

# Physical and chemical characterization of advanced drought tolerant bean lines for canning purposes

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## Abstract:

Eight new dry bean varieties, randomly selected from 150 new advanced drought tolerant dry bean lines were studied for their suitability in commercial canning process. Since Kenya's canning industry has relied on the foreign Mexican 142 variety since 1960, the popular canning bean variety was used as a control. Tests were done to confirm compliance with the industry canning standards as well as to evaluate if these varieties adequately compared with the Mexican 142 variety. Physical, chemical and cooking characteristics were assessed. Proximate composition, mineral composition and the anti-nutrient, phytic acid, were determined. Critical characteristics of dry beans destined for the canning industry including water uptake, effective moisture diffusivity, percent volume increase, leaching characteristics and cooking times after soaking were studied. The seed dimensions, hundred seed mass and bulk density were also evaluated. Results showed that among the varieties, there were significant differences ( $p < 0.05$ ) in initial moisture content, crude protein, crude fiber, crude fat, crude ash and carbohydrates. However, no significant differences were obtained for phytic acid content. The beans ranged from 9.14 - 11.43 % in moisture content, 24.25 - 27.65 % in crude protein, 0.87 - 5.73 % in crude fat, 6.00 to 7.57 % in crude fiber, 4.18 to 4.58 % in total ash and 47.77 to 53.91 % in total carbohydrate content. Analysis revealed significant difference ( $p \leq 0.05$ ) in the mean contents of potassium, calcium, manganese and strontium between the varieties. However, there were no significant differences ( $p > 0.05$ ) in phosphorus, iron, zinc, copper, rubidium, nickel and chromium. DNB 11-10 ranked the best overall for the various chemical characteristics measured. The least ranked was Kenya Early. There were significant differences ( $p \leq 0.05$ ) in seed dimensions, hundred seed mass and bulk density. In water uptake studies, there were significant differences ( $p < 0.05$ ) in maximum soaking rate ( $V_{max}$ ), time at which  $V_{max}$  occurred ( $t_{max}$ ), water uptake at which  $V_{max}$  occurred ( $U_{max}$ ), final water uptake (UF), time taken to reach final water uptake ( $t_{UF}$ ) and effective moisture diffusivity coefficient ( $Deff$ ). However, there were no significant differences ( $p > 0.05$ ) in volume change. No significant differences ( $p > 0.05$ ) among varieties were observed for the maximum leaching rate ( $V_{lmax}$ ) and time taken to reach final electrical conductivity ( $t_{ECF}$ ) the measure of leaching characteristics. Significant differences ( $p \leq 0.05$ ) were observed in time at which  $V_{lmax}$  occurred ( $t_{lmax}$ ), electrical conductivity at which occurred ( $EC_{max}$ ) and final electrical conductivity (ECF). Kenya Early ranked the best overall for the various physical characteristics measured. The least ranked was DPC 11-05. Results from cooking analysis showed that there were significant differences ( $p < 0.05$ ) in cooking time. These varied between 30.31 minutes and 51.29 minutes. DPC 11-05 ranked the best for cooking time. All the varieties are comparable to the control and are thus considered suitable for use in the industrial canning process. DSR 11-01 ranked the best while DPC 11-05 was the least ranked overall. Good canning qualities make it financially viable for seed producers

to proceed with new seed variety production and also for the canning industry to produce a marketable product.