Genotype × environment interaction effect and selection of cooking banana hybrids for yield and other relevant traits in Uganda


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Banana significance and breeding in Uganda

- Banana is an important food & income generating crop in Uganda
- It ranks first in area under production & consumption per capita
- Actual yield is as low as ≈9.2 t/ha, far below its potential ≈60 t/ha

**Critical yield reducing factors**
- Declining soil fertility
- Poor agronomic practices
- Inferior banana varieties
- Pests and diseases

**Key banana breeding objectives in Uganda are:**
- high bunch yield
- quality
- and resistance to key pests & diseases (BS, NTDs & WVLS)
Study objective and evaluation process

- The present study was aimed at selecting banana genotypes with stable and high performance for bunch yield, black Sigatoka resistance and other relevant traits.

Eleven secondary triploid (AAA) banana hybrids (NABIOs) developed by scientists at NARO & Bioversity International in Uganda, and two check varieties (Mbwazirume & Kabana 6H) were evaluated in replicated PYTs at four sites in Uganda.
Data analysis

Additive Main Effects and Multiplicative Interaction (AMMI) Model

\[ Y_{ij} = \mu + g_i + e_j + \sum_{n=1}^{N} \lambda_n \alpha_i \gamma_n + \rho_{ge} + \varepsilon_{ij} \]

AMMI Stability Value

\[ ASV = \sqrt{\frac{IPCA1SS}{IPCA2SS}} (IPCA1score) + (IPCA2score)^2 \]

Genotype Selection Index

\[ GSI_i = RY_i + RASV_i \]

Results: Table 1: AMMI ANOVA

Tumuhimbise et al. (2016) J. Plant Breed. Crop Sc. 8: 60-71
Figure 1. Biplot of mean bunch yield and IPCA1 scores for 13 banana genotypes evaluated across two cycles at 4 locations in Uganda.

Tumuhimbise et al. (2016) J. Plant Breed. Crop Sc. 8: 60-71
Table 2: Overall ranking and selection of genotypes using GSI

Table 1: AMMI ANOVA

<table>
<thead>
<tr>
<th>Genotype</th>
<th>BY GSI</th>
<th>BY Rank</th>
<th>NH GSI</th>
<th>NH Rank</th>
<th>FC GSI</th>
<th>FC Rank</th>
<th>YLS GSI</th>
<th>YLS Rank</th>
<th>GSI Sum</th>
<th>Overall Rank</th>
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</table>

CV = check variety; BY = bunch yield (t/ha); NH = number of hands; FC = fruit finger circumference (cm); YLS = youngest leaf spotted; S = selected; NS = not selected; GSI = genotype selection index; Remark = selection puts into consideration sensory evaluation results not presented in this table.

Tumuhimbise et al. (2016) J. Plant Breed. Crop Sc. 8: 60-71
Based on a combination of high stability, agronomic and organoleptic performance, NABIO306, NABIO1011, NABIO1009 and NABIO808 were selected as the best genotypes.

The select genotypes were advanced to on farm trials for a participatory variety selection process and subsequent national release.

Thank you