

주제-05

Could *Japonica* Rice Be an Alternative Variety for Increased Global Food Security and Climate Change Mitigation?

Daniel Dooyum Uyeh^{1,2}, Senorpe Asem-Hiablie³, Tusan Park^{1,2*}, Kyung-Min Kim⁴, Alexey Mikhaylov⁵, Seungmin Woo^{1,2}, Yushin Ha^{1,2}

¹Upland-Field Machinery Research Centre, Kyungpook National University, Daegu, Republic of Korea

²Department of Bio-Industrial Machinery Engineering, Kyungpook National University, Daegu, Republic of Korea

³Institutes of Energy and the Environment, The Pennsylvania State University, University Park, Pennsylvania, USA.

⁴Division of Plant Biosciences, School of Applied Biosciences, College of Agriculture & Life Science, Kyungpook National University, Daegu, Republic of Korea

⁵Research Center of Monetary Relations, Financial University under the Government of the Russian Federation, Moscow, Russia

[Introduction]

The majority of the world's food insecure are in Africa and Asia, where rice, which is considered a greenhouse gas (GHG) intensive crop, is a staple. In seeming conflict with the world's current GHG reduction goals, annual rice production increases of 1.5% have been forecasted to meet the demand of a growing world population, the majority of which, due to socioeconomic and cultural influences, are unlikely to decrease their rice consumption. The Intergovernmental Panel on Climate Change estimated the global emission rate of GHG from paddy fields to be at 60 Tg/yr driven by microbial activities and rice varieties. Indica and Japonica are commonly grown. Indica holds the largest market share of over 80% of the two main rice varieties. The Indica paddy is mostly treated to a parboiling process, and the milled grains are mostly fluffy, with separate kernels when cooked, while Japonica is non-treated and sticky.

[Materials and Methods]

The awareness, economics, and acceptability of *Japonica* rice in an *Indica* rice-consuming country were investigated through a survey of 1057 people across Nigeria, the second populous nation in sub-Saharan Africa. We then studied the impact of the parboiling treatment on Japonica rice and further investigated the factors which most impacted stickiness through sensory and statistical analyses. A review of literature was also carried out to determine the growth characteristics of *Japonica* rice and the climate impact of growing rice.

[Results and Discussion]

Survey results indicated that non-stickiness and aroma are the characteristics that determined preference in the countries used to consuming *Indica* rice. A literature review to assess the growth characteristics of rice showed that Indica rice grows well near the equator. In contrast, Japonica rice grows mostly in temperate and mountainous regions of Northeast Asia. Studies have shown that Japonica rice emits 43.06% less GHG with higher yields and a higher nutritional profile than Indica. Our parboiling analyses results also showed that it caused starch gelatinization and a comparable reduction in the stickiness of Japonica rice. Previous studies have shown that countries in Africa and Asia with the largest numbers of food-insecure people and high consumption of Indica rice have suitable conditions for growing Japonica rice. In conclusion, the adoption of the more nutritious Japonica rice has the potential to be a win-win for rice production to achieve higher yield and help strengthen global food security while lowering the GHG impacts associated with the consumption of the staple.

[Acknowledgement]

This work was supported by Korea Institute of Planning and Evaluation for Technology in Food, Agriculture and Forestry (IPET) through Agriculture, Food and Rural Affairs Convergence Technologies Program for Educating Creative Global Leader, funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA), Project No. (320001-4), Republic of Korea.

*Corresponding author: E-mail, tusan.park@knu.ac.kr Tel. +82-53-950-5791