

Comparative Analysis of Mechanical Properties of Paddy Rice for Different Variety-Moisture Content Interactions

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Abstract : In recent years, the issue of postharvest losses has become a serious concern in Sub-Saharan Africa. Postharvest technology development and adaptation need urgent attention, particularly for small and medium-scale rice farmers in Africa. However, to better develop any postharvest technology, knowledge of the mechanical properties of different varieties of paddy rice is vital. There is also the issue of the development of new rice cultivars. The objectives of this research are to (1) determine the mechanical properties of the selected paddy rice varieties at varying moisture content. (2) conduct a comparative analysis of the mechanical properties of selected rice paddy for different variety-moisture content interactions. (3) determine the significant statistical differences between the mean values of the various variety-moisture content interactions. The mechanical properties of AGRA rice, CRI-Amankwatia, CRI-Enapa and CRI-Dartey, four local varieties developed by Crop Research Institute of Ghana are compared at 11.5%, 13.0% and 16.5% dry basis moisture content. The mechanical properties measured are Sphericity, Aspect ratio, Grain mass, 1000 Grain mass, Bulk Density, True Density, Porosity and Angle of Repose. Samples were collected from the Kwadaso Agric College of the CRI in Kumasi. The samples were threshed manually and winnowed before conducting the experiment. The moisture content was determined on a dry basis using the Moistex Screw-Type Digital Grain Moisture Meter. Other equipment used for data collection were venire calipers and Citizen electronic scale. A 4×3 factorial arrangement was used in a completely randomized design in three replications. Tukey's HSD comparisons test was conducted during data analysis to compare all possible pairwise combinations of the various varieties' moisture content interaction. From the results, it was concluded that Sphericity recorded 0.391 mm³ to 0.377 mm³ for CRI-Dartey at 16.5% and CRI-Enapa at 13.5%, respectively, whereas Aspect Ratio recorded 0.298 mm³ to 0.269 mm³ for CRI-Dartey at 16.5% and CRI-Enapa at 13.5% respectively. For grain mass, AGRA rice at 13.0% also recorded 0.0312 g as the highest score and CRI-Enapa at 13.0% obtained 0.0237 as the lowest score. For the GM1000, it was observed that it ranges from 29.33 g for CRI-Amankwatia at 16.5% moisture content to 22.54 g for CRI-Enapa at 16.5% interactions. Bulk Density ranged from 654.0 kg/m³ to 422.9 kg/m³ for CRI-Amankwatia at 16.5% and CRI-Enapa at 11.5% as the highest and lowest recordings, respectively. It was also observed that the true Density ranges from 1685.8 kg/m³ for AGRA rice at 13.0% moisture content to 1352.5 kg/m³ for CRI-Enapa at 16.5% interactions. In the case of porosity, CRI-Enapa at 11.5% received the highest score of 70.83% and CRI-Amankwatia at 16.5 received the lowest score of 55.88%. Finally, in the case of Angle of Repose, CRI-Amankwatia at 16.5% recorded the highest score of 47.3o and CRI-Enapa at 11.5% recorded the least score of 34.27o. In all cases, the difference in mean value was less than the LSD. This indicates that there were no significant statistical differences between their mean values, indicating that technologies developed and adapted for one variety can equally be used for all the other varieties.

Keywords : angle of repose, aspect ratio, bulk density, porosity, sphericity, mechanical properties

Conference Title : ICAE 2024 : International Conference on Agricultural Engineering

Conference Location : Montreal, Canada

Conference Dates : May 23-24, 2024