GENETIC ANALYSES OF POD SHATTERING AND AGRONOMIC TRAITS OF SOYBEAN (*Glycine max* (L.) Merr.) GENOTYPES

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DECLARATION

This thesis is my original work and has not been presented for award of a degree in any other University or institute of higher learning.

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ABSTRACT

Pod shattering is as an important constraint associated with 34 to 99% loss in productivity of soybean (*Glycine max* (L.) Merr.). Common management strategies such as early harvesting and harvesting when temperature is still low are not very effective. Genetic resistance to shattering is a more effective strategy to reduce losses. The objective of this study was to evaluate soybean genotypes and to determine the combining ability of pod shattering resistance and selected agronomic traits. Twenty soybean genotypes were evaluated during the 2016 long and short rain seasons for resistance to pod shattering and other agronomic traits at KALRO-Embu and Mwea Research Centres. The genotypes included SB lines from IITA and local commercial varieties. The trial was laid out in an alpha-lattice design arranged in a 4 x 5 pattern and replicated three times. Pod shattering was assessed on a scale of 1 to 5 (1=very resistant; 5= highly susceptible). Data was also collected on germination percentage, days to 50% flowering, days to 75% maturity, plant height, biomass, number of pods per plant, number of seeds per pod, grain yield, 100-seed mass and harvest index. F_1 progenies were generated from a half-diallel mating design, involving eight parents. Two of the parental lines were resistant, three moderately resistant, one moderately susceptible and two highly susceptible to pod shattering. The trial design was laid out in an alpha-lattice arranged in a 6 x 6 pattern with three replicates. The 28 F_1 progenies and their parents were evaluated to determine the mode of gene action for pod shattering resistance and other selected traits in soybeans such as days to 50% flowering, days to 75% maturity, plant height and grain yield. Data were subjected to analysis of variance and residual maximum likelihood to test the significance of variation among the genotypes. General and specific combining abilities (GCA and SCA) were calculated following Griffing's Model 1, Method 2. The genotypes varied significantly in pod shattering from resistant to highly susceptible. Ten genotypes were resistant to pod shattering out of which seven were SB lines. Genotypes SB-8, Gazelle, SB-74, SB-4 and Nyala were the most resistant. SB-74 combined resistance to pod shattering and high grain yield. Genotypes SB-90 and SB-25 were highly susceptible while the rest of genotypes were either moderately resistant or susceptible to pod shattering. The high yielding genotypes were 931/5/34 followed by 915/5/12 and SB-154 with grain yields of more than 1800 kg ha^{-1}. Pod shattering resistance had significant negative correlation with number of seed per pod ($r=-0.13^*$), indicating that reduction of seeds in a pod made a significant contribution towards pod shattering resistance. Both general combining ability (GCA) and specific combining ability (SCA) were significant for all the traits measured indicating the importance of both additive and non-additive gene action in the inheritance of pod shattering and selected traits. The low ratio GCA/SCA (0.00124 to 0.0742) for all the traits studied indicated that non-additive gene action played a more significant role than additive gene action in the inheritance of these traits. Parental lines SB-8 followed by Nyala had the highest negative and significant GCA effects across the environments indicating that they were the best combiners for improving pod shattering resistance. Parental line 835/5/30 was the best combiner for high yield. Only the F_1 progenies of the cross SB-25 x SB-8 had significant negative SCA effects for resistance to pod shattering across the environments. In general early flowering and maturity of progenies did not result in higher grain yield except for some progenies such as 915/5/12 x SB-8. The study identified resistant and moderately resistant genotypes that could be used as sources of resistant genes to develop pod shattering resistant varieties. The results also suggested that genetic improvement for pod shattering resistance and selected agronomic traits in soybeans is possible based on the effective selection of F_2 population generated from all possible combinations and the use of heterosis breeding to allow hybrid offsprings from genetically diverse parents to develop significant improvements. The results suggested selection for pod shattering resistance in late segregating generations may also improve other agronomic traits.

Key words: general combining ability, specific combining ability, pod shattering, soybean.