

Title Freezing temperature and freezing injury of rough rice, and quality of rough rice stored at temperatures between -50°C and 25°C for four years

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Abstract

A differential scanning calorimeter was used to determine freezing temperature of rough rice. Rice grains with a moisture content of 22.1% froze at about -35°C . Rice grains with a moisture content of less than 20.8% did not freeze at a temperature of -55°C . Incidence of freezing injury of rice grains was determined by germination rate because grains that suffered from freezing injury did not germinate. Rice grains with a moisture content of less than 17.8% germinated after being stored at -80°C for 11 days. Thus, no grain with a moisture content of less than 17.8% froze at a temperature of -80°C .

Effects of temperatures between -50°C and 25°C on physiological properties and quality characteristics of rough rice during four-year storage were investigated. Low temperature maintained vitality of rice, minimized physiological activities, starch deterioration and rancidity in rice, and consequently preserved rice quality. Eating quality of rice stored at temperatures less than 5°C for four years was the same as that of newly harvested rice. These results indicate that preservation of rough rice quality for several years is possible by storing rice at an average temperature below 5°C during storage. A new on-farm rice storage technique at temperatures below ice point by using natural fresh chilly air in winter has been in practical use in Hokkaido, the northernmost island of Japan, in recent years. Twenty-six grain elevators have been constructed in Hokkaido since 1996. The storage capacity of rough rice in 2004 was 115,000 t.