Madras Agric. J., 87(1-3): 61 - 66 January - March 2000
https://doi.org/10.29321/MAJ.10.A00418

Effect of seed ageing on association between yield and its components in maize (Zea *mays L.)* hybrids

T. RAMANADANE, V. KRISHNASAMY, N. RAMAMOORTHI AND S. THIRUMENI
Tamil Nadu Agricultural University, Coimbatore - 641 003.

Abstract : Seed ageing is known to cause changes in vigour, viability and genetic status of crop plants. Two maize hybrids were subjected to accelerated ageing and a field trial was conducted. Observations on 15 quantitative characters were recorded. The results indicated that the phenotypic characters viz., plant height, number of leaves plant^{-1}, days to 50 per cent tasseling, days to 50 per cent cobing, plant weight at maturity, tassel length, cob weight, etc., get considerably altered in the ageing population. The ageing treatments also caused changes in the nature and degree of association between yield and its components. ***(Key Words** : Maize, Seed ageing, Correlation, Seed yield)*

Ageing of seed under storage results in increased frequencies of chromosomal aberrations and point mutations (Roberts, 1979; Purkar, 1980; Chauhan, 1982) and induces variability in all traits directly related to yield. It is well known that measures of correlation are important to the crop breeders as they serve as an aid in determining the association between any two characters and form the basis of selection index. Therefore, it is worthwhile to study the effect of seed ageing on the association between different quantitative characters in maize hybrids. The main objective of the present study was to determine the effectiveness of ageing treatments on the association (degree and nature of correlation) between yield and its components and the association among yield components.

Materials and Methods

Seeds of maize (*Zea mays* L.) hybrids HIM 123 and COH 2 were size graded with 19/64" round perforated metal sieve and subjected to accelerated ageing at 40°C and 100 per cent relative humidity (RH) for 6 to 18 days following method proposed by Delouche and Baskin (1973). A field experiment was conducted during 1993-95 at Tamil Nadu Agricultural University, Coimbatore with differentially aged seeds of both hybrids in five replications. Observations were recorded on five randomly selected plants per plot in each replication for 15 quantitative characters viz., plant height, number of leaves per plant, stem girth, days to 50 per cent tasseling, days to 50 per cent cobing, tassel length, style length, plant weight at maturity, harvest index, cob length, cob diameter, cob weight, number of rows per cob, number of seeds per row and grain yield per plant.

The data collected on different characters were subjected to statistical analysis and the estimates of inter component correlation (r) were calculated as per the method suggested by Goulden (1959).

Results and Discussion

The phenotypic correlation coefficients obtained from the control and differentially aged population of maize hybrids are given in tables 1 to 4.

The results of the present investigation showed that the relationship among the phenotypic characters get considerably altered in the ageing population. Among the total number of 105 combinations, the number of correlations found to be significant were 21 in control (non-aged), 28 in 6-day accelerated ageing, 16 in 12-day accelerated ageing and 6 in 18-day accelerated ageing treatments. The changes in association might be due to the gene as well as chromosomal mutation along with non-heritable physiological changes caused by ageing treatments. Similar results were reported by Purkar et al. (1979) in pea and wheat; Sarma (1975) in Groundnut and Mandal (1974) in gram.

Some of the alterations of correlation was also found in the ageing population. For instance highly significant positive correlation coefficient of 0.5753 observed in the control between plant hight and number of leaves changed to the value of -0.0639 and 0.0770 as a result of 6-day and 12- day accelerated ageing treatments respectively. Similarly highly significiant negative correlation coefficient of -0.4748 observed in the control between days to 50 percent tasseling and plant weight was changed to -0.3444 and -0.1406 as a result of 12 day and 18-day accelerated ageing treatments respectively. In control population, days to 50 percent tasseling and days to 50 percent cobing were negatively and significantly correlated with yield. The correlations become non-significant in 18-day accelerated ageing

Table 1. Phenotypic correlation among yield and its components in control (non-aged) population of maize hybrids

	Plant height	No. of leaves	Stem girth	Days to 50% tasse-ling	Days to 50% cobing	Tassel length	Style length	Plant Weight	Har-vest index	Cob length	Cob dia-meter	Cob weight	No. of rows cob^{-1}	No. of seeds row^{-1}	Seed yield $plant^{-1}$
Plant Height	1.0000	0.5753**	-0.1611	-0.1228	-0.2833	0.2708	0.1460	0.0649	-0.0393	0.1668	-0.0408	0.1639	-0.0399	0.2299	0.0256
No. of leaves		1.0000	0.1491	0.0459	-0.2354	0.1161	0.0237	-0.1885	-0.1311	-0.0356	0.0288	-0.1472	0.1728	0.0422	-0.1943
Stem girth			1.0000	-0.0596	0.0418	0.0715	-0.0759	0.0326	-0.0305	0.3235	0.3105	0.1194	-0.1409	0.0541	0.0057
Days to 50% tasseling				1.0000	0.5374**	-0.1817	0.0785	-0.4748**	-0.2004	-0.1390	-0.3131	-0.6107**	0.2022	-0.4028*	-0.4634*
Days to 50% cobing					1.0000	-0.3049	0.2941	-0.5729**	-0.1578	-0.1774	-0.1020	-0.6668**	0.1539	-0.2182	-0.5346
Tassel length						1.0000	-2.933	0.4807**	0.3019	0.4003*	0.0623	0.4320*	-0.0755	0.0183	0.5052
Style length							1.0000	-0.2972	0.0201	-0.2261	0.0476	-0.1858	0.1319	-0.1623	-0.2316
Plant weight								1.0000	0.2729	0.3346	0.1894	0.8146**	-0.1319	0.2909	0.9005**
Harvest index									1.0000	0.4008*	0.0628	0.4459*	0.0374	0.1286	0.6583**
Cob length										1.0000	0.1767	0.4211*	-0.0923	0.1002	0.4359*
Cob diameter											1.0000	0.2741	0.1497	0.1932	0.1665
Cob weight												1.0000	-0.1722	0.2539	0.8326**
No. of rows cob^{-1}													1.0000	-0.2562	-0.0908
No. of seeds row^{-1}														1.0000	0.2759*
Seed yield $plant^{-1}$															1.0000

* Significant at $p = 0.05$ ** Significant at $p = 0.01$

Table 2. Phenotypic correlation among yield and its components in 6-day accelerated ageing population of maize hybrids

	Plant height	No. of leaves	Stem girth	Days to 50% tasse-ling	Days to 50% cobing	Tassel length	Style length	Plant Weight	Har-vest index	Cob length	Cob dia-meter	Cob weight	No. of rows cob^{-1}	No. of seeds row^{-1}	Seed yield plant^{-1}
Plant Height	1.0000	-0.0639	0.0963	-0.0097	0.0400	0.2886	-0.0150	0.1477	0.0600	-0.0546	0.2786	0.2319	0.2536	0.0025	0.1339
No. of leaves		1.0000	-0.0813	-0.0084	-0.2726	0.2131	0.1123	0.3581	0.0283	0.0178	0.1333	0.3158	0.4171*	0.0205	0.2938
Stem girth			1.0000	-0.0270	0.2053	0.0146	-0.0127	0.0988	0.1674	-0.1073	0.2730	0.1299	-0.0548	0.3398	0.1718
Days to 50% tasseling				1.0000	0.4938**	-0.1688	0.1424	-0.5854**	-0.1304	-0.4187*	-0.2303	-0.5361**	-0.2848	-0.4738**	-0.4998**
Days to 50% cobing					1.0000	-0.3276	0.0253	0.5657**	-0.1850	-0.2529	-0.3000	-0.5619**	-0.2162	-0.4727**	0.5246**
Tassel length						1.0000	0.1776	0.4206*	-0.0026	0.0212	0.3921*	0.4563*	0.0654	0.1778	0.3040
Style length							1.0000	0.1415	0.1028	0.1219	0.1895	-0.0101	0.1377	0.1262	0.1691
Plant weight								1.0000	0.1479	0.1882	0.5066**	0.8832**	0.6254**	0.6465**	0.8298**
Harvest index									1.0000	-0.2404	0.3431	0.1983	-0.0295	0.2926	0.6726**
Cob length										1.0000	-0.0776	0.1774	0.2675	0.1389	-0.0073
Cob diameter											1.0000	0.5019**	0.1391	0.3921*	0.5658**
Cob weight												1.0000	0.5962**	0.6131**	0.7712**
No. of rows cob^{-1}													1.0000	0.2129	0.4487*
No. of seeds row^{-1}														1.0000	0.6487**
Seed yield plant^{-1}															1.0000

* Significant at p = 0.05   **Significant at p = 0.01

Table 3. Phenotypic correlation among yield and its components in 12-day accelerated ageing population of maize hybrids

	Plant height	No. of leaves	Stem girth	Days to 50% tasse-ling	Days to 50% cobing	Tassel length	Style length	Plant Weight	Har-vest index	Cob length	Cob dia-meter	Cob weight	No. of rows cob^{-1}	No. of seeds row^{-1}	Seed yield plant^{-1}
Plant Height	1.0000	0.0770	0.1289	-0.1690	-0.0828	0.1849	0.2715	0.3353	0.4591*	0.1501	0.1930	0.4668*	0.1382	0.2495	0.2710
No. of leaves		1.0000	0.0249	0.0386	-0.0333	0.2771	-0.2478	0.2350	-0.0410	-0.0361	-0.1437	0.2035	-0.0170	0.3059	0.1265
Stem girth			1.0000	-0.1175	0.1331	0.1723	0.4017	0.1451	0.5956**	-0.1252	0.0855	0.2796	0.1628	0.2646	0.3111
Days to 50% tasseling				1.0000	0.0041	0.1314	-0.0583	-0.3444	0.0394	0.4444*	0.0788	-0.3908*	0.1124	-0.1605	-0.1388
Days to 50% cobing					1.0000	-0.2398	0.1852	-0.5291**	-0.0166	-0.2127	-0.0551	-0.3571	-0.1083	-0.2560	-0.4507**
Tassel length						1.0000	0.1288	0.1161	0.2664	-0.0659	0.1460	0.3043	0.0712	0.2788	0.2445
Style length							1.0000	-0.0031	0.2026	0.1410	0.1925	0.0155	-0.0590	0.0193	-0.0105
Plant weight								1.0000	0.2132	0.1759	0.0935	0.7872**	0.0890	0.6122**	0.6104**
Harvest index									1.0000	0.1885	0.4534*	0.3496	0.3600	0.2323	0.4361*
Cob length										1.0000	0.4837**	-0.1027	0.2434	0.0777	0.0247
Cob diameter											1.0000	0.1834	0.2993	-0.0341	0.1390
Cob weight												1.0000	0.0602	0.5732**	0.6860**
No. of rows cob^{-1}													1.0000	-0.0175	0.1574
No. of seeds row^{-1}														1.0000	0.4587
Seed yield plant^{-1}															1.0000

* Significant at $p = 0.05$ ** Significant at $p = 0.01$

Table 4. Phenotypic correlation among yield and its components in 18-day accelerated ageing population of maize hybrids

	Plant height	No. of leaves	Stem girth	Days to 50% tasse-ling	Days to 50% cobing	Tassel length	Style length	Plant Weight	Har-vest index	Cob length	Cob dia-meter	Cob weight	No. of rows cob^{-1}	No. of seeds row^{-1}	Seed yield plant^{-1}
Plant Height	1.0000	0.4303*	0.0654	0.2647	-0.0484	0.3041	0.0160	0.2057	-0.0050	0.1742	0.0715	-0.1666	-0.1810	-0.1009	0.1719
No. of leaves		1.0000	0.2054	0.2073	0.0911	0.1925	0.1629	0.0954	0.0385	0.2751	0.1790	-0.0005	-0.1969	-0.3475	0.0319
Stem girth			1.0000	0.3601	0.0165	0.0843	-0.1490	0.0886	0.2868	0.1266	0.0367	0.0298	-0.2067	-0.1822	0.1488
Days to 50% tasseling				1.0000	0.0474	-0.0226	-0.2610	-0.1406	-0.0874	0.0655	0.0323	-0.0433	-0.1401	-0.2852	-0.2389
Days to 50% cobing					1.0000	-0.0657	-0.0191	-0.2817	-0.0765	-0.0431	-0.0385	-0.1888	0.0156	-0.1235	-0.2114
Tassel length						1.0000	0.0841	0.0965	0.2351	-0.1024	-0.1164	-0.0401	-0.1257	-0.2534	0.1599
Style length							1.0000	-0.0892	0.0470	-0.1144	0.1219	-0.0017	0.0936	0.1064	-0.0779
Plant weight								1.0000	-0.1087	0.1712	-0.2487	0.3757*	0.2010	0.2087	0.7699**
Harvest index									1.0000	-0.0955	0.2454	0.0520	-0.2613	-0.1582	0.4352
Cob length										1.0000	-0.0383	-0.0630	-0.0076	0.1230	0.1669
Cob diameter											1.0000	0.3699*	-0.0964	-0.0369	-0.0903
Cob weight												1.0000	0.3001	0.1216	0.3942
No. of rows cob^{-1}													1.0000	0.3786*	0.1269
No. of seeds row^{-1}														1.0000	0.1474
Seed yield plant^{-1}															1.0000

* Significant at $p = 0.05$ ** Significant at $p = 0.01$

treatments. The correlations between days to 50 per cent tasseling and plant weight, days to 50 per cent cobing and cob weight, tassel length and plant weight were significant in control population, which were changed to non-significant in 12-day and 18-day accelerated ageing treatments respectively.

It is concluded that the induced variation observed in association with different phenotypic characters and the alteration of degree and nature of correlation due to ageing treatments helps to improve crop varieties through selection in appropriate direction in its major components, provided, it is genetic in nature. The genetic nature can be confirmed only in later generations.

Reference

Chauhan, K.P.S. (1982). Studies on the impact of ageing on viability and cytogenetic behaviour of seeds of some crop plants. Ph.D. Thesis, Agrl. Univ. Agra (U.P.), India.

Delouche, U.C. and C.C. Baskin. (1973). Accelerated ageing techniques for predicting the relative storability of seed lots. *Seed Sci. Technol.* 427-452.

Goulden, C.H. (1959). Methods of Statistical Analysis. (2nd Ed.) John Willey & Sons, Inc., New York.

Mandal, N. (1974). Induction of variability for nutritional and agronomic characters in bengal gram. Ph.D. Thesis, IARI, New Delhi.

Purkar, J.K. (1980). Genetical changes in relation to seed ageing under tropical storage conditions. Ph. D. Thesis, IARI, New Delhi.

Purkar, J.K., R.B. Mehra and S.K. Banerjee. (1979). Effect of seed ageing on association between the quantitative characters. *Seed Res.*, 7: 197-213.

Roberts, E.H. (1979). Seed deterioration and loss of viability. *Adv. Seed Res. Technol.*, 4:25-34.

Sarma, V.S. (1975). Studies on induced mutagenesis in cultivated varieties of groundnut with special reference to the improvement of oil content and yield. Ph.D. Thesis, IARI, New Delhi.

(Received : December 1998 ; Revised : August 2000)

Madras Agric. J., 87(1-3): 66 - 70 January - March 2000

Biochemical factors for multiple resistance to foliar diseases of sorghum

I.K. KALAPPANAVAR AND R.V. HIREMATH
Department of Plant Pathology, MRS, UAS, Dharwad - 580 005.

Abstract : Overall the multiple resistant genotypes recorded higher amount of sugars, phenols, O-dihydroxy phenols, proteins and amino acids as compared to genotypes susceptible to sooty stripe, zonate leaf spot, anthracnose and rust diseases. The amount of total sugars decreased significantly with the age of the plants whereas, amount of phenols and O-dihydroxy phenols increased significantly. However, uniform trend was not observed for soluble proteins and amino acid content did not vary with stage of the crop growth. The study revealed that higher sugars, phenols, O-dihydroxy phenols, soluble proteins and amino acids are some of the possible reasons for multiple resistance to foliar diseases in sorghum. ***(Key Words: Sorghum, Biochemical, Disease, Resistance)***

It is well known that the disease resistance mechanism is a complex phenomenon and in response to invasion by a disease causing organism, plant produces various kinds of reactions. In recent years, it is becoming increasingly evident that several natural and induced defence mechanisms operate in host plants against different diseases. One such defence mechanism is the presence of certain biochemical compounds inhibitory to the pathogen (Prabhu *et al.,* 1984; Sing and Chand, 1982). During these processes considerable changes take place in biochemical and physiological aspects like changes in the concentrations of phenols (Prabhu *et al.,* 1984), orthodihydroxy phenols, carbohydrates, amino acids, proteins (Sharma and Sharma, 1994) in plant tissues and at the same time activities of various enzymes are also modified. Therefore, analysis of biochemicals in selected resistant and