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The relationship among some Quantitative Characters of Different Varieties of Soyabean (Glycine Max (L) Merrill.) in the Sudan Savannah Agro-Ecological Zone of Nigeria

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ABSTRACT

This research experiment was conducted at Teaching and Research Farm of Kano University of Science and Technology, Wudil (Latitude 11°51' N, Longitude 9°20' E at an altitude of 430 m above the sea level). The aim of the study is to study the relationship among some qualitative characters of different varieties of Soybean in the Sudan Savannah region. The germplasm of three different varieties of Soybean improves, namely TGX-1448-2E, TGX-1835-10E and one local variety were collected from Bayero University Kano Agronomy Laboratory and local market around the region. The seeds were sown in a randomized complete block design and replicated nine times. Days to 50% flowering, plant height, number of leaves /plant, number of pods/plants, number of seed per plant, seed yield/plant, and 100-seed weight were taken as growth and yield parameters. The result of analysis of variance indicated that all the growth and yield parameters were significantly (P>0.05) different between the varieties except plant height at 4WAS which was found to be statistically similar among the three varieties. Plant height at six weeks after sowing had positive and significant correlations with the number of pods per plant (0.254), days to 50% flowering (0.214) and negative significant correlation with the number of seeds per plant(- 0.30). Days to 50% flowering showed negative but highly significant correlations with the number of pods per plant (-0.870) and the number of seeds per plant (-0.659) however, it only shows positive and highly significant correlation with hundred seed weight (0.524). The number of pods per plant had positive and highly significant correlations with the number of seeds per plant (0.759) and negative significant correlation with hundred seed weight (-0.564). The number of seeds per plant showed negative and highly significant correlations with the hundred seed weight (-0.441).

Keyword: Soya bean, Quantitative characters, Yield component, Correlation, Germplasm.

1. INTRODUCTION

Soybean (*Glycine max* (L.)) is a legume crop that grows in tropical, subtropical, and temperate climates. It is one of the most economically important beans, considered as the one of the grain legumes that has the potentials to improve the livelihood of the African populace. The major reasons behind the importance of soybeans lies in the fact that it contains high protein (which is good in essential amino acid balance), lipids and many biologically active compounds and other micronutrients [1] and grown in almost every part of the world.

Soybean is also help to improve soil fertility by fixing nitrogen from the atmosphere. This is a major benefit in African farming systems, where soils have become exhausted by the need to produce more food for increasing populations, and where fertilizers are not available and or are too expensive for farmers to buy. Soybean continues to be the major source of protein and edible oil in the world. It yields more protein per hectare than most other crops and accounts for more than 63% of high protein meal and 28% of the total edible oil supply worldwide [2]. Soybean oil is recommended in stomach diseases and diabetes. It is also used as a raw material for the production of top quality drying oil, vanishes, soaps, plastics, strong glues and adhesive. The pharmaceutical

industry widely uses soybeans in the manufacture of antibiotics, soybean oil cake contain up to 47% and soy flour up to 40% protein [3].

The summary of the result of several clinical studies that showed the association of soy foods, particularly soy isoflavones with reduction in blood serum cholesterol levels, reduction in the risk of cardiovascular diseases in humans, reduction in mammary and prostrate cancers in women and men respectively and increased bone density and reduced osteoporosis among menopausal women [4]. Today it is a cheap substitute for meat and fish with a good quality milk production [5].

According to FAO estimates (IITA 2000), over 160 million tonnes of soybean were produced worldwide in 2000. The leading producer was the USA which accounted for 49%; Latin America and the Caribbean produced 34%, Asia 14%, and Africa less than 1%. In 2000 a total of 73 million hectares were planted with soybean throughout the world. More than 29 million hectares of these were in the USA; while about 817 000 hectares were in sub-Saharan Africa. The average yield in 2000 was 2210 kg per hectare, ranging from about 3520 kg per hectare in Western Europe and 2650 kg per hectare in the USA, to 990 kg per hectare in Africa. [6]

Soybean was introduced to Nigeria in 1908. However, the first most successful soybean cultivation in the country was in 1947 with the Malayan cultivars [7] which were found suitable for commercial production in Benue State. Nigeria is the leading producer of soybean in Africa [8]. Other major producers in Africa include South Africa, Uganda, Zimbabwe and Zambia [9].Large production is found in the Guinea Savanna area particularly on the Benue, Kaduna axis and in the derived Savanna of Oyo State, where prospects for large-scale production are increasing. Hence, soybean has gained much popularity in Nigeria and even around the globe for human nutrition [10] and it is therefore capable of solving the world nutritional deficiency particularly in the developing countries [8].

Despite the fact that Soybean cultivation in Nigeria has expanded as a result of its nutritive, economic importance and diverse domestic usage Soybeans production seem to face problems of improved viable seeds. This problem affects the production and often pushes farmers to abandon its cultivation and look for another alternative crop

An understanding of the relations among various characters with seed yield is essential so as to find appropriate selection criteria. Quite often, characters are correlated and selection for one character may lead to either positive or negative response in the other characters. This response can be predicted if the correlation and heritability of the characters are known. Therefore the aim of the study is to determine the high yielding varieties by assessing of their quantitative characteristics.

2. MATERIALS AND METHODS

I. Study Area

The Experiment was conducted at the Teaching and Research Farm, Kano University of Science and Technology Wudil, Kano State, Nigeria. The area is located on Latitude 11°51' N Longitude 9°20' E at an altitude of 430m above the sea level. The mean annual rainfall is 800mm with relative humidity of 75% during the rainy season with a mean annual temperature of 26^0C, [11]

II. Treatments and Experimental Design

The varieties used in the experiment were TGX-1448-2E, TGX-1835-10E which are the improve varieties and one local variety. The improved varieties were collected from Bayero University Kano Agronomy Laboratory while the local variety was obtained from the market. The plots were laid out in a randomized complete block design replicated nine times at a spacing of 45cm x 75cm intra and inter row spacing respectively. The land was ploughed, harrowed and then ridged to prepare the soil for sowing. After rains were fully established, the seeds were sown in the same day. Two seeds were initially sown per hole. All agronomic practices were done on time to achieve good stand. At maturity, the following parameters were observed and recorded such as Plant Height (cm) , Number of Leaves Per Plant (cm), Number of Pods Per Plant , Number of Seeds per plant , Days to 50% flowering and 100 Seed Weight (g).

III. Data Collection and Statistical Analysis

The data collected during the experiments includes, days to 50% flowering, Plant height (cm), Number of leaves /plant, Number of pods/plants, Number of seed per plant, Seed yield/plant (g) and 100-seed weight (g). The data collected on the quantitative traits was analyzed statistically using the analysis of variance (ANOVA) and coefficient of variation following the procedure of [12]. The procedure outlined by [13] was used to estimate the yield components, as well as to determine the genotypic and phenotypic variances according to [14]. The variance component was used to compute the genotypic coefficient of variability (GCV), phenotypic coefficient of variability (PCV) and expected genetic advance. Genotype coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was also determined. The genotypic correlation coefficient was estimated according to the procedure of [15]. The genotypic and phenotypic components of variance were computed according to formulae given by [16] and [15] for the observed characters.

Genotypic variance Vg = (Tr.m.s.s-E.m.s.s)/ r

Error variance (Ve) =E.m.s.s.

Phenotypic variance (Vp) =Vg+Ve

Number of replications =r

Genotypic and phenotypic coefficients of variability were computed according to Burton and Devane (1953).

Genotypic coefficient of variability (GCV) = (√Vg x100)/X

Phenotypic coefficient of variability (PCV) = (√Vp x 100)/X

Where Vg = Genotypic variance

And x = General mean of character

Vp = Phenotypic Variance

3. RESULTS AND DISCUSSION

The mean sum of squares due to various source of variation for six quantitative characters on plant height, number of leaves per plant, days to 50 percent flowering, number of pods per plant, numbers of seed per plant and 100-seed weight are presented in Table 1. The result of analysis of variance indicated that all the six quantitative traits studied were significantly differed between the varieties except plant height at 4WAS which was found to be statistically similar among the three varieties. The knowledge of genetic variability is basic to improve any character by adopting selection based on variation present in the population; therefore, the analysis of variance for six quantitative traits reveals a highly significant variation among the varieties. The high variability observed might be attributed to their genetic makeup and the environment in which the varieties were evaluated.

Table 1: Analysis of variance of six quantitative traits in three different soybean varieties

S/N	Characters	Mean sum of squares Genotypes	Mean sum of squares Error
1.	Plant height(4WAS)	15.410*	3.9610
2.	Plant height(6WAS)	15.603ns	2.0300
3.	Number of leaves/plant(4WAS)	9.5930*	1.8840
4.	Number of leaves/plant(6WAS)	466.93*	120.60
5.	Days to 50% flowering	381.82**	1.9400
6.	Number of pods/plant	20.340**	0.7270
7.	Number of seed/plant	27.000**	1.7000
8.	100-seed weight(g)	1.0190**	0.1410

Probability, ns means no significant difference and WAS Week after sowing

Table 2: Estimation of different genetic parameters for different characters in three soybean varieties

S/N	Characters	V p	V g	PCV	GCV
1.	Plant height(4WAS)	5.233	1.272	9.770	4.820
2.	Plant height(6WAS)	3.538	1.508	5.031	3.284
3.	NOL/plant(4WAS)	2.741	0.857	10.93	6.111
4.	NOL/plant(6WAS)	159.1	38.48	11.71	5.760
5.	Days to 50% flowering	40.26	42.20	11.54	11.27
6.	Number of pods/plant	2.906	2.179	13.76	11.91
7.	Number of seed/plant	4.511	2.811	18.57	14.66
8.	100-seed weight(g)	0.239	0.098	4.540	2.907

Key: 4WAS= Four Weeks after Sowing, 6WAS = Six weeks after Sowing

From Table 2 there were no much significant differences between the PCV and GCV values except in number of leaves per plant at 6WAS with a PCV of (11.71) and GCV of (5.76) and plant height at 4WAS with a PCV of (9.77) and GCV of (4.83).

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Table 3: Correlation coefficients of six quantitative characters in three soybean varieties

S/N	Characters	PH (4)	PH (6)	NOL (4)	NOL (6)	DF	NOP	NOS	100_SW
1.	PH (4)	1							
2.	PH (6)	0.059	1						
3.	NOL (4)	-0.101	0.472	1					
4.	NOL (6)	-0.110*	-0.238	0.263	1				
5.	DF	-0.090	0.214*	0.206**	0.346**	1			
6.	NOP	0.351*	0.254*	-0.317	- 0.265	-0.870**	1		
7.	NOS	0.371*	- 0.30*	-0.257*	-0.123	-0.659**	0.759**	1	
8.	100_SW	-0.061	-0.085	0.244	0.514	0.524**	-0.564**	-0.441**	1

Key: DF- days to 50% flowering; PH- plant height; NOP- number of pods per plant; NOL- number of leaves per plant; NOS- number of seeds per plant; 100_SW- hundred seed weight

The results of Correlation coefficients of six quantitative characters in three soybean varieties studied were presented in Table 3; Plant height at 4WAS had positive and significant correlations with number of pods per plant (0.351), number of seeds per plant (0.371) and a negative significant correlation with number of leaves per plant at 6WAS (-0.110). Plant height at 6WAS had positive and significant correlations with number of pods per plant (0.254), days to 50% flowering (0.214) and negative significant correlation with number of seeds per plant (- 0.30). Number of leaves at 4WAS per plant only had highly positive significant correlation with days to 50% flowering (0.206) and negative significant correlation with number of seeds per pod (-0.317). Number of leaves at 6WAS per plant only had highly positive significant correlation with days to 50% flowering (0.346).

Days to 50% flowering showed negative but highly significant correlations with number of pods per plant (-0.870) and number of seeds per plant (-0.659), however, it only shows positive and highly significant correlation with hundred seed weight (0.524). Number of pods per plant had positive and highly significant correlations with number of seeds per plant (0.759) and negative significant correlation with hundred seed weight (-0.564). Number of seeds per plant showed negative and highly significant correlations with the hundred seed weight (-0.441).

.Crop improvement programmes generally commence with the collection of germplasm from diverse origin as possible, followed by its proper evaluation and characterization. This requires careful analysis of variability present in the material by computing various parameters like the phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV) and heritability. In the present study, the phenotypic coefficient of variation was higher than genotypic coefficient of variability for all the six characters. All the three varieties shows a wide range of variation for the traits viz; days to 50 % flowering, plant height, number of branches per plant, numbers of pod per plant, number of seeds per plant and 100_seed weight. This variation indicated the scope for selection of these traits for further breeding work. The characters viz; days to 50 percent flowering, plant height and hundred seed weight showed low values of PCV and GCV. Similar results were obtained by [17].

Yield being a complex quantitative character governed by large number of genes and highly influenced by environment, hence the selection of superior genotypes based on yield as such is not effective for a rational approach towards improvement of yield; selection has to be made based on the components of yield. Association of yield components and yield then assumes special importance as the basis for indirect selection. Genetic correlation between different characters of plants often arises because of linkage or Pleiotrophy [18]. In the present study number of seed per plant was positive and highly significant with number of pods per plant, but with negative and highly significant association with days to 50 percent flowering. The findings of [19] confirmed the above results, similar results were also obtained by [20-21].

4. CONCLUSION

The analysis of variance revealed the prevalence of significant difference among the genotypes for all the six traits/characters studied. Phenotypic coefficient of variation was higher in magnitude than the genotypic coefficient of variation in respect to all the characters. The characters number of seeds per plant and number of pods per plant showed high PCV and GCV , while days to 50% flowering, number of leaves per plant and plant height had moderate PCV and GCV values whereas, hundred seed weight had low PCV and GCV.

The study revealed that there is a significant difference for all the studied characters, indicating the presence of substantial genetic variability. These characters may serve as effective selection parameter in breeding programme for crop improvement. The varieties can be used as source of germplasm. The correlation analysis pointed out that number of seeds per plant had significant and positive association with plant height and number of pods per plant. It might be emphasize that the importance of these characters should be considered in selection programs aimed at yield improvements.

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