.67	306.13	23.38	19.92	3.73	0.29
5	150 x 137	60.00	163.93	2.45	10.57	13102	1127.00	211.43	20.38	18.78	3.52	0.34
6	BA1F-102	82.00	242.67	2.62	11.20	15780	1475.67	266.20	19.18	18.00	3.25	0.23
7	BA1F-109	57.00	159.80	1.99	8.17	9043	438.67	79.99	7.79	7.70	1.40	0.14
8	BAIF-112	61.00	138.67	1.77	7.13	7440	454.33	77.22	6.78	7.45	1.27	0.11
9	BAIF-137	59.00	125.27	1.79	9.07	7807	369.33	70.07	6.61	6.26	1.19	0.11
10	BAIF-146	68.00	141.60	2.41	9.00	10551	621.33	113.60	8.58	9.14	1.67	0.13
11	BAIF-150	62.00	148.93	2.22	9.57	10918	765.67	138.57	13.30	12.35	2.24	0.21
12	African Tall	82.00	266.20	2.67	10.83	18883	1488.33	282.70	19.90	18.15	3.45	0.24
SE(m)±			8.48	0.09	0.43	958.43	127.13	24.04	3.35			

**Table 2.** Heterosis (%) for green forage yield and quality in forage maize hybrids over national check variety

S.No.	Hybrids/parents	Days to 50% flowering	Plant height (cm)	Stem dia. (cm)	Leaf breadth (cm)	Total leaf area/ (cm <sup>2</sup> )	Green fodder yield/ plant (g)	Dry matter yield/ plant (g)	Crude protein yield/ plant (g)	Per day productivity of green fodder (g/ plant)	Per day productivity of dry matter (g/ plant)	Per day productivity of crude protein (g/ plant)
1	109 x 102	-26.83	-17.70	-10.48	-9.51	-10.00	-10.14	-16.54	-0.61	22.81	13.99	35.85
2	112 x 102	-9.75	-21.21	-5.24	-10.15	-18.95	-16.53	-18.39	17.62	-7.55	-9.62	30.36
3	146 x 102	-9.75	-23.31	-3.74	-0.90	-14.48	-34.81	-35.28	-20.92	-27.82	-28.57	-15.12
4	AT x 102	0.00	-5.00	0.37	12.00	2.67	9.74	9.55	19.20	10.67	9.62	19.19
5	150 x 137	-26.82	-38.41	-8.23	-2.40	-30.61	-24.26	-25.19	0.51	3.47	1.46	37.60

Highest positive heterosis for leaf breadth (12%), total leaf area per plant (2.67%), GFY/ plant (9.74%), DMY/plant (9.59%) and CPY/plant (19.20%) was exhibited by hybrid A.T. x 102. Positive useful heterosis for these traits in forage maize was reported by Bhoite *et al.* [4] and Jha *et al.* [5].

Positive heterosis for crude protein yield per plant was showed by hybrids A.T. x 102 and 112 x 102 which

was 19.20% and 17.62%, respectively. The highest positive heterosis for per day productivity of green fodder (22.81%) and dry matter (13.97 %) was found in hybrid 109 x 102 over A.T. Maximum percentage of positive heterosis over A.T. variety for per day productivity of crude protein was exhibited in hybrids 109 x 102 (35.85%) and 150 x 137 (37.60%).

Out of five heterotic hybrids, A.T. x 102 hybrid

expressed high magnitude of heterosis for all the characters studied except plant height while hybrids 109 x 102 showed high heterosis for per day productivity of green fodder, dry matter and crude protein. Hence these two hybrids could be utilized as forage hybrids as well as exploited for development of better composites.

The results of this study suggested that the unexploited maize germplasm from tribal areas of the country can be tapped and utilized for further breeding programme.

### References

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