

Stability Analysis for Stem Girth in Forage Maize (*Zea Mays L.*) Accessions

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Abstract: *Stem girth is a critical phenotypic parameter for forage maize, integral to yield prediction and lodging resistance assessment. One hundred and one forage maize accessions including African Tall were evaluated during kharif seasons to identify stability for stem girth in forage maize. Study revealed that most of the accessions had non-significant b_i and S^2_{di} showing absence of $G \times E$ interaction. Similarly many accessions and African Tall had b_i values equal to one or unity, indicating their adaptability to favourable, unfavourable and general environments, respectively. Thickest stem was observed in African Tall (2.94), which was stable to all type of environments ($b_i = 0.87$). Among stable maize accessions maximum stem girth was recorded for IC-335048 (2.37) followed by IC-334848 and was stable to favourable environments.*

Keywords: Forage maize, stability analysis, stem girth, $G \times E$ interaction

I. INTRODUCTION

Maize plays a vital role in agriculture worldwide. It is not only a staple food for many communities but also serves as feed for livestock. Stem girth is an important trait to improve forage as well as seed quality in maize. Previous studies have pointed out that thicker stems usually have greater mechanical strength and can effectively support the weight of the ears, thereby reducing the risk of lodging in the middle and late stages (Robertson et al., 2017). This trait also helps to improve silage quality of maize for dairy cattle. 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

A core collection of 101 forage maize (*Zea mays L.*) accessions including African Tall were used to study the stability of stem girth /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. The thickness of the stem was measured at fifth node from the base of the shoot. Stability parameters were computed as method suggested by Eberhart and Russell (1966). The regression coefficient (b_i) and mean square deviation from the linear regression (S^2_{di}) were also estimated.

III. RESULT AND DISCUSSION

Stability parameters for stem girth indicated that 74 accessions and African Tall had non- significant b_i and S^2d_i showing absence of $G \times E$ interaction. Only two accessions had significant b_i and S^2d_i indicating the presence of linear as well as non- linear component. Eighteen accessions had significant b_i revealing the presence of linear portion of $G \times E$ interaction, whereas six accessions had significant non- linear component (S^2d_i).

Twelve accessions had b_i values > 1 , another eight accessions were having < 1 b_i values and remaining 80 accessions and African Tall had b_i values equal to one or unity, indicating their adaptability to favourable, unfavourable and general environments, respectively. Forty six accessions had below average mean, 54 accessions had average mean and only African Tall was having above average mean value than the population means. Thickest stem was observed in African Tall (2.94), which was stable to all type of environments ($b_i = 0.87$). Among stable maize accessions maximum stem girth was recorded for IC-335048 (2.37) followed by IC-334848 and was stable to favourable environments. Eight accessions namely IC-334836, IC-334863, IC-335035, IC- 335045, IC- 335050, IC-335089, IC-335178 and IC-335184 were found to be stable.

Stability analysis in forage maize identifies accessions that produce high, consistent dry matter and green fodder yields across diverse environments. According to Srivas (2020) 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 with more stem girth is strongly associated with fodder yield. 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. According to Eberhart and Russell (1966) a desirable variety is one that has high mean with unity regression coefficients and S^2d_i values approaching to zero. 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.

Table- Estimation of stability parameters for stem girth.

S. No.	Acc. No.	Mean	b_i	S^2d_i	S. No.	Acc. No.	Mean	b_i	S^2d_i
1.	IC- 334821	1.85	1.82	-0.02	52.	IC- 335025	2.17	-0.40	0.01
2.	IC- 334825	2.05	0.23	0.00	53.	IC- 335027	2.14	1.24	0.12
3.	IC- 334826	2.23	0.99	0.16	54.	IC- 335028	1.99	1.68	-0.01
4.	IC- 334830	2.26	-0.65	0.01	55.	IC- 335032	2.12	0.09	0.10
5.	IC- 334833	2.36	0.09	-0.02	56.	IC- 335035	2.12	-0.17	0.35*
6.	IC- 334834	2.34	1.03	0.04	57.	IC- 335041	2.25	0.76	0.03
7.	IC- 334836	2.20	1.05	0.25*	58.	IC- 335043	1.99	1.42	-0.01
8.	IC- 334837	2.07	0.39	0.14	59.	IC- 335045	1.88	1.78	0.35*
9.	IC- 334838	2.31	1.98	0.02	60.	IC- 335048	2.13	1.79	-0.01
10.	IC- 334841	2.23	1.54	0.03	61.	IC- 335050	2.08	-1.14*	0.38*
11.	IC- 334842	2.28	3.17*	-0.02	62.	IC- 335051	1.82	1.42	-0.02
12.	IC- 334846	2.33	0.99	0.00	63.	IC- 335053	2.23	1.86	-0.02
13.	IC- 334848	2.37	3.58*	0.00	64.	IC- 335056	1.97	1.33	0.04
14.	IC- 334853	2.06	1.74	-0.02	65.	IC- 335060	1.54	3.10*	0.00
15.	IC- 334855	2.24	2.52	0.18	66.	IC- 335062	1.71	1.51	0.18
16.	IC- 334863	2.24	3.30*	0.25*	67.	IC- 335068	1.54	0.71	0.01
17.	IC- 334864	2.17	0.05	0.01	68.	IC- 335069	1.86	1.15	-0.02
18.	IC- 334867	2.16	3.59*	-0.01	69.	IC- 335079	1.94	-0.35	0.00
19.	IC- 334869	2.20	2.46	-0.02	70.	IC- 335082	1.82	1.94	0.03

20.	IC- 334871	1.99	0.96	0.01	71.	IC- 335086	1.89	2.53	0.16
21.	IC- 334872	2.21	1.17	-0.01	72.	IC- 335089	1.89	0.08	0.44*
22.	IC- 334876	2.17	0.85	0.00	73.	IC- 335092	2.04	2.76*	-0.02
23.	IC- 334877	1.98	0.23	-0.02	74.	IC- 335094	1.90	-1.38*	0.00
24.	IC- 334879	2.04	-1.15*	0.02	75.	IC- 335098	1.89	1.15	0.07
25.	IC- 334880	2.08	-0.62	-0.02	76.	IC- 335103	2.02	-2.83*	0.00
26.	IC- 334881	2.02	0.62	0.00	77.	IC- 335109	2.15	0.23	0.06
27.	IC- 334884	2.14	-1.95*	0.09	78.	IC- 335110	2.11	1.03	0.04
28.	IC- 334889	1.80	1.33	0.00	79.	IC- 335111	2.01	2.36	-0.01
29.	IC- 334904	2.22	1.42	-0.02	80.	IC- 335112	1.97	1.86	-0.02
30.	IC- 334915	2.11	0.50	0.02	81.	IC- 335115	1.91	0.44	-0.02
31.	IC- 334920	1.97	0.65	-0.02	82.	IC- 335116	1.91	2.04	-0.02
32.	IC- 334929	1.98	1.77	-0.02	83.	IC- 335117	2.03	0.26	0.00
33.	IC- 334932	2.09	-0.71	0.00	84.	IC- 335120	1.98	2.84*	0.20
34.	IC- 334942	2.10	0.58	-0.01	85.	IC- 335122	1.82	1.15	-0.02
35.	IC- 334943	2.23	0.48	0.01	86.	IC- 335128	2.16	2.27	-0.02
36.	IC- 334944	1.94	-0.09	0.14	87.	IC- 335131	1.96	-0.44	0.00
37.	IC- 334945	2.33	-0.32	-0.01	88.	IC- 335138	1.97	0.58	-0.02
38.	IC- 334947	1.86	1.68	-0.02	89.	IC- 335141	1.94	-0.36	0.00
39.	IC- 334949	2.06	1.15	0.00	90.	IC- 335144	1.84	1.91	0.00
40.	IC- 334954	2.14	-0.20	-0.02	91.	IC- 335148	1.93	0.00	0.00
41.	IC- 334955	1.80	1.06	-0.01	92.	IC- 335149	2.01	3.41	0.03
42.	IC- 334957	2.03	3.67*	-0.02	93.	IC- 335152	1.83	0.26	0.10
43.	IC- 334973	1.88	3.10*	0.00	94.	IC- 335156	1.85	3.70*	0.02
44.	IC- 334974	2.10	0.80	0.02	95.	IC- 335158	1.98	2.83	-0.01
45.	IC- 334989	1.82	-0.50	0.07	96.	IC- 335164	1.86	1.68	0.00
46.	IC- 334996	1.84	0.44	0.14	97.	IC- 335169	1.81	2.30	-0.02
47.	IC- 334999	2.11	3.57*	0.07	98.	IC- 335173	1.79	0.88	0.16
48.	IC- 335000	2.15	-1.29*	-0.02	99.	IC- 335178	2.18	0.17	0.48**
49.	IC- 335009	2.08	-0.88*	-0.02	100.	IC- 335184	1.98	-0.12	0.33**
50.	IC- 335017	2.19	0.41	0.03	101.	African Tall	2.94	0.87	-0.02
51.	IC- 335024	2.16	-1.77*	-0.02					

Significant at 5% level

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