THE ESTIMATION OF COMBINING ABILITIES AND HETEROSIS IN A SWEETPOTATO 8X8 DIALLEL FROM CIP-UGANDA

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SANTOS; Iara Gonçalves Dos [1], SWANCKAERT; Jolien [2], SSALI; Reuben [3], MWANGA; Robert [4], AZEVEDO; Camila Ferreira [5], PAULA; Thiago O. Mendes De [6], BOECK; Bert De [7], EYZAGUIRRE; Raul [8], KETAVI; Mercy [9], GEMENET; Dorcus [10], ANDRADE; Maria [11], GRÜNEBERG; Wolfgang J. [12], LINDQVIST-KREUZE; Hannele [13], YENCHO; Craig [14], CAMPOS; Hugo [15], PEREIRA; Guilherme Da Silva [16]

RESUMO

The heterosis exploiting breeding scheme (HEBS) has become popular among sweetpotato breeders. At the International Potato Center (CIP) in Uganda, two gene pools are enhanced separately (population improvement pipeline) while heterosis is exploited between pools (product development pipeline). This study aimed to estimate heterosis increments for storage root yield (t ha^{-1}) in a sweetpotato population from CIP-Uganda. The Mwanga Diversity Panel (MDP) was obtained from a diallel of bi-parental crosses between parents from gene pools A and B (8A × 8B), resulting in 64 families (1,913 clones). The experiment consisted of a row-column design where unreplicated parents and offspring clones were planted between columns of two alternating checks in two locations (Namulonge and Serere), over two years (2018 and 2019) in two growing seasons. Data were analyzed in two stages. In the first stage, spatial differences and trends were modeled for each environment using the Spatial Analysis of field Trials with Splines (SpATS) mixed model using the R package *sommer* v. 4.1.2, with a hybrid relationship matrix (H matrix) for genotypes. The H matrix was computed using the *AGHmatrix* R package by combining genomic information from parents and pedigree information from the population to improve the genetic predictions. In the second stage, Best Linear Unbiased Predictions (BLUPs) plus residuals were used to estimate general (GCA) and specific (SCA) combining abilities. Family predictions and mid-parent heterosis increments were obtained using the BLUPs from the second step. The female GCA (–3.13 to 3.00) accounted for the largest additive genetic variation for storage root yield compared to the male GCA (–0.90 to 0.94), while SCA estimates ranged from –1.19 to 1.82. NASPOT 11 had the highest GCA and storage root yield among the female parents, while NK259L was the male with the highest GCA and storage root yield. The highest SCA effects were observed in the families 'NASPOT 11 × Dimbuka Bukulula' (1.82) and 'New Kawogo × NASPOT 10 O' (1.03). On the other hand, the lowest SCA were

[1] Federal University of Viçosa, iara.santos@ufv.br
[2] International Potato Center, swanckaertjolien@gmail.com
[3] International Potato Center, R.Ssali@cgiar.org
[4] International Potato Center, rmwanga7@gmail.com
[5] Federal University of Viçosa, camila.azevedo@ufv.br
[6] International Potato Center, T.Mendes@cgiar.org
[7] International Potato Center, B.DeBoeck@cgiar.org
[8] International Potato Center, R.Eyzaguirre@cgiar.org
[9] University of Georgia, mercy.kitavi@uga.edu
[10] International Maize and Wheat Improvement Centre, D.Gemenet@cgiar.org
[11] International Potato Center, M.Andrade@cgiar.org
[12] International Potato Center, W.GRUNEBERG@cgiar.org
[13] International Potato Center, h.lindqvist-kreuze@cgiar.org
[14] NC State University, yencho@ncsu.edu
[15] International Potato Center, h.campos@cgiar.org
[16] Federal University of Vicosa, g.pereira@ufv.br

observed in the families ‘NASPOT 11 × NASPOT5/58’ (–1.19) and ‘Resisto × Ejumula’ (–1.07). Mid-parent heterosis increments ranged from –5.98% in the family ‘NASPOT 5 × NASPOT5/58’ to 6.44% in ‘NASPOT 11 × Dimbuka Bukulula’. The genetic variance of GCA suggests that it is possible to select parents with high breeding values within each gene pool for future crosses. Non-additive effects were also important in the inheritance of storage root yield in sweetpotato due to the variance range of the SCA in the different environments. Parents whose progenies showed the highest mid-parent heterosis are candidates for having superior families regarding storage root yield and can potentially serve as testers in future steps of the breeding program.

PALAVRAS-CHAVE: Ipomoea batatas, mixed model, H matrix, spatial variation, GCA, SCA

[1] Federal University of Viçosa, iara.santos@ufv.br
[2] International Potato Center, swanckaertjolien@gmail.com
[3] International Potato Center, R.Ssali@cgiar.org
[4] International Potato Center, rmwanga7@gmail.com
[5] Federal University of Viçosa, camila.azevedo@ufv.br
[6] International Potato Center, T.Mendes@cgiar.org
[7] International Potato Center, B.DeBoeck@cgiar.org
[8] International Potato Center, R.Eyzaguirre@cgiar.org
[9] University of Georgia, mercy.kitavi@uga.edu
[10] International Maize and Wheat Improvement Centre, D.Gemenet@cgiar.org
[11] International Potato Center, M.Andrade@cgiar.org
[12] International Potato Center, W.GRUNEBERG@cgiar.org
[13] International Potato Center, h.lindqvist-kreuze@cgiar.org
[14] NC State University, yencho@ncsu.edu
[15] International Potato Center, h.campos@cgiar.org
[16] Federal University of Vicosa, g.pereira@ufv.br