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Evaluation of Some Morphological and Yield Component Traits Relationship to Soybean Seed Yield.

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Abstract
Studies on soybean seed yield in relation to morphological and yield component traits under different population and phosphorus levels was carried out at the University of Ilorin Teaching and Research farm, Ilorin Lat $8^0$29, N long 4^0 35 E Nigeria; over two years 2005 and 2006.Three soybean varieties at three population densities and four phosphorus levels were factorially combined in a randomized complete block and replicated four times.
The result showed that the highest contribution to seed yield plant-^{1} was recorded in pod weight with coefficient of determination R^2= 0.998 while the lowest was observed in harvest index with R^2 value of 0.078. Number of seeds and pods plant-^{1} with R^2 value of 0.937 and 0.884 respectively, ranked second and third in their contributions to soybean seed yield plant-^{1} in the study area.
The regression equations for the combined morphological and yield component traits further showed that yield component traits with R^2 value of 0.999 contributed more to seed yield than morphological traits with R^2 value of 0.713. Invariably, the regression equation truly represented the relationships. Of the yield components traits, pods weight, number of pods and seeds plants-^{1} contributed more to the determination of soybean seed yield plant-^{1} than the other measured traits. These traits are therefore, considered as good indices for soybean breeders in varietal development, improvement and selection programme. It could also be a good indicator for soybean producers in variety selection for planting to increase yield in the study area.
Key words: Coefficient of determination, yield components, pod, soybean, seed yield.

1.0 Introduction

Soybean, first introduced to Nigeria in 1908 had been noted importantly for its valuable protein and cholesterol-free oil of 40% and 22% respectively (Johnson and Bernard, 1963). In spite of Nigeria as the leading country in soybean production in Africa, the yield is still low owing to limitations of inadequate knowledge of production techniques (IITA, 2000). The worldwide yield average was 3,520kg/ha in Europe, 2,650kg/ha in USA and 900kg/ha in Africa (FAO, 2002). Cultural practices such as phosphorus fertilizer and population density were considered as an important management practices for yield increase (Atanda *et al.*, 2014; Adeyemo and Bello, 2002; Olofintoye,1996).This recorded yield obtained, is significantly lower compared with what is obtained in other parts of the world. In order to improve production level, ability to breed and select improved, adaptable, disease resistant and high yielding varieties for the study area cannot be over emphasized. Research studies (Spetch and Williams, 1984; Morrison *et al*.,1999), noted that 50% and 29% yield increase in the USA and Canada respectively was due to improvement in varietal development. There was the need for concerted research efforts to improve yield to an acceptable level that would compared favourably with what is obtained in other parts of the world through breeding and selection of appropriate variety for each location. Identification of morphological growth and yield component traits that contribute to soybean seed yield plant-^{1} may be a good indicator in soybean breeding and selection for maximum yield. Information on these traits is lacking, particularly in the study area with its high potential for soybean production.

2.0 Materials and Methods

Two experiments were conducted in 2005 and 2006 cropping seasons at the University of Ilorin Teaching and Research Farm, Ilorin (Lat.8^{o}29'N, Long.4^o 35'E) in the Guinea Savannah agro-ecological Zone of Nigeria. The treatments consist of three soybean varieties (early, medium and late) at three population densities (333,333; 500,000 and 666,666 plants ha-^{1}) and four levels of phosphorus (0, 30, 60, 90kg P_20_5 ha-^{1}). The design was a 3x3x4 factorial in a Complete Randomized Block (RCB) and replicated four times. The land was ploughed and harrowed twice. Two seeds stand-^{1} was maintained at 60cm, 40cm and 30cm inter rows and 10cm intra row spacing respectively for 333,333; 500,000 and 666,666 population densities.
Single superphosphate fertilizer (18% P) at 200 kg ha-^{1} was applied at planting. Pendimethalin, a pre-emergence herbicide at 2 kg ha-^{1} active ingredient was applied the second day after planting.
Data collected on morphological traits were number of leaves and nodes at 50% flowering and plant height at maturity while number of pods, seeds, 100 seeds and dry fodder plant-^{1}, grain yield and fodder dry yield ha-^{1}, shelling percentage and harvest index were collected for yield and yield component traits at maturity. The collected data over the two years were pooled and analysed statistically using GENSTAT 5.32 software. Correction coefficient (r), coefficient of determination(R^2) from correlation and regression analyses were

subjected to Duncan Multiple Range Test (DMRT) at 0.01% probability for high precession except for harvest index which was at 1% probability level. This was done to determine and quantify the contribution of morphological growth and yield component traits to seed yield plant-^{1} in the evaluated soybean varieties.

3.0 Results and Discussion

The correlation coefficients (r) and coefficients of determination (R^2) from the correlation and regression analyses of some morphological growth and yield component traits in relation to soybean seed yield (Tables 1,2,3 and 4), showed that the morphological growth and yield component traits were positively and significantly related and contributed to soybean seed yield. This observation agreed with Malik *et al.*, (2011) in a similar study.

The highest contribution to seed yield plant-^{1} was recorded in the pod weight with coefficient of determination R^2=0.998 while the lowest was observed in the harvest index with coefficient of determination R^2 =0.078. Thus, indicating that, the number of leaves, nodes and plant height, number of pods and seeds, pods weight, fodder dry yield plant-^{1},100 seeds weight, shelling percentage and harvest index contributed to soybean seed yield plant-^{1}. Consequently, pods weight, number of seeds and pods plant-^{1} with R^2 values of 0.998, 0.937 and 0.884 ranked first, second and third respectively in their contributions to soybean seed yield in the study area. Other researchers, Maria *et al*.,(2009) and Benedict *et al*.,(2011) on pea and bambara nut respectively also observed that the number of pods and seeds were the main components of seed yield having maximum contribution to seed weight plant-$^{1.}$

Table 1: Correlation coefficient (r) and coefficient of determination (R^2) of some morphological and yield components against soybean seed yield.

Seed Yield Plant^{-1} Versus	r	R^2
Number of leaves plant^{-1} (NLPPT)	0.733***	0.537***
Number of nodes plant^{-1} (NNPPT)	0.735***	0.540***
Plant height (PHT)	0.701***	0.491***
Number of pods plant^{-1} (NPDPPT)	0.940***	0.884***
Number of seed plant^{-1} (NSDPPT)	0.968***	0.937***
Pod weight plant^{-1} (PDWTPPT)	0.999***	0.998***
100 seed weight (100SDWT)	0.549***	0.301***
Fodder Dry yield plant^{-1} (FDYPPT)	0.791***	0.626***
Shelling percent (SP)	0.823***	0.677***
Harvest Index (HI)	0.280**	0.078**

, * Denote effect significant at 1% and 0.1% probability levels of DMRT

Table 2: Contributions of some morphological growth and yield component parameters to seed yield of soybean over two years (2005 & 2006).

Regression Equation	**R^2**
$Y=-2.345+0.01077X_1 + 0.0394X_2 +0.1875X_3$	0.714***

*** Denotes effects significant at 0.1% probability level of DMRT.
X_1=NLPPT, X_2=NNPPT, X_3=PHT
NLPPT = Number of Leaves Plant-^{1}
NNPPT = Number of Nodes Plant-^{1}
PHT = Plant Height

Table 3: Contribution of some yield component parameters to seed yield of soybean over two years (2005 & 2006)

Regression equation	**R^2**
$Y=-0.3682 + 0.020416X_1+ 0.012708X_2+ 0.97285X_3 - 0.01171X_4+ 0.0057X_5$	0.999***

***Denote effect significant at 0.1% probability level of DMRT.
X_1=NPDPPT, X_2=NSDPPT, X_3=PDWTPPT, X_4=100SWT, X_5=FDYPPT.
NPDPPT = Number of Pods Plant-^{1}
NSDPPT =Number of Seed Plant-^{1}
PDWTPPT =Pod Weight Plant-^{1}
100SWT = 100 Seed Weight
FDYPPT = Fodder Dry Yield Plant-^{1}

Table 4: Contribution of some morphological growth and yield component parameters to seed yield of soybean over two years (2005 &2006)

Regression	**Equation**
R^2	
$Y=-0.4146 - 0.00265X_1 - 0.00007X_2 - 0.00145X_3+0.019097X_4 +0.01263X_5 +0.96926X_6 - 0.00567X_7 +0.0072X_8$	
$= 0.999$***	

*** Denote effect significant at 0.1% probability level of DMRT.
X_1=NLPPT, X_2=NNPPT, X_3=PHT, X_4=NPDPPT, X_5=NSDPPT, X_6=PDWTPPT, X_7=100XWT, X_8=FDYPPT
NLPPT = Number of Leaves Plant-^{1}
NNPPT = Number of Nodes Plant-^{1}
PHT = Plant Height
NPDPPT = Number of Pods Plant-^{1}
NSDPPT =Number of Seed Plant-^{1}
PDWTPPT =Pod Weight Plant-^{1}
100SWT =100 Seed Weight
FDYPPT = Fodder Dry Yield Plant-^{1}

The regression equations showed the contributions of morphological growth traits (Table 2), yield component traits (Table 3) and combined morphological growth and yield component traits (Table 4) to soybean seed yield over two years. These measured traits contributed significantly to soybean seed yield. The R^2 value of 71.3% for morphological growth, 99.9% for yield components and 99.9% for both morphological growth and yield components showed that the regression equations truly represented the relationships.

Consequently, the morphological growth traits contributed least to the determination of soybean seed yield than for both yield components and combined morphological growth traits and yield component traits with the same value. The yield components alone contributed more to the determination of seed yield than morphological growth traits. Of the yield component traits, pod weight, number of pods and seeds plant-^{1} contributed more to the determination of soybean seed yield than the other measured traits. However, pod weight plant-^{1} gave the highest contribution followed by the number of seeds and pods plant-^{1} respectively in this study. In another research, (Oladajo *et al*., 2011) noted pod weight as one of the agronomic traits that is most appropriate for selection of improved grain yield in cowpea.

4.0 Conclusion

Conclusively, the positive relationships and contributions of pod weight, number of seeds and pods plant-^{1} to soybean yield plant-^{1} irrespective of the maturity date can be considered as good indices for variety selection during breeding programme and at farmer's field level.

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