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Stability analysis of leaf blade length and sheath length in forage maize (*Zeamays* L.) accessions under different Environmental Conditions

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Abstract

The present study was undertaken with a view to know the G x E interactions and stability parameters in forage maize for leaf blade length and leaf sheath length. One hundred and one forage maize accessions including control forage maize variety African tall collected from different geographical origin were evaluated in different environmental conditions. Among the accessions, IC-334999 had maximum leaf blade length (99.00), which was suited to unfavorable environments due to its above average response and was stable. Six accessions namely IC-334841, IC-334884, IC-334889, IC-334904, IC-334957 and IC-334989 were not stable for leaf blade length.African Tall had maximum sheath length (20.53) followed by IC-334833, IC-334846 and IC-334871. All of these were stable for all kinds of environments. The present study helped to identify some accession, which could be suitable for different kinds of environmental conditions. The selected accessions are likely to give predicted response for leaf blade and sheath length in a given environment.

Key words: Forage maize, Zea mays L., stable genotype, African tall, stability

Introduction

The forage maize plant, scientifically known as Zea mays L., is a cross- pollinating cereal crop. The herbage of the plant is commonly used for livestock feed, while the kernels is typically used for human consumption.Maize stands out as one of the most important major cereal crop in the world with enormous role in nutritional security. It is an ideal cereal forage crop because of its fast growing habit, high palatability and can be grown in any season. Maize is grown in almost all geographical regions of India hence; its performance to different growing regions is differing. The present study was an attempt to assess the possibilities of exploitation of stable and high yielding hybrids of forage maize, through estimating stability parameters analysis.

Material and Methods

In present study a core collection of forage maize (*Zea mays* L.) accessions were evaluated with a control variety African Tall to study the stability of leaf blade length and leaf sheath length.This core collection was selected from the entire genetic diversity collected from the different parts/ eco-geographical location of the country. This genetic stock is being maintained at gene bank of Indian Grassland and Fodder Research Institute, 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^2di) were also estimated.

Result and Discussion

For leaf blade lengthfrom the perusal of Table- 1, both bi and S^2di values of 64 accessions revealed the absence of G x E interaction, as both bi and S^2di were non-significant in these accessions. Regression coefficient (bi) alone was significant in 31 accessions and African Tall exhibited linear component of G x E interaction. Only three accessions had both linear and non-linear components of G x E interactions, as bi and S^2di of these accessions were significant, whereas non-linear components of G x E interaction were reported in two accessions.

Fourteen accessions had above average response, 21 accessions and African Tall below average response and remaining 65 accessions were average in response, which showed their adaptability to favorable, unfavorable and general environments, respectively. Thirteen accessions and African Tall had above average mean performance than population mean, whereas eight accessions had mean values below average. However, 79 accessions were average in performance for this character. African Tall had maximum leaf blade length (104.81) specially suited to favorable environments due to its below average response (bi = -23*). Among the accessions, IC-334999 had maximum leaf blade length (99.00), which was suited to unfavorable environments due to its above average response and was stable. Among germplasm lines, six accessions namely IC-334841, IC-334884, IC-334889, IC-334904, IC-334957 and IC-334989 were not stable for leaf blade length.

In case of sheath length, both bi and S^2di were non-significant for 64 accessions and African Tall showed absence of G x E interaction. 35 accessions were having only significant bi indicating the presence of linear components of G x E interaction and non-linear components of G x E was observed in only one accession while no accessions was having significant bi and S^2di values (Table- 2).Twelve accessions had bi values < 1 showed their suitability to unfavourable/poor environments. 18 accessions were having above average response (bi = 71) while 70 accessions and African Tall had average response (bi = 1) showing their adaptability to favourable and general environments, respectively. 78 accessions had average sheath length, 12 accessions below average mean and 10 accessions and African Tall were having mean above average. Among the stable maize accessions, 20 accessions were stable for favourable environment with high mean values than population mean whereas only one accession namely IC-335169 was unstable. African Tall had maximum sheath length (20.53) followed by IC-334833, IC-334846 and IC-334871. All of these were stable for all kinds of environments.

The present study helped to identify some accessions, which could be suitable for different kinds of environmental conditions. The selected accessions are likely to give predicted response for leaf blade and sheath length in a given environment. According to Eberhart and Russell (1966) a desirable variety is one that has high mean with unity regression coefficients and S^2di values approaching to zero.Srivas & Singh (2004) concludedthattheimprovementincharacterslike 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.

Estimation of stability parameters for leaf blade length.

S. No.	Acc. No.	Mean	bi	S ^{2}di	S. No	Acc. No.	Mean	bi	S ^{2}di
1.	IC- 334821	83.96	2.21	-14.52	52.	IC- 335025	89.04	0.44	64.54
2.	IC- 334825	84.36	-1.29*	28.33	53.	IC- 335027	86.24	1.89	-17.85
3.	IC- 334826	85.55	1.84	77.77	54.	IC- 335028	91.07	0.52	113.93
4.	IC- 334830	90.81	-0.87*	71.75	55.	IC- 335032	91.15	0.46	150.07
5.	IC- 334833	98.37	0.13	-2.74	56.	IC- 335035	86.00	1.38	-19.52
6.	IC- 334834	94.83	-0.79*	56.78	57.	IC- 335041	86.57	0.94	37.20
7.	IC- 334836	90.70	-1.75*	43.56	58.	IC- 335043	95.04	0.63	-17.12
8.	IC- 334837	98.44	-2.00*	-20.33	59.	IC- 335045	89.07	0.36	-0.01
9.	IC- 334838	91.09	-0.09	2.40	60.	IC- 335048	89.83	2.84*	-16.67
10.	IC- 334841	88.35	-1.66*	237.18*	61.	IC- 335050	91.33	1.23	-4.43
11.	IC- 334842	88.43	2.32	5.83	62.	IC- 335051	84.56	2.27	-18.31
12.	IC- 334846	97.00	1.99	29.29	63.	IC- 335053	95.89	-0.60*	18.35
13.	IC- 334848	88.65	2.19	13.67	64.	IC- 335056	79.10	3.00*	20.58
14.	IC- 334853	90.62	0.02	47.68	65.	IC- 335060	72.93	2.02	98.12
15.	IC- 334855	98.83	-0.13	54.40	66.	IC- 335062	79.82	-0.34	25.75
16.	IC- 334863	89.04	1.41	36.63	67.	IC- 335068	65.67	2.30	-18.89
17	IC- 334864	84.48	2.67*	8.30	68.	IC- 335069	78.71	0.09	38.71
18.	IC- 334867	87.87	2.32	-14.41	69.	IC- 335079	81.27	2.68*	-15.18
19.	IC- 334869	86.09	2.00	-11.75	70.	IC- 335082	82.34	3.09*	-19.13
20.	IC- 334871	90.57	1.19	-0.16	71.	IC- 335086	80.28	0.56	95.96
21.	IC- 334872	97.93	1.62	-6.00	72.	IC- 335089	86.94	2.19	69.33
22.	IC- 334876	83.04	-0.33	118.88	73.	IC- 335092	88.35	1.81	-19.90
23.	IC- 334877	90.84	-0.07	41.88	74.	IC- 335094	85.91	2.77*	114.82
24.	IC- 334879	92.57	-0.83*	-13.21	75.	IC- 335098	79.90	1.94	208.43
25.	IC- 334880	84.95	-0.61*	-0.03	76.	IC- 335103	87.83	1.01	147.77
26.	IC- 334881	86.07	1.28	-19.57	77.	IC- 335109	88.54	0.76	15.12
27.	IC- 334884	86.67	-1.90*	252.98*	78.	IC- 335110	88.04	0.29	-7.47
28.	IC- 334889	76.91	0.42	272.64*	79.	IC- 335111	82.67	0.84	12.99
29.	IC- 334904	75.62	-0.69*	365.38*	80.	IC- 335112	80.83	2.64*	-5.73
30.	IC- 334915	89.11	1.32	-1.38	81.	IC- 335115	78.23	0.05	-14.84
31.	IC- 334920	79.29	0.46	106.43	82.	IC- 335116	74.61	2.03	-5.40
32.	IC- 334929	82.65	0.03	64.03	83.	IC- 335117	82.83	-0.28	71.17
33.	IC- 334932	80.61	0.73	-19.90	84.	IC- 335120	87.66	1.87	7.62
34.	IC- 334942	81.57	-1.29*	-20.32	85.	IC- 335122	86.42	0.69	12.06
35.	IC- 334943	86.75	-0.40	21.14	86.	IC- 335128	87.39	-0.44	69.65
36.	IC- 334944	79.18	1.35	-18.79	87.	IC- 335131	84.90	1.80	51.15
37.	IC- 334945	88.11	-0.30	66.02	88.	IC- 335138	85.38	1.44	-17.82
38.	IC- 334947	88.74	-0.05	26.57	89.	IC- 335141	80.86	0.83	-10.43
39.	IC- 334949	93.78	4.24*	-18.34	90.	IC- 335144	83.07	-0.76*	140.12
40.	IC- 334954	90.56	-0.62*	44.41	91.	IC- 335148	90.24	1.21	105.36
41.	IC- 334955	86.60	2.43	-4.70	92.	IC- 335149	88.11	0.18	-12.96
42.	IC- 334957	84.78	-0.41	453.18**	93.	IC- 335152	80.33	4.54*	4.75

43.	IC- 334973	87.49	0.25	-1.04	94.	IC- 335156	88.04	0.01	-13.15
44.	IC- 334974	85.02	3.17*	-20.28	95.	IC- 335158	91.42	2.92	-16.61
45.	IC- 334989	75.87	1.71	318.1*	96.	IC- 335164	88.54	-0.08	7.67
46.	IC- 334996	84.28	2.02	20.21	97.	IC- 335169	80.69	3.01*	-20.26
47.	IC- 334999	99.00	4.55*	-2.46	98.	IC- 335173	82.85	2.33	-13.66
48.	IC- 335000	88.04	0.16	18.48	99.	IC- 335178	92.53	1.52	-8.31
49.	IC- 335009	95.35	1.64	-17.26	100.	IC- 335184	88.39	1.71	-1.00
50.	IC- 335017	87.89	3.02*	-17.10	101.	African Tall	104.81	-0.23	-1.68
51.	IC- 335024	86.50	2.02	4.74					

Significant at 5% level

Estimation of stability parameters for sheath length

S. No.	Acc. No.	Mean	bi	S^2di	S. No	Acc. No.	Mean	bi	S^2di
1.	IC- 334821	15.65	1.34	-0.27	52.	IC- 335025	16.19	0.18	-0.45
2.	IC- 334825	15.26	0.47	-0.91	53.	IC- 335027	16.69	1.16	-0.79
3.	IC- 334826	17.28	5.09*	0.91	54.	IC- 335028	16.60	2.00	0.60
4.	IC- 334830	18.65	1.51	2.40	55.	IC- 335032	17.31	2.83*	1.90
5.	IC- 334833	19.49	2.17	-1.03	56.	IC- 335035	18.44	2.54*	-0.87
6.	IC- 334834	17.67	1.14	-0.99	57.	IC- 335041	16.87	-0.61*	-1.02
7.	IC- 334836	16.96	-1.86*	0.60	58.	IC- 335043	17.54	-2.68*	0.64
8.	IC- 334837	17.07	0.94	1.36	59.	IC- 335045	16.69	0.20	4.82
9.	IC- 334838	16.89	1.26	-0.40	60.	IC- 335048	17.33	0.99	-1.04
10.	IC- 334841	18.09	-0.67*	-1.00	61.	IC- 335050	17.28	1.19	-0.34
11.	IC- 334842	17.91	1.57	-0.97	62.	IC- 335051	16.46	0.82	-0.75
12.	IC- 334846	19.33	1.92	0.64	63.	IC- 335053	17.93	-0.27*	1.18
13.	IC- 334848	16.72	0.75	-0.99	64.	IC- 335056	15.91	1.27	0.17
14.	IC- 334853	17.93	0.06	-0.69	65.	IC- 335060	13.09	0.83	0.77
15.	IC- 334855	18.93	1.80	-0.41	66.	IC- 335062	14.82	-1.12*	-0.98
16.	IC- 334863	16.96	1.57	-1.04	67.	IC- 335068	14.01	0.62	-0.26
17	IC- 334864	16.87	5.70*	5.96	68.	IC- 335069	15.39	-0.27*	-0.18
18.	IC- 334867	17.53	3.80*	-0.72	69.	IC- 335079	15.69	0.73	-0.59
19.	IC- 334869	16.86	2.65*	-0.43	70.	IC- 335082	14.67	0.32	11.54
20.	IC- 334871	17.80	0.63	0.80	71.	IC- 335086	15.98	0.78	-1.02
21.	IC- 334872	18.61	1.42	0.88	72.	IC- 335089	18.28	1.94	2.19
22.	IC- 334876	16.71	-0.04	-0.35	73.	IC- 335092	16.06	-0.10	4.72
23.	IC- 334877	17.34	-0.18	0.23	74.	IC- 335094	16.12	2.59*	-0.99
24.	IC- 334879	19.06	1.87	3.81	75.	IC- 335098	16.12	1.68	2.34
25.	IC- 334880	17.64	2.73*	5.70	76.	IC- 335103	17.18	2.50	4.74
26.	IC- 334881	17.21	1.67	-0.84	77.	IC- 335109	17.26	1.62	-0.92
27.	IC- 334884	15.96	-1.44*	5.00	78.	IC- 335110	16.62	0.41	0.14
28.	IC- 334889	14.11	-2.03*	-1.02	79.	IC- 335111	16.23	-1.66*	2.09
29.	IC- 334904	15.37	-2.15*	0.14	80.	IC- 335112	16.19	0.42	-0.95
30.	IC- 334915	18.04	-0.61*	-0.50	81.	IC- 335115	15.73	0.10	-0.12
31.	IC- 334920	16.46	0.96	2.72	82.	IC- 335116	15.41	0.45	2.71

32.	IC- 334929	15.81	0.40	-0.94	83.	IC- 335117	15.23	0.37	-0.40
33.	IC- 334932	16.20	2.61*	-0.14	84.	IC- 335120	17.91	-0.09	-1.05
34.	IC- 334942	17.52	2.46*	0.43	85.	IC- 335122	17.02	1.12	-1.06
35.	IC- 334943	16.79	2.51	-0.23	86.	IC- 335128	15.94	-1.08*	-1.05
36.	IC- 334944	15.87	2.24	-0.87	87.	IC- 335131	16.20	0.13	-0.53
37.	IC- 334945	18.06	-0.63*	-0.82	88.	IC- 335138	15.95	1.38	-0.79
38.	IC- 334947	15.67	1.67	-0.99	89.	IC- 335141	16.07	1.48	-1.05
39.	IC- 334949	17.54	3.56*	-1.05	90.	IC- 335144	16.17	0.16	0.11
40.	IC- 334954	17.73	1.24	-0.09	91.	IC- 335148	18.10	4.10*	-1.04
41.	IC- 334955	15.79	2.13*	0.27	92.	IC- 335149	16.83	-0.39*	-0.20
42.	IC- 334957	17.35	-2.47*	1.30	93.	IC- 335152	15.58	0.15	-0.37
43.	IC- 334973	16.96	0.44	1.15	94.	IC- 335156	15.99	-0.37*	-0.93
44.	IC- 334974	16.04	1.67	-0.96	95.	IC- 335158	16.31	1.15	0.27
45.	IC- 334989	14.99	5.12*	2.31	96.	IC- 335164	17.23	1.27	-1.04
46.	IC- 334996	15.72	3.72*	1.49	97.	IC- 335169	15.52	1.05	15.53*
47.	IC- 334999	17.43	2.36	5.04	98.	IC- 335173	16.27	1.26	3.74
48.	IC- 335000	16.39	0.70	-1.05	99.	IC- 335178	17.15	0.19	0.01
49.	IC- 335009	17.04	1.08	0.02	100.	IC- 335184	17.96	0.99	-1.04
50.	IC- 335017	16.73	0.28	0.70	101.	African Tall	20.53	0.03	0.07
51.	IC- 335024	16.44	1.49	0.59					

Significant at 5% level

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