Title Analysis of the causes of postharvest rice grain yellowing

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Citation 2008.

Keywords Rice; Grain; Discoloration; Postharvest losses; *Aspergillus flavus; Rhizopus stolonifer*

Abstract

Matured rice grain ready for harvest is normally bright yellowish brown with 18% or higher moisture content (MC) wet basis, depending on the weather. Harvested grain is dried to 14% MC to arrest biodeterioration. It has been observed that paddy and milled rice grains turn dark yellowish or discolored, progresses with time and are more prevalent during wet seasons when drying is delayed. This results in significant economic loss to farmers and millers. Yellowish/discolored paddy or milled rice is severely discounted. Consumers prefer good quality milled rice with white luster. This study was conducted to determine the real cause of postharvest rice grain yellowing or discoloration. A laboratory scale experiment wad done to determine the individual and/or interaction effect of MC, grain form, storage temperature and time. Field conditions were simulated to control the variables and isolate suspected causal factors and determine their effect on the grain. The theory was that postharvest rice grain yellowing was due to the diffusion of yellowish-brown pigment from the rice hull to the starchy endosperm. Diffusion of yellowish-brown pigment from the rice hull did not occur. The yellowish-brown color, after dehulling, was confined to the aleurone layer, which disappeared after milling. The interaction of MC, grain form, storage temperature and time had a significant effect but were not the primary cause of rice grain yellowing. The rate of rice grain yellowing generally increased over time in both paddy and milled rice. Grains stored as paddy developed significantly higher amount of yellow grains than did milled rice. The biochemical aspects of the rice grain were investigated. Changes in the total protein content and viscosity of white and yellow grain over time were statistically analyzed. No significant differences were found. Hence, biochemical changes were not the cause of rice grain yellowing or discoloration. Furthermore, if they were the cause then all grains in the stock would become yellow or discolored, which was not the case. The negative results led to an investigation of possible effects of microbial growth on wet grains. Laboratory sterilization and culture technique applied on the grain samples, from the wet season harvest,

indicated that microorganisms specifically fungi, were present and possibly caused the postharvest rice grain yellowing. *Aspergillus flavus, Rhizopus* and *Penicillium* species were detected in both paddy and milled rice. A validation experiment was done and it confirmed that *Aspergillus flavus* and *Rhizopus stolonifer* were causal agents of rice grain yellowing. *Penicillium* sp. was not found in the grain samples during the dry season validation experiment. Given this new knowledge, a collaborative effort applying the principles of microbiology and agricultural bioprocess engineering is required to develop a rice postharvest system and technology that can control fungal growth and preserve grain quality in commercial systems.