General and Specific Combining Ability for Seed Quality Traits in some Nigeria Hybrid Maize

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Abstract: Lack of access to high quality seeds is a major factor contributing to the worsening of food security situation in Africa. High seed quality is essential for optimum stand establishment in maize; and it is therefore necessary to have seed vigour tests that permit rapid, objective and accurate evaluation of seed quality**.** This study was conducted to determine combining abilities of seed qualities in some Nigeria hybrid maize using Diallel procedure. Fifty-five different genotypes generated from half diallel crosses made among ten tropical inbred maize (Striga resistance and Early matured inbred germplasm) developed at International Institute for Tropical Agriculture (IITA) were evaluated for seed quality traits such as days to germination, percentage germination, seed dry weight, seedling length, initial seed quality and seed half-life**,** Results from diallel analysis indicated that the mean squares for GCA and SCA were highly significant for all seed quality attributes studied except days to germination. Estimate of GCA showed that parents 3(TZSTR 137), 5(TZEI 11), and 7(TZEI 15) recorded high values for nearly all the characters studied. Likewise, estimate of SCA identified Genotype 18 (2x9) as the best specific combiners for nearly all the characters studied. This study concluded that two best performing parents can combine and produce high quality hybrid maize.

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Introduction

One of the major problems facing maize producers in tropical rain forest zone of Nigeria is the unavailability of high quality seeds of improved maize cultivars and hybrids for crop production. (Oloyede, 2013). Most farmers have shown increased interests in acquiring high quality seeds of hybrid varieties of maize (Daniel *et al.,* 2006); which was the background for this research work. Several reports had shown that seed quality is a trait that can be genetically manipulated through controlled hybridization. Thus this work focused on investigating seed quality of parental inbred populations and their hybrid progenies available in Nigeria. Genetic manipulation to improve seed physiology will create opportunities for producing hybrid seeds with high vigour. High seed vigour in return means enhanced stand establishment and ultimately high crop productivity. (Oloyede, 2013)

Germination is a component of seed quality (Ellis, 1992). It occurs when a viable seed takes up water to induce respiration, protein synthesis and other catalyzing metabolic reactions needed for germination and seedling growth (Adebisi, 1999). Viability is usually highest at the time of physiological maturity, although environmental conditions on the parent plants may not permit germination. Several tests exist for determining seed viability, these include germination and tetrazolium test (AOSA, 1970) and other useful tests like conductivity tests, excised embryo tests, x-ray tests and free fatty acid test (Copeland, 1976). Germination test is the most commonly used method to determine seed viability. It has become so universally accepted that seed germination and seed viability are usually considered to be the same.

Materials and Methods

Fifty five different genotypes (Table 1) generated from half diallel crosses made among ten tropical inbred maize (Striga resistance and Early matured inbred germplasm) developed at International Institute for Training Agriculture (IITA) were used for this study. The inbred lines were TZMSTR 139 (P1), TZMSTR 146 (P2), TZMSTR 147(P3), TZMSTR 148 (P4), TZEI 11(P5), TZE 13(P6), TZEI 15(P7), TZEI 16(P8), TZEI 3(P9), TZEI 25(P10). Other materials used include germination pots, Petri-dishes, incubator and sensitive weighing balance.

Standard Germination Test: one hundred seeds per replicate were placed in sand pots in three replications. Germination counts were recorded on the third day and seventh days after sowing (DAS). The final counts of germination were recorded on the 7th day according to International Seed Testing Association (ISTA, 1985) rules, and number of sprouted seedlings was expressed as percentage germination. Seedling were also evaluated for dry weight, seedling length, initial seed quality and seed half-life.

Table 1. List of F_1 hybrids with their pedigree (parents involved in each cross)

Genotypes	Crossing code (Hybrid tag)	Pedigree (parents involved in a cross)
1	1 x 1	TZSTR 139 x TZSTR 139
2	1 x 2	TZSTR 139 x TZSTR 146
3	1 x 3	TZSTR 139 x TZSTR 147
4	1 x 4	TZSTR 139 x TZSTR 148
5	1 x 5	TZSTR 139 x TZEI 11
6	1 x 6	TZSTR 139 x TZEI 13
7	1 x 7	TZSTR 139 x TZEI 15
8	1 x 8	TZSTR 139 x TZEI 16
9	1 x 9	TZSTR 139 x TZEI 3
10	1 x10	TZSTR 139 x TZEI 25
11	2 x2	TZSTR 146 x TZSTR 146
12	2 x 3	TZSTR 146 x TZSTR 147
13	2 x 4	TZSRT 146 x TZSTR 148
14	2 x 5	TZSTR 146 x TZEI 11
15	2 x 6	TZSTR 146 x TZEI 13
16	2 x 7	TZSRT 146 x TZEI 15
17	2 x 8	TZSTR 146 x TZEI 16
18	2 x 9	TZSTR 146 x TZEI 3
19	2 x 10	TZSRT 146 x TZEI 25
20	3 x 3	TZSTR 147 x TZSTR 147
21	3 x4	TZSTR 147 x TZSTR 148
22	3 x 5	TZSTR 147 x TZEI 11
23	3 x 6	TZSTR 147 x TZEI 13
24	3 x 7	TZSTR 147 x TZEI 15
25	3 x 8	TZSTR 147 x TZEI 1
26	3 x 9	TZSTR 147 x TZEI 3
27	3 x 10	TZSTR 147 x TZEI 25
28	4 x 4	TZSTR 148 x TZSTR148
29	4 x 5	TZSTR 148 x TZEI 11
30	4 x 6	TZSTR 148 x TZEI 13
31	4 x 7	TZSTR 148 x TZEI 15
32	4 x 8	TZSTR 148 x TZEI 16
33	4 x 9	TZSTR 148 x TZEI 3
34	4 x 10	TZSTR 148 x TZEI 25
35	5 x 5	TZEI 11 x TZEI 11
36	5 x 6	TZEI 11 x TZEI13
37	5 x 7	TZEI 11 x TZEI 15
38	5 x 8	TZEI 11 x TZEI 16
39	5 x 9	TZEI 11 x TZEI 3
40	5 x 10	TZEI 11 x TZEI 25
41	6 x 6	TZEI 13 x TZEI 13
42	6 x 7	TZEI 13 x TZEI 15
43	6 x 8	TZEI 13 x TZEI 16
44	6 x 9	TZEI 13 x TZEI 3
45	6 x 10	TZEI 13 x TZEI 25
46	7 x 7	TZEI 15 x TZEI 15
47	7 x 8	TZEI 15 x TZEI 16
48	7 x 9	TZEI 15 x TZEI 3
49	7 x 10	TZEI 15 x TZEI 25
50	8 x 8	TZEI 16 x TZEI 16
51	8 x 9	TZEI 16 x TZEI 3
52	8 x 10	TZEI 16 x TZEI 25
53	9 x 9	TZEI 3 x TZEI 3
54	9 x 10	TZEI 3 x TZEI 25
55	10 x 10	TZEI 25 x TZEI 25

Statistical analysis: A genetic linear model for Griffing's diallel model 1 method 11 was used to obtain estimate of general (GCA) and specific (SCA) combining abilities, and the interaction between both GCA & SCA and. Griffing's (1956) linear model is as follows:

$$X_{ijk} = U + B_k + g_{i\,+}\,g_j + S_{ij} + r_{ij} + E_{ijk}$$

Where

X_{ijk} = observed value, U = population mean, B_k = block effect, g_i = general combining ability (GCA) for i^{th} parent, g_j = general combing ability for j^{th} parent, S_{ij} = specific combining ability (SCA) for ixj^{th} crosses, r_{ij} = reciprocal effect for ixj^{th} crosses and E_{ijk} = residual.

Genetic parameters for the estimation of gene effects in the parents and F_1 population of the diallel cross were also obtained according to the method of Hayman (1954) using the DIAL statistical package of Ukai (1998). Mean square from the analysis of variance showing the effect of additive and dominance components was obtained according to Walter and Molton (1978).

Heterotic parterns of seed quality traits were examined by estimating the Mid-parent Heterosis (MPH) for each character Relative MPH was estimated using the formula:

$$\%MPH = MF_1 – MP / MP \text{ X } 100$$

Where MP = Mean of parents, MF_1 = Mean of crosses.

Results and Discussion

Mean squares for general combining ability (GCA) and specific combining ability (SCA) for seed quality characters is presented in Table 2. The mean squares due to GCA were highly significant ($p < 0.01$) for percentage seed germination, seed half life (P_{50}), seedling length and seed dry weight, while non-significant GCA was recorded for only days to germination. The mean squares for SCA (Table 2) among the hybrids were highly significant ($P < 0.01$) for all the characters studied except in days to germination which recorded non-significant SCA effects.

Table 2. Mean squares for general and specific combing abilities among F_1 hybrids for seed quality performance

	Df	Percentage Germination	*P50* Seed Half Life	Seedling Length	Seed dry weight	K_I (initial seed quality)	Days to Germination
Replicate	2	2.16	206.89	99	20.42*	0.02	2.73
GCA	9	4.13**	1172.16**	334.34**	90.42**	0.02**	3.92
SCA	35	0.54**	88.67**	88.02	29.91**	0.00**	4.12
Error	88	0.24	44.12	64.51	2.76	0.00	4.25
Total	134						

Estimates of GCA and SCA effects for seed quality traits in parental lines and their F_1 hybrids were presented in Tables 3 to 8. Table 3 showed that parent 2 (TZSTR 146) recorded positive GCA (0.96) while parent 3 (TZSTR 147), parent 6(TZEI 13 and parent 8 (TZEI 16) recorded lowest GCA values of -0.04, -0.08 and -0.08 respectively for days to germination. The GCA effect for percentage seed germination indicated that parent 5 (TZEI 11) had the highest positive GCA value of 7.48, followed by parent 3 (TZSTR 147), and parent 7 (TZEI 15) which recorded 4.86, and 4.77 respectively, while parent 10 (TZEI 25) had the least GCA value of 0.07 (Table 4).

Table 5 showed that parent 1 (TZSTR 139) had highest GCA value of 8.56 for seed half life while the least (-0.41) was recorded in parent 9 (TZEI 3). Table 6 showed that estimate of GCA for seed dry weight ranges between -0.02 to 0.01 in parent 1 (TZSRT 139), parent 2 (TZSTR 146), parent 3 (TZSTR 147), parent 4 (TZSTR 148), parent 5 (TZEI 11), parent 9 (TZEI 3) and parent 10 (TZEI 25). Parent 7 (TZEI 15) had the highest positive value (3.16) while parent 9 (TZEI 3) recorded the least value (0.218) for seedling length as shown in Table 7. While table 8 showed that GCA value for initial seed quality (K_i) was highest (0.83) in parent 7 (TZEI 15) and least (-0.01) in parent 5 (TZEI 11).

Tables 3 to 8 also showed the estimate of Specific Combining Ability of half diallel crosses for seed quality traits among 10 inbred maize cultivars and their F_1 hybrids. Table 3 showed that days to germination was highest in genotype 3 (1 x 3) and genotype 54 (hybrid 9 x 10) with SCA value of 1.01 respectively and lowest in Genotypes17 (hybrid 2 x 8) with SCA value of -0.01. The SCA effects for percentage seed germination (Table 4) was highest in Genotype 18 (hybrid 2 x 9) with SCA value of 14.05, followed by genotype 52 (8 x 10) with SCA value of 11.47 and lowest in genotype 36 (hybrid 5 x 6) with SCA value of -0.12.

Estimate of SCA effects was highest and positive in Genotype 18 (2 x9) with SCA value of 19.43, followed by Genotype 8 (1 x 8) with SCA value of 10.60 and lowest but negative value of -0.19 in Genotype 10 (1 x 10) for seed half life (Table 5). Table 6 showed that the hybrids had relatively similar values of SCA ranges between -0.01 to 0.11 for seed dry weight. The SCA value from table 7 showed that the highest values for seedling length were recorded in Genotype 9 (1x 9) with SCA value of 5.58, Genotype 10 (hybrid 1 x 10) with SCA value of 4.62, Genotype 22 (3 x 5) with SCA value of 4.44 and Genotype 8 (1 x 8) with SCA value of 4.29, while the lowest value was recorded in Genotype 48 (7 x 9) with SCA value of 0.00. The highest and positive value of SCA for the initial seed quality (*Ki*) was recorded in Genotype 18 (2 x 9) with SCA value of 6.28 while the least value was recorded in Genotype 51(8 x 9) with SCA value of (0.02), as shown in Table 8.

Table 9 showed the estimate of degree of dominance effects for seed quality traits among F_1 hybrid. This table showed that all the F_1 hybrids had positive dominance for percentage seed germination which indicated that the gene for high germination percentage is highly dominant over the gene of the parent with lower percentage seed germination and the case was almost the same for the initial seed quality (*k*i), in contrast, over 60% of the crosses for all other traits recorded negative values which indicated that the F_1 hybrids for these traits performed towards the poorer parents.

Table 3. Estimates of GCA (on diagonal) & SCA (off diagonal) for days to germination among parental lines and F_1 hybrids

	1	2	3	4	5	6	7	8	9	10
1	0.25	-0.32	1.01	0.18	-0.28	0.06	-0.11	-0.61	0.22	-0.15
2		0.96	0.31	0.14	0.68	-0.65	0.18	-0.01	-0.15	-0.19
3			-0.04	0.14	-0.32	-0.32	-0.15	-0.32	-0.15	-0.19
4				-0.54	0.18	0.18	0.01	-0.15	-0.32	-0.36
5					-0.42	0.06	0.56	-0.28	-0.44	-0.15
6						-0.08	0.22	0.39	-0.11	0.18
7							0.22	0.22	-0.28	-0.65
8								-0.08	0.22	0.51
9									0.08	1.01
10										0.12

Table 4. Estimates of GCA (on diagonal) & SCA (off diagonal) for percentage seed germination among parental lines and F_1 hybrids

	1	2	3	4	5	6	7	8	9	10
1	-11.81	-1.99	-11.9	-1.87	-2.95	2.51	-0.24	5.01	1.05	0.47
2		-5.48	-1.99	8.47	0.72	1.18	3.43	-2.99	14.25	-1.87
3			4.86	8.13	0.38	0.84	-0.24	-3.22	3.38	7.8
4				-0.27	5.51	-0.7	1.55	-3.2	-14.16	-3.74
5					7.48	-0.12	-2.53	-4.28	8.00	-1.82
6				¤		2.02	-14.07	-0.49	3.55	7.3
7							4.77	-3.24	7.47	7.88
8								1.19	1.05	11.47
9									-2.85	-24.49
10										0.07

Table 5. Estimates of GCA (on diagonal) & SCA (off diagonal) for seed half-life parental lines and F_1 hybrids

	1	2	3	4	5	6	7	8	9	10
1	8.56	-5.00	-6.85	-6.22	-8.44	-7.56	3.17	10.6	0.87	-0.19
2		-1.1	3.11	2.25	2.81	3.42	-2.54	-1.2	19.43	-2.64
3			-3.23	3.05	2.44	-0.33	-2.61	-3.71	8.24	-3.32
4				-2.31	0.82	1.06	2.15	-1.3	0.66	-2.46
5					-1.86	1.84	1.14	1.29	0.21	-2.12
6						-2.18	-1.12	2.43	1.21	-0.94
7							2.01	-0.3	-3.13	3.24
8								1.1	-2.26	-5.56
9									-0.41	-5.62
10										2.43

Table 6. Estimate of GCA (on diagonal) & SCA (off diagonal) for seed dry weight among parental lines and F_1 hybrids

	1	2	3	4	5	6	7	8	9	10
1	-0.02	-0.01	0.01	0.01	-0.03	0.02	0.00	-0.02	0.01	0.01
2		0.01	-0.02	0	0.02	-0.01	0.02	0.01	-0.01	0.02
3			0.01	0.01	-0.03	0.01	0.00	-0.01	0	0.02
4				-0.01	-0.02	-0.01	0.01	-0.01	0.01	0.00
5					0.02	-0.03	0.00	0.11	0.01	-0.03
6						-0.01	0.00	-0.02	0.01	0.02
7							0.00	-0.02	0	-0.01
8								0.01	-0.01	0.02
9									-0.02	0.00
10										-0.01

Table 7. Estimate of GCA (on diagonal) & SCA (off diagonal) for seedling length among parental lines and F_1 hybrids

	1	2	3	4	5	6	7	8	9	10
1	-0.43	-2.41	-1.79	-3.9	-3.96	-0.8	1.37	4.29	5.58	4.62
2		-4.43	-1.65	0.29	2.04	2.21	-1.62	0.96	-3.42	3.63
3			-1.48	-2.34	4.44	0.93	2.09	-3.32	2.3	2.34
4				0.6	-1.99	2.52	0.68	2.27	3.56	-1.07
5					0.49	-0.38	0.79	-3.96	2.66	0.37
6						0.32	-0.71	-0.13	-2.5	-1.13
7							3.16	-0.3	0	-2.3
8								0.91	-0.75	0.95
9									0.28	-7.42
10										0.57

Table 8. Estimate of GCA (on diagonal) & SCA (off diagonal) for intercept (K_i) among parental lines and F_1 hybrids

	1	2	3	4	5	6	7	8	9	10
1	-0.19	-0.03	0.23	0.06	0.2	-0.61	-0.66	0.22	0.16	0.31
2		-0.29	0.17	0.19	0.53	-0.58	-0.79	0.04	6.28	0.20
3			-0.32	0.7	0.29	-0.86	-1.1	0.24	0.13	0.20
4				-0.11	0.07	-0.7	-0.97	0.55	0.4	-0.3
5					-0.01	-1.44	-0.72	0.16	0.57	0.04
6						0.65	5.99	-0.87	-0.7	-0.63
7							0.83	-0.61	-0.96	-0.18
8								-0.24	0.02	0.26
9									-0.18	0.1
10										-0.14

Table 9. Estimate of dominance effect of seed quality trait among F_1 hybrids maize cultivars

F_1 hybrids	Days to Germination	Percentage Germination	Half Life (P_{50})	Seedling Length	Seed Dry weight	Intercept {*Ki*}	F_1 hybrids	Days to Germination	Percentage Germination	Half Life (P_{50})	Seedling Length	Seed Dry weight	Intercept {*Ki*}
1 x 2	0.83	0.14	1.4	-0.80	-0.36	-0.98	**3 x 10**	0.00	2.75	-0.64	1.39	0.50	11.21
1 x 3	0.50	0.42	2.51	-0.75	0.00	0.90	**4 x 5**	-0.50	1.50	0.71	-0.37	0.40	3.40
1 x 4	-1.5	0.29	-0.33	-0.23	-0.50	1.56	**4 x 6**	-1.50	0.33	-0.5	1.50	0.93	5.24
1 x 5	-0.25	0.26	-0.02	0.11	-0.50	0.00	**4 x 7**	-2.00	0.00	-0.41	5.00	3.00	0.17
1 x 6	0.00	0.26	2.70	0.09	0.06	2.30	**4 x 8**	0.00	2.00	-0.55	4.00	1.50	0.87
1 x 7	-2.50	0.50	3.81	1.02	-0.25	1.02	**4 x 9**	-1.50	0.07	-0.32	1.50	0.67	3.88
1 x 8	-2.50	0.68	7.45	1.13	0.00	-0.12	**4 x 10**	-1.50	0.64	-0.66	0.28	0.50	-0.56
1 x 9	-0.50	4.25	4.92	2.22	0.00	1.02	**5 x 6**	0.00	0.00	-0.23	-0.05	-0.77	-0.38
1 x 10	-1.00	3.33	5.75	9.25	0.50	2.20	**5 x 7**	0.10	1.20	0.60	2.33	-0.13	1.56
2 x 3	0.50	2.19	-1.19	-5.79	-0.50	0.79	**5 x 8**	-0.50	0.63	0.25	-1.17	1.15	0.18
2 x 4	1.00	2.26	-0.57	-2.50	0.50	37.5	**5 x 9**	-0.50	0.80	0.13	14.5	-0.07	3.20
2 x 5	5.50	0.50	-0.71	-1.17	0.17	5.71	**5 x 10**	0.33	0.50	-1.29	1.30	-0.33	1.75
2 x 6	1.50	0.18	0.06	-1.13	-1.00	4.74	**6 x 7**	0.50	-0.50	0.17	0.70	-0.3	20.34
2 x 7	0.50	2.26	-1.53	-3.17	3.83	0.13	**6 x 8**	0.50	0.50	-1.77	-0.30	-0.17	-0.39
2 x 8	1.50	1.93	-2.20	-2.83	1.93	-0.56	**6 x 9**	-0.50	0.50	1.01	0.58	-0.04	3.40
2 x 9	0.30	0.82	0.05	-0.50	0.50	2.15	**6 x 10**	-0.25	0.70	0.10	0.12	0.19	17.5
2 x 10	0.30	0.82	-1.04	0.50	1.05	3.25	**7 x 8**	-1.00	3.50	3.32	0.00	1.00	0.25
3 x 4	-1.17	2.50	-0.46	0.50	0.50	11.97	**7 x 9**	-1.50	1.21	0.32	0.00	1.00	0.25
3 x 5	0.50	1.00	-0.32	28.62	0.60	2.32	**7 x 10**	-5.50	1.00	0.46	0.36	1.00	-0.15
3 x 6	-0.75	0.75	97.21	-0.20	-1.50	0.00	**8 x 9**	-0.50	1.00	0.46	0.36	1.00	-0.15
3 x 7	-1.50	2.17	-0.61	1.88	0.67	-0.69	**8 x 10**	-0.17	1.67	-0.78	0.81	0.50	0.20
3 x 8	-1.17	2.50	-1.60	0.19	0.50	-0.14	**9 x 10**	0.00	0.00	-0.05	-1.17	0.00	4.50
3 x 9	0.00	2.20	2.51	15.5	0.14	1.85							

Estimate of genetic parameters (dominance and additive effects) were presented in Table 10. High estimate of dominance variance was recorded in percentage seed germination (83.73) while the least dominance variance (0.001) was recorded in seed dry weight. High estimate of additive variance (544.05) was recorded in percentage seed germination with additive variance of 330.5 and 279.73, while the lowest additive variance was recorded in seed dry weight (0.002). The whole Environmental Variance (E) was highest (30.65) in initial seed quality (K_I) and least (0.078) in days to germination.

Estimate of heritability in broad sense (h^2b) was highest in seedling length (0.97), while the least broad sense heritability (0.32). was recorded in initial seed quality (K_i). The high estimate of heritability in narrow sense (0.42) was recorded in days to germination, followed by percentage seed germination (0.41) and seed dry weight (0.41) while the least narrow sense heritability value (0.04) was recorded in initial seed quality (k_i) Table 10.

The mid–parent heterosis (mp) for seed quality traits are presented in Table 11. The table showed that most F_1 hybrids exhibited heterosis lower than 10% in days to germination (2.78%), seed dry weight (0.07%), initial seed quality (0.76%) and seed half life (9.26%), while some hybrids exhibited very high heterosis (87.27%) in percentage seed germination, the overall heterosis over the mid-parent was highest (51.32%) in initial seed quality (k_i) and percentage seed germination (20.71). Most hybrids showed negative overall heterosis for days to germination (-13.13%) which is a favourable phenomenon indicating that the F_1 hybrids flowered earlier than their parents especially in genotypes 18 and 25.

Table 10. Estimate of Genetic Parameters (Dominance and additive effects) for seed quality traits evaluated among 55 F_i hybrids

Genetic parameters	Days to germination	Percentage germination	Seed Half life (P_{50}}	Seedling Length	Seed dry weight	*Ki* Initial seed quality
Dominance variance	0.45	83.73	47.86	6.08	0.00	1.22
Additive variance	1.62	330.55	176.83	45.20	0.00	1.40
E (Whole environmental variance)	0.08	0.91	0.69	0.92	0.88	30.65
H^2_B (Broad sense heritability)	0.85	0.88	0.65	0.97	0.86	0.32
H^2_N (Narrow sense heritability)	0.42	0.41	0.24	0.36	0.41	0.04

Table 11. Estimate of heterotic pattern in F_1 hybrid of half diallel cross of seed quality characters in maize (*Zea mays* L.)

	Days to Germination	**Percentage Germination**	**Half Life (P_{50})**	**Seedling Length**	**Seed dry weight**	**Initial seed quality (K_i)**	**Sigma**
Mean of parent (mp)	3.20	72.30	9.44	11.64	0.06	0.37	24.43
Mean of F_1 (M_{f1})	2.78	87.27	9.26	12.76	0.07	0.76	16.71
Overall percentage heterosis	-13.13	20.71	-2.28	8.78	4.52	51.32	46.20

Conclusion

In seed production, parental genotypes that produce progenies with better quality characters are needed as parent stocks for the development of improved varieties. Breeders also want to improve seed quality traits while keeping the genetic merit of yield traits. Therefore, understanding the genetic relationship between seed quality traits and plant yield traits is of serious importance. This study intended to determine the general (GCA) and Specific (SCA) combining abilities for seed qualities in maize genotypes. The results demonstrated the importance of diallel and Probit analysis in detecting the relationship between the initial quality of seed (k_i), and seed storage life (P_{50}) and concluded that the higher the quality of seed before storage the longer the expected seed storage life.

References

1. Adebisi, M.A. 1999. Effect of Chemical Seed Treatment on Viability and Vigour in Soybean Cultivars. *M. Agric. Thesis*. University of Agriculture, Abeokuta, Nigeria. 101pp.
2. Adebisi, M. A. 2004. Variation, Stability and Correlation Studies in Seed Quality and Yield Component of Sesame *Sesamum indicum* L.

Ph.D. Thesis, University of Agriculture, Abeokuta, Nigeria. 122p.

3. Adegbuyi, E.1990. Seed certification and quality control. National Seed Service, Federal Department of Agriculture, Ibadan, Nigeria 10pp.
4. Aremu, C. O. 2005. Diversity, selection and genotype - environment interaction in cowpea (*Vigina unguiculata* L walp) Ph.D. thesis University of agric Abeokuta, Nigeria 125pp.
5. Association of Official Seed Analyst (AOSA). 1970. Tetrazolium Test. Handbook for Agricultural seeds, No. 29.
6. Copeland, L.O. 1976. Principles of Seed Science and Technology. Burgess Publishing Company. Minneapolis. Minnesota. Pp369.
7. Ellis, R. H. 1992. Seed and seedling vigour in relation to crop plant growth and yield. *Agronomy Journal* 32: 249-255.
8. Griffing, B. 1956. Concept of general and specific combing abilities in relation to diallel crossing system. *Austr. Journal of Bio. Sci.* 9: 463-493.
9. Hayman, B. I. 1954. The theory and analysis of diallel crosses *Genetics* 39:789-809.
10. International Seed Testing Association (ISTA) 1985. International rules for seed testing. *Seed Science and Technology*, 13, 307-513.
11. Ukai, Y. 1998. DIAL, a new 20 version of half diallel statistical package, JPn. j. *Breeding* 39:107-109.
12. Walters, J. E. and Morton, J. R. 1978. On the analysis of variance of a half diallel table. *Biometrics 34:91-94.*

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