Abstract

Maize is a very important food crop in Kenya with its annual consumption being estimated at 98 Kg per person. Maize yield and production in Kenya is 1.7 ton/ha and 2.7 million tons annually and is on the decline due to both biotic and abiotic constraints. Biotechnological approaches such as genetic transformation can be used to overcome these constraints. Genetic transformation of plants can be achieved through direct uptake of naked DNA into target cells or via Agrobacterium mediated transformation. However Agrobacterium mediated transformation is increasingly becoming the method of choice due to its ability to generate transformants containing low copy insertions. Transformation involves not only the transfer of the gene of interest into the host cell but also the use of an efficient selection system for the transformants. Genes that confer resistance to selected antibiotics are the most widely used selectable markers. However, there have been concerns about the possibility of horizontal gene transfer from transgenic plants back to bacteria, which may result in antibiotic resistance. The phosphomannose isomerase (PMI) system utilizes the pmi gene encoding phosphomannose isomerase enzyme that converts mannose-c-phosphate to fructose-6-phosphate that can subsequently enter the glycolytic pathway. This gene is not normally encoded in the maize genome and therefore only the transformed cells are capable of utilizing mannose as a carbon source. In this study two Kenyan maize genotypes: an open pollinated variety, Katumani (KAT), and the Dryland hybrid DH (02), were used to evaluate the use of pmi as selection marker for the selection of transformed maize cells. Genotype A188 was used as a positive control genotype with respect to transformation. A mannose concentration of 5 g/l was used to select for the transformants as it was observed to be the lowest concentration of mannose in the selection media at which non-transformed KAT calli did not register any increase in fresh weight. The transformation efficiencies obtained for KAT and DH (02) were significantly high when EHA101 was used for infection compared to LBA4404 ($p \sim 0.05$). Genotype DH (02) recorded the lowest transformation efficiencies among the three genotypes and this may be attributed to the fact that DH (02) immature embryos were very sensitive to Agrobacterium infection and they rapidly browned and eventually died after infection. The pmi gene was inherited in the progeny and found to segregate in the 3: 1 Mendelian ratio for the selfed plants. The results of this study show that PMI system is an effective and efficient selection system for transgenic Kenyan maize genotypes. This study will help in developing transgenic dry landKenyan maize genotypes

carrying desirable traits such as drought tolerance and pest resistance but generated through a more acceptable selection system which poses no regulatory challenge.