Genetic Analysis of Grain Yield and Quality Traits in Sorghum (*Sorghum bicolor* L. Moench) Varieties.

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Introduction

Sorghum is one of the world's major cereal crops and a dietary staple for more than 500 million people in sub-Saharan Africa and Asia (Alina et al., 2017). Numerous studies have demonstrated that sorghum is a very diverse crop, with cultivated sorghums exhibiting great phenotypic variability. Assessment of the genetic variability for yield and quality characters is a key component of breeding programs for broadening the gene pool of crops, in characterization of germplasm collections and for the choice of parental genotypes. A study was conducted to estimate genetic variability and broad-sense heritability in some bold grained sorghum varieties.

Materials and Methods

Twenty-five sorghum varieties, plus two checks, were evaluated using a randomized complete block design (RCBD) with two replications at Bayero University, Kano (BUK), Gambawa and Dadin-Kowa in Nigeria in 2018. Data collected on grain yield related traits and quality traits were analyzed using statistical software package (SAS).

Results and Discussions

In the combined ANOVA, the genotype mean squares were significant ($p < 0.05$) for all measured traits except 100 seed weight. In contrast, genotype x environment interaction was highly significant for only grain yield, panicle weight, Fe and Zn content. The mean grain yield of the genotypes ranged from 854 kg ha^{-1} for NRL-1 to 2415kg ha^{-1} for KL-1 with an average of 1449 kg ha^{-1}. The highest performing genotype KL-1, had a high Fe (49.7 mg kg^{-1}) and Zn (31.4 mg kg^{-1}) content, while the genotype NRL-3, with the highest Fe (62.4 mg kg^{-1}) and Zn (37.4 mg kg^{-1}) content performed poorly in terms of grain yield (Table 1). The phenotypic coefficient of variations were generally higher than the genotypic coefficients of variation. The highest broad sense heritability estimates were observed for days to 50% heading and flowering date (94.1%), while the least was observed for 100 seed weight (14.9%) (Table 2).

Table 1. Means of grain yield, yield related traits and quality traits of sorghum varieties evaluated at Bayero University Kano (BUK), Gambawa and Dadin-Kowa in Nigeria

ENTRY	Heading date (Julian days)	Flowering date (Julian days)	Plant height (cm)	100 seed weight (g)	Panicle weight (kg)	Grain yield (kg/ha)	Fe (mg kg^{-1})	Zn (mg kg^{-1})
IS23509	265	266	226	2.4	1884	1437	47.1	28.6
ZSV3	255	258	294	2.3	2098	1601	33.5	29.5
KL-1	281	285	390	3.0	3115	2415	49.7	31.4
Fara kano	280	284	393	3.1	2386	1943	41.7	31.7
Dalwanda	279	282	357	2.9	2114	1738	37.7	29.4
Yala fara fara	288	292	376	2.7	1730	1351	56.3	32.4
Fara 2 Bauchi	290	293	362	2.5	1628	1090	50.9	34.7
Kaura Borno	279	283	313	2.7	2446	1952	61.9	30.2
K/Maigundum	278	282	355	2.6	2050	1525	56.9	34.8
NRL-3	286	289	281	2.6	1391	977	62.4	37.4
KL-2	259	262	279	2.9	2627	2161	35.4	28.5
SAMSORG 44	278	283	236	2.7	2377	1683	54.6	35.7
IESV92076 DL	253	257	231	2.5	1637	1099	59.3	29.3
M 36121	255	259	189	2.8	1201	925	40.5	27.0
IESV90270 DL	270	273	271	2.2	2319	1879	54.9	25.8
IESV91012 DL	254	258	141	2.1	1790	1679	48.1	25.2
IESV92011 DL	262	266	282	2.5	1980	1439	58.9	28.3
IESV92147 DL	269	273	299	2.4	1948	1437	62.2	30.9
NRL-1	282	286	245	2.9	1095	854	47.8	33.2
Yar Washa	255	258	287	2.5	1104	889	44.9	32.7
K/Mtama 1	258	261	240	2.5	1818	1248	42.4	23.4
IS 15127	265	269	336	2.6	1292	1011	54.2	30.4
IESV92004 DL	256	260	289	2.6	1750	1356	42.6	27.2
PATO	266	269	286	2.8	1847	1418	50.5	36.3
SV4	256	259	177	2.1	1462	1111	38.5	23.9
Mean	269	272	285	2.6	1884	1449	49	30
LSD	7.3	7.0	48.7	0.7	614.7	516.9	3.1	0.2
C.V	2	2	14	22	28	31	5	1

σ^2_e = error variance, σ^2_{ph} = phenotypic variance; σ^2_g = genetic variance; GCV = Genotypic coefficient of variation; PCV = phenotypic coefficient of variation; H2= broad-sense heritability; S.E= standard error.

Table 2: Component of variance and broad-sense heritability estimates of grain yield, yield related traits and quality traits of sorghum varieties evaluated at Bayero University Kano (BUK), Gambawa and Dadin-Kowa in Nigeria

Trait	σ^2_e	σ^2_g	σ^2_{ph}	GCV (%)	PCV (%)	H^2 (%)
Heading date (Julian days)	8.80	140.7	149.5	4.4	4.6	94.1
Flowering date (Julian days)	9.00	145.2	154.2	4.4	4.6	94.1
Plant height (cm)	357.4	4039.9	4397.3	22.3	23.3	91.8
100 seed weight (g)	0.06	0.01	0.07	4.1	10.5	14.9
Panicle weight (kg)	192874	99657	292531	16.8	28.7	34.1
Grain yield (kg ha^{-1})	128329	75158	203487	18.9	31.1	36.9
Fe (mg kg^{-1})	52.4	40.9	93.3	13.0	19.6	43.9
Zn (mg kg^{-1})	15.7	3.9	19.6	6.5	14.6	19.7

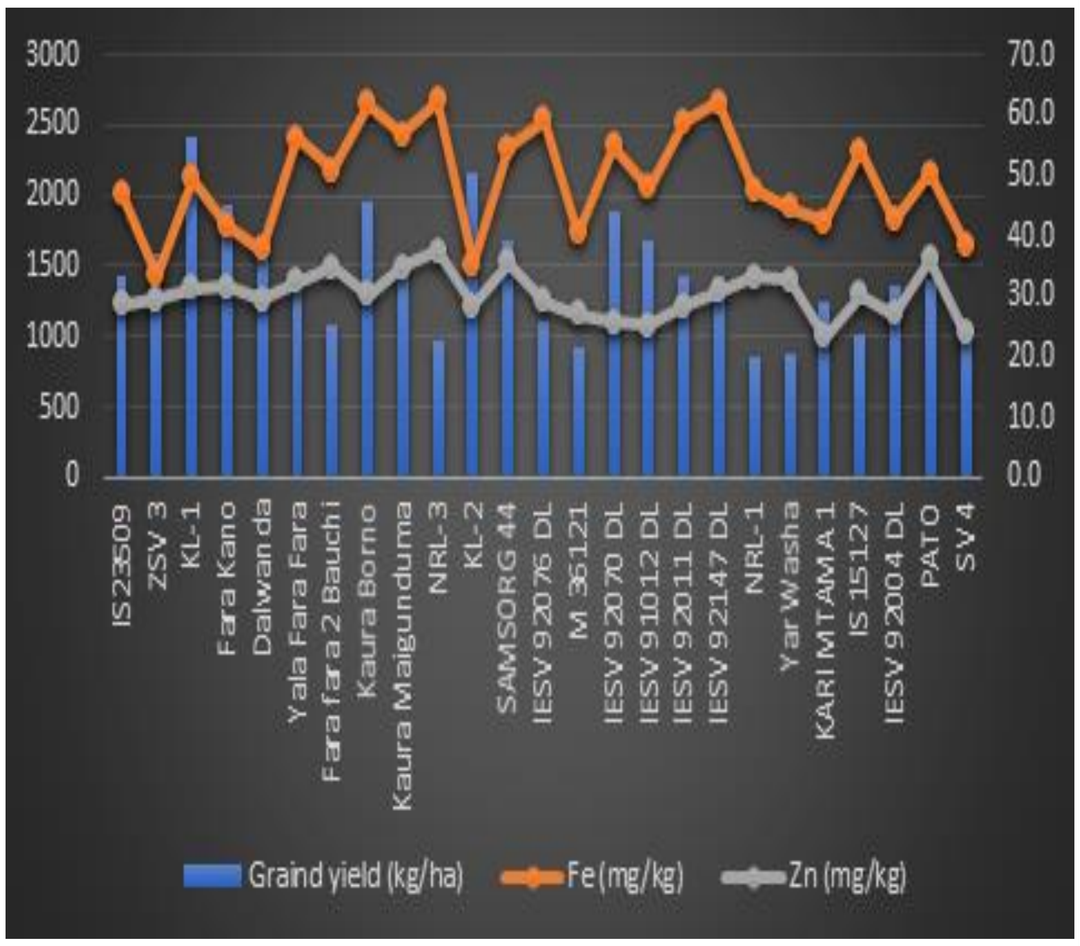

Figure 1. Graphical performance of sorghum varieties with high Fe and Zn with their corresponding grain yield.

Conclusions

Our result indicated that the genotypes KL-1 and NRL-3 could serve as important parents for improving grain yield and micronutrient density in sorghum varieties.

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