Determination of Amylose Content in Different Rice Varieties

* S. Pandarinathan

* Agricultural College & Research Institute, Killikulam, Tamil Nadu, India - 628 252

Abstract

A Laboratory study was conducted to determine the Amylose content in different varieties of rice at Biochemistry Laboratory of Anbil Dharmalingam Agricultural College & Research Institute, Trichy - 620 009, India, during the period from 2013 to 2014. Fourteen varieties as the test grains in completely randomized design with three replications were tried. Significant (p< 0.05) differences of Amylose content were observed among the varieties. Kambansamba recorded the highest and Kanda Sali the lowest Amylose among them. Specifically in Tamilnadu of south India, hundreds of rice varieties had been marked with nutrient values and culinary taste. This paper describes the amylose content of various rice varieties. Results of this study between the various rice varieties investigated might be able to provide vital information on identifying low amylose rice varieties cultivated/marketed in Tamilnadu.

Keywords: Amylose, Rice varieties

Introduction

Rice is grown on about one-tenth of the earth's arable land (Ammar et al., 2007). Rice (Oryza sativa L.) is an important cereal and a staple food for half of the population of the world. There are many varieties of rice in the world. Rice is India's prominent crop. The type of rice grown in different parts of India depends on the weather, soil structure, characteristics and purposes. Rice in India is grown under diverse conditions. Rice is an economically important food crop with nutritional diversification and helps in poverty alleviation. There are various varieties of rice cultivated in India. Rice comes in many shapes and colors. Rice is an enormous source of starch and amylose is the component, which affects the cooking and eating properties of rice. Grain quality is one of the most important objectives of most rice breeding programs. Consumer acceptance of a variety depends primarily on its cooking quality. Varieties with desirable cooking qualities are at a premium in the market. The varieties, hybrids, land races of rice are immense in diversity not only in morphological traits but also in end-use qualities. Starch is the major energy reserve in many of the world's most important foods such as the seeds of cereal grains. Rice starch is digested so quickly than any other high starchy food and this aspect make it distinctive among other cereals. Of the cooking quality components, amylose content is the most important because it determines cooked rice texture. Rice varieties with very low amylose content become very sticky, moist and tender on cooking. Whereas varieties with intermediate amylose content become fluffy, soft, moist and tender and those with high amylose content become fluffy and dry and harden on cooling. Different regions of the world prefer rice varieties with different cooking characteristics. Rice grain quality will be influenced by various physiochemical characteristics that determine the cooking behavior as well as the cooked rice texture. Specialty rice is a term used to distinguish cultivars of rice that have unique properties like flavor, color, nutrition and chemical composition (Yang et al., 2010). Consumers are now begin to demand higher quality and better tasting rice. Classification of amylose content identified classes as waxy (0-5%), very low (5-12%), low (12-20%), intermediate (20-25%) and high (25-33%), even considering that commercially rice is classified by amylose content as either low (less than 20% amylose), medium (21-25%) and high (26-33%) (Juliano, 1992; Suwannaporn et al. 2007).
The main differences in starch composition that influence physiochemical and metabolic properties of rice are caused by the variation in the ratio of its two macromolecules, amylose and amylopectin. Amylose is essentially a linear molecule in which D-glucose units are linked by α(1→4) glucosidic bonds, while amylopectin, a branched polymer, contains both α(1→4) and α(1→6) bonds. Rice texture is soft and sticky for varieties having low amylose content while rice varieties become stiff and fluffy on cooking having high amylose content (Shabbir, 2008). The amylose content of the grains of a rice plant can be seen as the result of interaction between environmental forces and genetic properties of the individual variety (Gomez, 1979).

Hence, there is a need to identify the various ranges of Amylose content for commercial cultivation. Therefore, in the present investigation, emphasis has been given to evaluate the amylose contents of multiple varieties.

**Materials and Methods**

During this study, Whole rice grains were collected without any physical damage or insect infestation of traditionally cultivated rice varieties from traditional farming practicing farmers which are random in their morphological characters of shape, size and color. The main basic parameter for cooking and eating quality i.e. amylose content, is estimated for 14 traditional varieties of rice.

**Estimation of Amylose Content**

Amylose content in dehusked and ground rice grain samples were determined based on the Iodine-binding procedure as described by Juliano (1971). In brief, for 100mg of rice flour, 1ml of ethanol (95%) and 9ml of 1N NaOH were added in a volumetric flask (100ml) followed by thorough mixing. Further, samples were heated on a boiling water bath for 10min to gelatinize the starch and later on cooled to room temperature. Five millilitre of gelatinized starch solution was then transferred to a 100ml volumetric flask followed by 1ml of 1N acetic acid and 2ml of iodine reagent were added (0.2g of iodine and 2g of potassium iodide diluted to 100ml with distilled water), with the volume adjusted to 100ml with distilled water. All the contents were thoroughly vortex mixed and allowed to stand for 20 min. The absorbance was read at 590nm using a UV-Spectrophotometer. The amylose content in the samples was determined based on standard graph. Experiments were performed in triplicates.

**Statistical Analysis**

The experiment was carried out in a completely randomised design. All results were expressed as the mean value. The data obtained were subjected to statistical scrutiny for the parameter under study. The level of significance was considered at P<0.05.

**Results and Discussion**

The results obtained were analyzed during the period from 2013 to 2014. Table-1 depicted that Panagkattukudavazai and Kanda Salí contain very low levels of amylose (4%) whereas Kamban samba contains very high amount of amylose content (19%) i.e fivefold increase present in this particular variety. Amylose content ranged from 4.02 to 19.56%.
Table -1: Amylose Content of Traditional Rice Varieties

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Rice Variety</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vasanaiseeragasamba</td>
<td>5.490</td>
</tr>
<tr>
<td>2</td>
<td>Vellaikaar</td>
<td>6.210</td>
</tr>
<tr>
<td>3</td>
<td>Neelan samba</td>
<td>8.490</td>
</tr>
<tr>
<td>4</td>
<td>Kottara samba</td>
<td>17.020</td>
</tr>
<tr>
<td>5</td>
<td>Panagkattukudavazai</td>
<td>4.050</td>
</tr>
<tr>
<td>6</td>
<td>Kosuvakuthalai</td>
<td>12.610</td>
</tr>
<tr>
<td>7</td>
<td>Kudaivazhai</td>
<td>12.113</td>
</tr>
<tr>
<td>8</td>
<td>Thengapoo samba</td>
<td>16.177</td>
</tr>
<tr>
<td>9</td>
<td>Karupukavuni</td>
<td>14.020</td>
</tr>
<tr>
<td>10</td>
<td>Kamban samba</td>
<td>19.560</td>
</tr>
<tr>
<td>11</td>
<td>Kaivara samba</td>
<td>13.270</td>
</tr>
<tr>
<td>12</td>
<td>Sivapukuruvikar</td>
<td>14.750</td>
</tr>
<tr>
<td>13</td>
<td>Kanda Sali</td>
<td>4.027</td>
</tr>
<tr>
<td>14</td>
<td>Koomvalai</td>
<td>10.630</td>
</tr>
</tbody>
</table>

SEm 0.0218  
SED 0.0308  
CD 5% 0.0622

By CRD analysis, Varieties are statistically significant at 5% level of significance

A good knowledge of the nutritional value of individual cereal crop like rice locally available is important. As in other cereals, the amylose content of rice endosperm is thought to play important roles in grain yield, palatability and processing quality. The Amylose content of rice is governed by the genotype and the conditions under which they are grown. Knowledge of the causes of difference in grain amylose among varieties may also be useful in studying how environmental factors affect the amylose content of the grain. The results of the present study report shows that there were very low and low amylose content containing rice varieties too present. Low amylose rice cooks moist and sticky. The data regarding amylose content revealed significant difference among rice varieties. Based on the amylose content, the gelatinization temperature varies and the tenderness of rice grain depends upon the amylose content (Juliano, 1985). Amylose content can play a significant role in determining the overall cooking, eating and pasting properties of a rice variety(Adu-kwarteng et al., 2003). Apart from the amylose content, the cooking quality of rice can also be influenced by components such as proteins, lipids or amylopectin (Cai et al., 2011). Most of these traditional rice varieties are found mainly in Tiruchirappalli region and cultivated in small patches. Out of 14 rice varieties collected, some of the varieties becoming rare but their amylose content is appreciable. So there is a need to preserve these varieties. The amylose content of a rice variety can vary by as much as 6 percentage points (Juliano, 1972). Temperature during grain ripening has been shown to affect amylose content (Stansel, 1965; Suzuki and Murayama, 1967);
Kihara and Kajikawa, 1960; Murayama et al., 1963; Nikuni et al., 1969). Amylose content generally decreased as the mean temperature increased. However, response to temperature may differ, depending on whether the variety is japonica or indica (Resurreccion et al., 1977) and depending upon the inherent level of amylose content of the varieties (Paule, 1977). Waxy rice flour is chosen for its unique soft and sticky texture in many Asian desserts. Snacks, many puffed breakfast cereals are produced using low amylose rice; intermediate amylose rice is used in canned soups and higher amylose rice is chosen for products requiring an intact cooked product, such as extruded pasta, noodles, and retort boiled rice (Juliano and Hicks 1996).

A key finding was that mere cultivation of rice alone will not yield biologically effective rice seeds. Knowledge of varietal influence of rice with high or low content of amylose will be useful to screen before cultivation.

Conclusion:

The amylose content of rice seeds is an important biochemical trait, affecting both yield and nutritional quality of one of the world’s most important foods. Thus, an understanding of the genetic control of amylose content in rice is a major goal of basic agricultural research. Information about the molecular mechanisms that control amylose content in rice endosperm will be important in designing breeding and genetic engineering strategies for improving both yield and nutritional quality in this prominent food crop. Results obtained in this study are expected to be useful for preparation of novel rice based food products, based on the individual requirements. Regarding the significance of consumer preference of such traditional rice varieties could aid in the conservation and propagation using conventional and unconventional breeding programmes. The studied rice varieties are mostly of low amylose type. These varieties are acceptable for the low amylose content, which are easily digestible and so good for the elder people and the children. High amylose content rice variety might be useful for malnourished people whereas less amylose content variety might be useful for diabetic patients. Since India being the diabetic hub, the outcome of the present study will serve good to the human society.

References:


