GLUTAMIC ACID DECARBOXYLASE ACTIVITY AS A VIABILITY INDEX OF ARTIFICIALLY DRIED AND STORED RICE[1]

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ABSTRACT

Glutamic acid decarboxylase activity (GADA), as determined by a Sandstedt and Blish pressuremeter, was a more reliable index than fat acidity of the viability of stored rice of two varieties. The regression equations for GADA of the two varieties were not significantly different.

With combine harvesting of rough rice at high moisture contents and subsequent artificial drying, it is expected that the rice kernel may be increasingly subjected to conditions of high temperature and humidity which would adversely affect its viability (4,7,10). Hence, there is urgent need for a rapid, reliable viability index. Recently, glutamic acid decarboxylase activity (GADA), as determined with the Sandstedt and Blish (9) pressuremeter, has been found to be a sensitive index of quality for stored wheat (5,6) and corn (3). This method is rapid and simple compared with other indices also based on the activity of specific enzymes of the grain. As part of this study of the physicochemical properties of stored rice, the relationship between GADA and seed viability was investigated.

Materials and Methods

The 24 samples each of two nonwaxy (nonglutinous) varieties, Peta (*indica*) and Chianung 242 (*japonica*), were derived from the same 1962 wet-season crop at the Institute farm. The samples had been artificially dried with heated air at 40°C. and they had been stored for at least a month at various conditions of moisture content and temperature in airtight containers.[2]

The stored rough rice samples were immediately dried in a forced-draft oven at 37°C. for 24 hr. (final moisture content, about 11%). Percentage germination was determined by the modified paper towel method (4,7) on kernels which had been preheated to about 49°C. for 4 days to break dormancy. The viability ranged from 0 to 92%. The dried samples were dehulled with a McGill Sheller and cleaned in a Bates Laboratory Aspirator. The brown (dehulled) rice was stored in

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[2]The storage study in progress will be reported in a later paper.

airtight bottles at 4°C. until analyzed.

Glutamic acid decarboxylase activity (GADA) was determined as described by Linko (5), using Sandstedt and Blish pressuremeters filled with crystal violet-colored ethyl lactate instead of mercury. Gas evolution, during 30 min. at 30.0 ± 0.1°C. by 30.0 g. of ground brown rice (2 min. with a Waring Blendor at high speed) from 15.0 ml. of 0.10*M* glutamic acid in 0.067*M* phosphate buffer at pH 5.8, was recorded; the reading, in mm. ethyl lactate, was taken as a measure of GADA.

Fat acidity was determined on freshly ground brown rice by the benzene extraction method (1) and expressed as mg. of potassium hydroxide in 100 g. of sample (wet-weight basis).

Results and Discussion

Highly significant correlation was obtained between GADA and germination percentage for both varieties (Fig. 1). The correlation

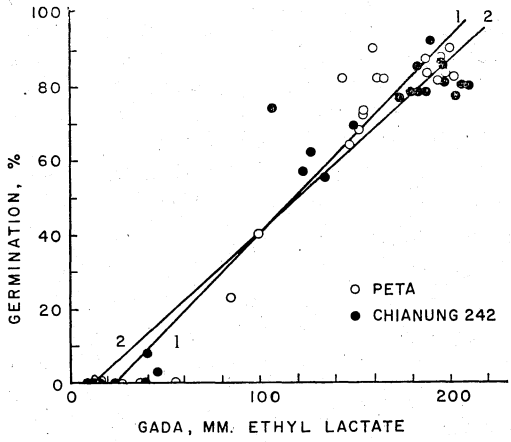

Fig. 1. Relation between glutamic acid decarboxylase activity (GADA) and germination percentage of 24 samples each of two varieties of rice. 1 = Peta and 2 = Chianung 242.

coefficient was +0.96** (22 d.f.) for Chianung 242 and +0.97** (22 d.f.) for Peta. The corresponding regression equations were $y = -5.4 + 0.46x$ and $y = -13 + 0.53x$, respectively. The difference in the regression equations of the two varieties was not significant. Brown rice was intermediate in GADA to corn (3) and wheat (6), corn having the highest activity.

A comparable relationship was noted between log GADA and germination percentage. The correlation coefficient was +0.93**

(22 d.f.) for Chianung 242 and +0.97** (22 d.f.) for Peta. These coefficients obtained were as high as those reported for wheat (6) and corn (3).

Figure 2 illustrates the relationship between the fat acidity and germination percentage in the tests with rice. The regression equation

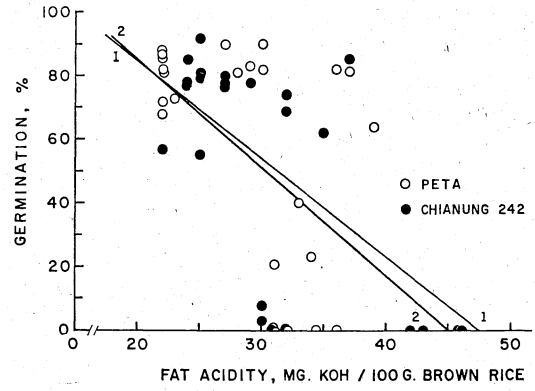

Fig. 2. Relation between fat acidity and germination percentage of 24 samples each of two varieties of rice. 1 = Peta and 2 = Chianung 242.

was y = 153 − 3.4x for Chianung 242 and y = 147 − 3.1x for Peta. The correlation coefficients of −0.67** (22 d.f.) for Chianung 242 and −0.48* (22 d.f.) for Peta were lower than those obtained between GADA and germination percentage, indicating the higher reliability of the GADA method. GADA also more reliably and sensitively measures deterioration of wheat (5,6) and corn (3) than does fat acidity. Houston and co-workers (4) noted that log free acidity of rice fat had lower correlation than germination percentage with log mold growth. A fat acidity limit of 25 mg. of potassium hydroxide per 100 g. had been tentatively set for undeteriorated rough rice (2), which is equivalent to about 30 mg. per 100 g. of brown rice.

Aside from its reliability, the GADA method compares favorably with other tests of viability in terms of rapidity. For example, although it is claimed that the rapid 2,3,5-triphenyltetrazolium bromide test can be performed in 3 hr. (8), a technician can analyze one sample with the GADA method in approximately 45 min., or a series of 10 in about 90 min.

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