DETERMINATION OF THE HETEROTIC GROUPS OF MAIZE INBRED LINES AND THE INHERITANCE OF THEIR RESISTANCE TO THE MAIZE WEEVIL (*Sitophilus zeamais*)

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SUMMARY

Maize weevil (*Sitophilus zeamais*) is an important insect pest of maize in the tropics. It causes economic losses to maize growers, especially resource-poor farmers who lack adequate storage facilities. The weevil infests maize in both the field and in storage, particularly in susceptible varieties. The weevil can cause more than 30% weight loss and 100% grain damage, depending on the susceptibility and the duration of storage. Research has focused on developing high-yielding, field stress-tolerant varieties, with little attention to storage characteristics that are a very important component of maize production. The mechanism of resistance to weevils in maize is not yet fully understood, and high-yielding weevil-resistant genotypes are unavailable. Fifty-two maize inbred lines reported to possess resistance to weevil attack were developed at the National Crops Resources Research Institute (NaCRRI), Namulonge (Uganda), but have not yet been characterized for resistance. This study was therefore designed to: (a) determine the relative importance of additive and non-additive gene action for resistance to maize weevil (MW) in maize, and (b) to assign inbred lines to their heterotic groups.

The inbred lines were testcrossed to two testers, A and B and the resulting hybrids were evaluated in two locations (Namulonge and Masaka) for yield, anthesis date, anthesis-silking intervals, plant height and ear height, husk cover, grain texture reaction to *Turcicum leaf blight* ,rust and Maize streak virus. Results from analysis of variance showed highly significant differences among testcrosses for yield and other agronomic traits. Analysis of genetic variances and components indicated that 7 inbred lines had significantly positive GCA for yield, with a maximum effect of $1.24 t.ha^{-1}$. Based on the genetic components of variance, and on Baker's ratios, gene action was mostly additive for all the traits. Non-additive gene action was also important for grain yield. The

Narrow sense coefficient of genetic determination (analogous to heritability) was low for yield (0.27), very low for ASI, and moderate to high for other traits. Twenty-three of the inbred lines were assigned to heterotic group A, twenty-four to group B, and five to both A and B.

For weevil resistance evaluation, 10 inbreds showing good performance with either of the two testers were selected, and their corresponding testcrosses with the other tester were also included, giving a total of 40 testcrosses. These testcrosses and their parents were evaluated for weevil resistance. Fifty grams of chemically untreated sound grains were frozen for two weeks at -20^{o}C to destroy any weevil eggs and then left for a three-week period to achieve uniform temperature and humidity. The samples were then infested with 32 unsexed weevils, using glass jars with perforated lids that were sealed with wire mesh. An alpha-lattice experimental design was used. After 10 days for oviposition, the adults were removed and the samples incubated at room temperature. The F_1 progeny were removed upon emergence every two days up to the time when no more insects emerged. The total number of F_1 progeny, median development period (MDP), weight loss and Dobie's index of susceptibility (SI) were used to measure resistance in this study. The resistance parameters were strongly correlated, strong association being especially with SI. Two inbred lines, WL118-9 and WL429-27 contributed to both yield and weevil resistance, but the best general combiner for weevil resistance, WL118-9 did not show a significant contribution to yield. The other inbred line, WL429-27, exhibited a highly significant positive GCA for yield and showed a significant contribution to weevil resistance only as measured by MDP. The line WL118-14 was classified as moderately susceptible, but had a negative GCA effect for yield. The other lines were either susceptible or highly susceptible to the maize weevil. According to the classification for resistance based on SI, there was no highly resistant line among those evaluated for weevil resistance, with the best line for weevil resistance classified as moderately resistant, and the second best moderately susceptible. Flint texture was correlated with maize weevil resistance and dent

texture with susceptibility. However, the association of texture with the resistance parameters was weak. The two inbred lines, WL118-9 and WL429-27 are the best for combining yield and weevil resistance. Gene action was more additive than non-additive for weevil resistance, and the highly significant contribution to resistance was from variation among lines.

The weevil resistant line can be used to improve resistance of high yielding varieties. Grain texture should not be used alone as an indicator of resistance. The results showed that it is possible to combine high yield with improved weevil resistance in maize. This study identified a number of inbred lines that lacked either yield potential or resistance to maize weevil. These lines can be excluded from further evaluation.