Storage of Rice. XI.

Studies on HOSHII Stored Hermetically Sealed for Twenty-three Years on a Mountain.

By

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I. Introduction.

In an earlier paper the authors reported the results of their studies on hulled rice stored air-tight 26 and 28 years, as well as on four lots of unhulled rice stored 46 to 84 years in granaries. Recently they had an opportunity to continue the work, employing Hoshii, which had been stored 23 years in a cottage on a mountain in anticipation of the needs of laborers there. Hoshii is made of polished white glutinous rice and is much used for cakes. In ancient times it was eaten by travelers and soldiers. The mountain being 700 meters high, the climate is cool and moist. Since the Hoshii was stored in tin containers hermetically sealed, the moisture in the air was not significant. It is believed that the study of Hoshii stored 23 years under these conditions is of particular interest, especially as the subject has not previously received attention. In 1933 the containers were opened and the quality of the Hoshii was determined.

II. Results of Investigation.

In all cases the authors compared the results on the old Hoshii with those on the new.

A. General Quality.

Hoshii is graded according to the size of the grain as coarse, medium, and fine. The lot under investigation belonged to the fine class. It was pale yellowish brown and it appeared to have lost a little of its luster, whereas the new Hoshii was white, semitransparent and distinctly lustrous; however, so far as the general quality was concerned, no real spoilage was evident.
B. Boiled Hoshii.

The old and the new Hoshii were steam boiled for 15 minutes and the taste of the two was compared. Preliminary to boiling, the Hoshii was thoroughly cleaned by washing and soaked in water until a sufficient amount was absorbed. The general quality of the boiled Hoshii was as shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Colour</th>
<th>Stickiness</th>
<th>Odour</th>
<th>Change of Qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Hoshii</td>
<td>pale yellowish</td>
<td>slightly</td>
<td>slightly</td>
<td>After 30 minutes became a little hard, after 24 hours granular, much less sticky, rough on tongue.</td>
</tr>
<tr>
<td>(Stored 23 years)</td>
<td>brown</td>
<td>deficient</td>
<td>abnormal</td>
<td></td>
</tr>
<tr>
<td>New Hoshii</td>
<td>milkly white</td>
<td>satisfactory</td>
<td>normal</td>
<td>After 30 minutes no change was noticed, after 24 hours still soft, sticky, smooth on tongue.</td>
</tr>
</tbody>
</table>

As the above table shows, the boiled Hoshii from the lot stored 23 years was slightly coloured, less sticky than normal, had a slightly abnormal odour, and easily became granular, but it was nevertheless fairly edible. When it was boiled again, it became very soft and smooth and had a very pleasing taste. When Hoshii is boiled, its volume increases greatly. The increase in volume of the old Hoshii was 47 per cent and that of the new Hoshii 45 per cent, that is in the former case the volume increase was a little greater than in the latter. Determinations of the viscosity of a 5 per cent paste at 40°C. were made on both the old and the new Hoshii and compared with water taken as 1. The results are as follows:

Old Hoshii 1.23, New Hoshii 1.53.

It appears that the viscosity of the old Hoshii is much less than that of the new, thus paralleling the results on the stickiness of the boiled rice given above.

C. Chemical Analyses.

The Hoshii was analyzed by the ordinary process, the results being as given in Table 2.

In comparing the composition of both lots of Hoshii, it may be seen that no distinct change occurred during storage for 23 years. The slightly higher percentages of ash and crude fiber in the old Hoshii were doubtless due to insufficient polishing.
Table 2.
**Composition of Hoshii.**

<table>
<thead>
<tr>
<th></th>
<th>Moisture</th>
<th>In the dry substance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Old Hoshii</td>
<td>16.44</td>
<td>0.35</td>
</tr>
<tr>
<td>New Hoshii</td>
<td>15.30</td>
<td>0.16</td>
</tr>
</tbody>
</table>

### III. Discussion.

Although it was brought out in the investigation, as stated above, that the old Hoshii, which had been stored for 23 years, showed no chemical change and was in fairly edible condition, nevertheless some physical changes occurred during the storage. In general it may be said that the storage was a success and the success must be due to the air-tight storage. If the Hoshii had been packed in a sack or a wooden box, it certainly would have greatly deteriorated and perhaps not have been edible. On the mountain, where the Hoshii was stored, the atmosphere although moist was cool and this factor must be regarded as favorable for proper storage. The moisture content of the Hoshii, which was 16.4 per cent, in the opinion of the authors, was rather too high: had it been less, the quality would have been better.

The authors have demonstrated that Hoshii can be kept without change in quality even longer than 23 years, if thoroughly dried and stored hermetically sealed in a cool place.

### IV. Summary.

1. The authors secured a sample of Hoshii which had been stored 23 years hermetically sealed in tin containers in a cottage on a mountain. In 1933 the containers were opened and the quality and composition of the Hoshii were compared with those of new Hoshii.

2. The old Hoshii was pale yellowish brown and less lustrous. The boiled Hoshii was less sticky, had a slight odour, and hardened easily. Notwithstanding these changes in the physical properties, chemical analysis showed no difference in the nutrients. Its culinary characters on the whole were quite satisfactory.

3. It is clearly evident that the success of the storage of the Hoshii for 23 years was due chiefly to the air-tight storage. If the Hoshii had been more thoroughly dried and stored cool, it doubtless would have been in even better condition.
Literature.
