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Research article

STUDIES ON GENETIC DIVERSITY FOR GRAIN YIELD AND PHYSIOLOGICAL PARAMETERS IN MAIZE (*Zea mays* L.)

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ABSTRACT: The D^2 statistics is useful tool to assess genetic diversity among genotypes. It also provides qualitative measures of association between geographical and genetic diversity based on generalized distances. In the present study data on forty nine genotypes were subjected to D^2 analysis, which revealed the presence of substantial amount of genetic variability among them. The pattern of distribution of genotypes into various clusters was random, suggesting that geographical and genetic diversity were not related. The experimental material was partitioned into eight clusters. Flag leaf area per plant contributed maximum towards genetic diversity followed by days to 50 per cent tasseling.
Key words: Maize, A.S.I, Chlorophyll content, Intra and Inter cluster distances

INTRODUCTION

Maize (Zea mays L.) is one of the important food and industrial crops grown extensively in major parts of the world. The crop is cultivated in a wider range of environments than both wheat and rice because of its wider adaptability. Genetic Divergence is the basic for any crop improvement programmes. The hybrids involving the parents with more diversity among them are expected to exhibit higher amount of heterotic expression and broad spectrum of variability in segregating generations. The present investigation was taken up to obtain information on some physiological parameters, grain yield and its components related to genetic diversity.

MATERIALS AND METHODS

The present investigation was under taken to carry out the estimation of genetic divergence for physiological parameter, grain yield and its components. The present study consisting of forty nine genotypes was conducted with two replications in simple lattice design at College Farm, College of Agriculture, Rajendranagar, Hyderabad. Data were recorded for all the traits on five randomly selected plants in each entry in two replications and averages were computed. The parameter Anthesis-Silking Interval (ASI) calculated as differences between days to 50 per cent silking and 50 per cent tasseling. Chlorophyll content recorded in the ear leaf using SPAD-meter at 50 per cent silking. Flag leaf area calculated as maximum width of flag leaf X lengthX0.75.

RESULTS AND DISSCUSSIONS

The analysis of variance revealed significant differences among the genotypes for all the traits under studied, indicating the wide variability in the experimental material. The extent of genetic divergence between genotypes in the experimental material was assessed by D^2 analysis following the procedure given by Rao (1952).. The clustering analysis had partitioned the forty nine genotypes into eight clusters. The success and usefulness of D^2 analysis in quantifying the genetic diversity had been followed in maize (Saxena and Sandhu,1989).

The distribution of genotypes into various clusters is presented in Table 1.The data on cluster means is presented in Table 2. From the data it was observed that considerable differences existed among the genotypes between the clusters. The cluster means for days to 50 per cent tasseling was higher in cluster VII (79.71) and least in cluster VI (67.72). Cluster VII had the highest value (109.34) for days to physiological maturity.

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Cluster II had the highest value for leaf area per plant (69.88), ear girth (14.27), ear length (18.22) and 100 seed weight (22.37), while cluster I had maximum values for grain yield per plant (100.70) and Chlorophyll content (54.54). The average intra and inter cluster D^2 values are presented in Table 3. ®Intra cluster values ranged from 25.409 (cluster VIII) to 86.346 (cluster I). Maximum intra cluster distances were recorded in cluster II and cluster VIII (1842.793) followed by cluster II and cluster VII (1171.038) and this might be due to limited gene exchange or selection practices among the genotypes for diverse characters.

Contribution of different characters towards genetic divergence is presented in Table 4. Highest contribution towards genetic divergence in this regard put forth by Flag leaf area per plant (67.43%) followed by days to 50 per cent tasseling (12.24%) and Plant height (10.20%). Similar results were reported by Kumar and Singh (2002), Datta and Mukherjee (2004). Emphasis should be laid on characters contributing maximum D^2 values for choosing the cluster for the purpose of further selection and choice of parents for hybridization.

The genotypes exhibited random pattern of distribution into various clusters showing that genetic diversity and geographical diversity is not related. This suggests that forces other than geographical origin such as genetic drift, natural and artificial selection, exchange of breeding material plays an important role in the diversity of genotypes. Similar conclusions were also drawn by Singh et al., (1999). Maximum diversity was found between cluster II and VIII suggesting that the genotypes in these clusters could be fully exploited to explore the wide range of heterosis and to release good recombinant lines by intermating them in a definite design.

Table: 1 Distribution of Forty nine genotypes into different clusters in Maize

Cluster No	No. of Genotypes	Genotypes
I	8	DMV12-1-1-2-®-1-1-1-1-1-2: BML-492-1-1-1-2-®: EM 30-1-1-1-2-1-1-2; BQL 326-1-1; DMR 149-1-1-1-1-1-1-1-1; TQPM 27-2-1-1-®-2-1; TQPM 42-1-2-1-®-2-1-1-1-1; CM-211
II	2	BML 497-3-1-1-1; EI 28-2-1-1-1-1-1
III	8	PN 24E-1-2-1-®1-4-1-1-1-1-1; BHOL 383-1-1-1; BHOL 444-2-1-1-1; DMR 332-1-1-1-1-1-1-1-1; BML 497-1-1-1-1; BML 497-2-1-1-1; BQL 258-1-1-1-1; HOL OP 10-1-1-1-1-1-1
IV	6	BSRL 12-1-1-1-®; CM-119; BML-497-8-1-1-®; DMR 332-31-1-1-1-®; DMR 332-5-1-1-1-®; QPM (KR)-1-1-1-1- ®
V	7	EI 10-1-1-1-1-1-1-1-1; DMR-156-2-1-1-®3-1- 1-1-1; BHOL 212-3-1-2-1-1®; TQPM 34-1-2- 1-1-2-1-1-1-1; PN24E-1-3-2-®1-1-1-1-1; BSRL-16-1-1-1-®; BSRL 12-1-1-®;
VI	9	PN24E-2-1-1-®-1-2-1; BML-497-12-1-2-1® HOL OP25-1-1-1-2-1-1; BML483-1-1-1; TQPM 27-1-1-1-®3-1-1-1-1-1; EI-17-1-1-1-1-1-1; BSRL-7-1-1-®; DMR-332-8-1-1-1-®; EI10-2-1-1-1-®;
VII	7	BHOL444-1-1-1-1; HOLOP 10-3-1-1-1-1; BHOL 212-1-1-1-2-1; BQL 344-1-1-1-1; BSRL-2-1-1-®; DMR 40E-1-4-1-1-®1-1-1-1-1; TQPM 34-3-1-1-®-1-1;
VIII	2	BQL 349-1-1; BQL 332-1-1-1-1

® - Bulk population

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Table : 2 Cluster means of Physiological , Grain yield and its components in Maize (*Zea mays* L.)

S.No	Cluster group	Days to 50% tasseling	Days to 50% silking	A.S.I	Plant height (cm)	Leaves above ear	Chlorophyll content (SPAD –units)	Leaf area per plant (cm2)	Days to physilological maturity	Ear length (cm)	Ear girth (cm)	100 Seed wt (g)	Yield per plant (g)
1	Cluster I	73.93	77.56	3.62	174.19	7.33	54.54	542.17	107.32	16.25	13.86	22.24	100.70
2	Cluster II	68.5	76.00	7.50	189.08	7.85	49.34	696.88	105.02	18.22	14.27	22.37	96.40
3	Cluster III	67.93	73.43	5.50	138.06	6.16	51.53	461.87	104.98	13.59	12.10	18.35	67.32
4	Cluster IV	78.25	82.41	4.16	140.15	6.26	43.35	448.50	108.62	14.04	12.47	16.15	60.77
5	Cluster V	77.71	82.00	4.28	137.79	5.75	43.61	521.14	108.83	12.56	12.32	16.94	51.93
6	Cluster VI	67.72	73.33	5.50	140.25	6.26	48.35	375.81	105.16	14.80	12.74	19.46	79.32
7	Cluster VII	79.71	93.00	3.28	138.77	6.16	46.01	367.03	109.34	13.52	12.10	15.35	56.57
8	Cluster VIII	76.75	80.75	4.00	132.62	6.02	44.84	270.11	108.49	12.97	12.48	16.82	61.89

Table: 3 Average intra (bold) and inter cluster distances among eight clusters.

	I cluster	**2 cluster**	**3 cluster**	**4 cluster**	**5 cluster**	**6 cluster**	**7 cluster**	**8 cluster**
I cluster	**86.346**	292.809	181.124	190.514	120.915	377.035	412.050	809.924
2 cluster		**42.804**	633.208	700.996	419.342	1076.226	1171.038	1842.793
3 cluster			**62.850**	85.987	110.767	134.496	181.509	416.126
4 cluster				**37.926**	89.782	132.525	97.538	322.777
5 cluster					**41.395**	284.600	268.634	623.312
6 cluster						**72.690**	96.596	175.138
7 cluster							**38.219**	112.691
8 cluster								**25.409**

Table: 4 Contribution of Physiological, Grain yield and yield components towards genetic Divergence.

S.No	Source	Times ranked Ist	Contribution%
1	Days to 50% tasseling	144	12.24%
2	Days to 50% Silking	13	1.11%
3	Anthesis-Interval silking	0	0.00%
4	Plant Height (cm)	120	10.20%
5	Leaves above Ear	1	0.09%
6	Chlorophyll Content	34	2.89%
7	Flag Leaf area per plant (cm^2)	793	67.43%
8	Days to Physiological maturity	1	0.09%
9	Ear Length (cm)	7	0.60%
10	Ear Girth (cm)	6	0.51%
11	100 Seed Weight (g)	12	1.02%
12	Yield per plant (g)	45	3.83%.

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