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Stability Analysis of Plant Height in Forage Maize (*Zea Mays* L.) Accessions Under Different Environmental Conditions

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Abstract: *In the present study a core collection of 101 forage maize (Zea mays L.) accessions including African Tall were used to study the stability of plant height. African Tall had maximum plant height followed by IC-334855 (233.19), whereas IC-335060 showed minimum plant height and stability for all kinds of environments. The study revealed that an ideally typical forage maize plant has a tall and leafy structure. Plant does not have problems of hydrocyanic acid and therefore it can be used even before in flowering or in dry weather. Fodder yield is not a unitary character but depends on the development of various plant characters with suitable environment. There is a significant positive correlation between plant height and other forage yielding traits in forage maize (Zea mays L.), meaning taller plants strongly associated with more fodder yield.*

Keywords: Forage maize, Stability analysis, Plant height.

I. INTRODUCTION

Maize (Zea mays L.) is the third major cereal crop in the world after wheat and rice (Das *et al*., 2018). It is one of the most important cereal crops of India and is used as fodder at various stage of the plant growth. Forage maize are rich in nutrients and are essential for balancing the diets of ruminant animals, contributing to higher milk and meat production. Fodder yield primarily depends upon the magnitude and the nature of genetic variability present in the population. The knowledge of association of fodder yield with its component traits helps in achieving success in a breeding programme. Therefore, the analysis was undertaken to determine the effects of changing environment on plant height per plant in forage maize accessions. The present study was an attempt to assess the possibilities of exploitation of stable and high yielding accessions of forage maize, through estimating stability parameters analysis.

II. MATERIAL AND METHODS

In the present study a core collection of 101 forage maize (*Zea mays* L.) accessions including African Tall were used to study the stability of plant height /plant. This core collection was selected from the entire genetic diversity collected from different geographical regions of India. This genetic stock is being maintained at gene bank of Indian Grassland and Fodder Research Institute (IGFRI), Jhansi. Most of these genetic lines were initially explored and collected from the states of Rajasthan, Madhya Pradesh and Uttar Pradesh under NATP sub project on "Sustainable Management of Plant diversity on forage crops".

The experiment was conducted at the Central Research farm of Indian Grassland and Fodder Research Institute, Jhansi (78° E longitude, 25° N latitude and 271metre altitude) during 2001 – 2003. Each entry was sown in randomized block design having three replications on well-prepared land with optimum moisture for germination. Observation on various parameters contributing to fodder yield potential were recorded at 50% silking stage of the accessions. Stability parameters were computed as method suggested by Eberhart and Russell (1966). The regression coefficient (bi) and mean square deviation from the linear regression (S ^{2}di) were also estimated.

III. RESULT AND DISCUSSION

There is a significant positive correlation between plant height and other fodder yielding traits in forage maize (Zea mays L.), meaning taller plants generally possess more fodder yielding traits. Hence, the present study was undertaken with a view to know the G × E interactions and stability parameters of entire core collection of forage maize accessions collected from different geographical regions of India for plant height per plant.

In case of plant height, both regression coefficients (bi) and mean square deviation (S^{2}di) values were non-significant for 71 accessions and African Tall revealing the absence of G x E interaction. 23 accessions had significant bi values indicating the presence of linear components of G x E interactions. On the other hand, only one accessions had non-linear components of G x E interaction as S^{2}di values were significant, whereas five accessions had both bi and S^{2}di values significant which showed the presence of linear and non-linear components of G x E interaction (Table- 1).

Nineteen accessions had bi values more than one indicating their suitability to favourable environment, out of which 12 accessions namely IC-334830, followed by IC-335032, IC-335148, IC-334943, IC-334880, IC-334881, IC-334973, IC-334826, IC-335103, IC-334869, IC-334864 and IC-335028 were found to have mean values greater to population mean. Only five accessions were having bi values significantly negative showing their adaptability for unfavourable/ poor environments in which only one accession namely IC-335158 had its mean more than population mean. 76 accessions and African Tall were found suitable to all kind of environments as these were having bi values approaching one. Out of 100 accessions and African Tall, 46 accessions were below average, 48 accessions at average value and only one accession along with African Tall were found to have mean values greater or above average to the population mean. African Tall (268.93) had maximum plant height followed by IC-334855 (233.19), whereas IC-335060 showed minimum plant height (148.44) and stability for all kinds of environments. Similar findings were also reported by Yadav et al. (2010) and Bikash et al. (2013) in pearl millet and V"Lchinkov (1992) and Nanavati (2016) in maize

According to Eberhart and Russell (1966) a desirable variety is one that has high mean with unity regression coefficients and S ^{2}di values approaching to zero. Srivas & Singh (2004) concluded that the improvement in characters like days to 50% silking, number of leaves per plant and stem girth will help to improve the fodder yield in maize both directly and indirectly. Nirala and Jha (2003) studied the phenotypic stability for fodder traits in maize and reported highly significant mean squares due to genotypes and environments (linear) for all the traits under study indicating the presence of significant difference among genotypes and environments. Srivas et al. (2012) concluded that a dual purpose variety in maize may be developed by selecting plant with more plant height and number of leaves per plan alone or jointly which will increase the level of fodder and kernel yield.

Table- Estimation of stability parameters for plant height.

S. No.	Acc. No.	Mean	bi	S ^{2}di	S. No	Acc. No.	Mean	bi	S ^{2}di
1.	IC- 334821	168.90	0.65	-95.72	52.	IC- 335025	178.45	1.36	-76.67
2.	IC- 334825	183.85	1.15	571.07	53.	IC- 335027	170.15	0.51	111.34
3.	IC- 334826	194.52	2.41*	-102.72	54.	IC- 335028	191.15	2.08*	153.82
4.	IC- 334830	221.35	1.68*	44.44	55.	IC- 335032	210.70	1.82*	454.66
5.	IC- 334833	214.86	0.81	209.13	56.	IC- 335035	212.11	-0.03	255.27
6.	IC- 334834	215.08	0.35	-37.02	57.	IC- 335041	203.15	-0.02	142.12
7.	IC- 334836	203.54	0.16	-95.45	58.	IC- 335043	185.37	0.02	493.67
8.	IC- 334837	207.80	1.31	436.03	59.	IC- 335045	180.87	1.13	45.25
9.	IC- 334838	211.79	0.22	-100.28	60.	IC- 335048	201.84	0.56	24.21
10.	IC- 334841	206.46	0.25	-56.33	61.	IC- 335050	199.30	1.52	-38.35
11.	IC- 334842	199.98	-0.20	28.22	62.	IC- 335051	189.82	0.72	289.36

12.	IC- 334846	221.02	0.93	-104.51	63.	IC- 335053	177.37	0.59	1887.29*
13.	IC- 334848	203.00	0.88	1243.66*	64.	IC- 335056	153.71	0.19	-72.60
14.	IC- 334853	206.59	1.43	28.23	65.	IC- 335060	148.44	0.40	-16.86
15.	IC- 334855	233.19	0.58	-45.09	66.	IC- 335062	156.78	-0.37*	247.22
16.	IC- 334863	184.94	2.26*	51.46	67.	IC- 335068	157.31	0.44	665.01
17	IC- 334864	191.52	2.75*	-97.60	68.	IC- 335069	154.89	0.23	-55.86
18.	IC- 334867	186.13	2.87*	-7.39	69.	IC- 335079	161.33	0.99	-102.62
19.	IC- 334869	192.59	2.27*	-103.95	70.	IC- 335082	166.07	1.81*	1510.49*
20.	IC- 334871	181.59	2.44*	214.69	71.	IC- 335086	154.63	1.15	-76.13
21.	IC- 334872	196.08	1.08	-103.65	72.	IC- 335089	189.16	1.25	70.26
22.	IC- 334876	181.43	2.14*	504.70	73.	IC- 335092	181.94	-0.38*	-83.16
23.	IC- 334877	191.67	0.74	876.08	74.	IC- 335094	188.62	2.37*	-104.42
24.	IC- 334879	185.22	1.33	464.57	75.	IC- 335098	173.32	-0.42*	-47.68
25.	IC- 334880	203.47	1.89*	841.20	76.	IC- 335103	193.04	2.50*	-87.89
26.	IC- 334881	200.53	2.75*	61.80	77.	IC- 335109	181.35	1.32	-25.40
27.	IC- 334884	202.98	0.44	-62.21	78.	IC- 335110	192.69	0.83	-34.29
28.	IC- 334889	169.70	0.83	-104.16	79.	IC- 335111	182.88	-0.21	21.02
29.	IC- 334904	173.07	-1.14*	300.31	80.	IC- 335112	188.04	-0.14	-104.57
30.	IC- 334915	210.46	0.66	-28.24	81.	IC- 335115	186.63	0.29	-46.09
31.	IC- 334920	189.15	0.30	-103.76	82.	IC- 335116	168.67	1.02	-57.87
32.	IC- 334929	195.33	0.50	-52.62	83.	IC- 335117	175.26	0.64	-94.72
33.	IC- 334932	185.74	0.98	-59.65	84.	IC- 335120	175.84	-0.15	234.76
34.	IC- 334942	211.84	1.23	305.41	85.	IC- 335122	187.26	1.47	-80.84
35.	IC- 334943	206.00	2.25*	25.15	86.	IC- 335128	193.80	1.61	413.94
36.	IC- 334944	169.78	1.09	601.76	87.	IC- 335131	196.46	0.81	-51.99
37.	IC- 334945	196.07	1.29	40.16	88.	IC- 335138	192.48	0.76	713.06
38.	IC- 334947	169.51	1.50	723.40	89.	IC- 335141	176.85	0.34	-103.09
39.	IC- 334949	192.20	1.61	239.01	90.	IC- 335144	175.30	1.12	1378.00
40.	IC- 334954	197.13	1.19	51.70	91.	IC- 335148	209.61	1.96*	512.36
41.	IC- 334955	191.37	0.98	360.29	92.	IC- 335149	183.23	0.43	-97.39
42.	IC- 334957	177.69	0.92	-103.52	93.	IC- 335152	195.35	0.24	65.52
43.	IC- 334973	198.96	1.98*	59.67	94.	IC- 335156	182.11	1.03	1104.33*
44.	IC- 334974	184.52	1.22	-62.54	95.	IC- 335158	197.59	-0.85*	941.84
45.	IC- 334989	175.37	1.95*	124.79	96.	IC- 335164	192.70	1.55	-75.88
46.	IC- 334996	186.22	1.61	32.21	97.	IC- 335169	184.07	0.49	1949.27*
47.	IC- 334999	195.80	1.07	1016.36	98.	IC- 335173	191.58	1.00	414.79
48.	IC- 335000	205.78	1.14	-78.37	99.	IC- 335178	197.74	1.24	-90.62
49.	IC- 335009	203.63	1.55	5.24	100.	IC- 335184	186.24	0.54	-7.41
50.	IC- 335017	194.48	1.26	-90.52	101.	African Tall	268.93	0.14	-104.40
51.	IC- 335024	195.11	1.53	188.23					

Significant at 5% level

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