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Rice Quality identification and Rice market in Italy : present norms and new proposals

Authors :

MAZZINI, Flavio

ENTE NAZIONALE RISI - Centro Ricerche Sul Riso
 ,Strada per Ceretto 4 -27030 - Castello d'Agogna ITALY
 Tel : + +39 384 90073
 Fax:+ 39 384 98673

Abstract

The Italian rice market is variety-based and a variety name has to be printed on the rice package. More than one hundred varieties are registered in Italy, but the effectively cultivated are about eighty and about ¼ of them are grown on 1000 ha or more. Rice mixture of two or more varieties cannot be marketed as rice. Having so many varieties, it is necessary to group them into clusters of similar varieties.

According to the in force law, the rice produced in Italy is grouped in 11 clusters : some include only one variety, others many varieties. Each year, new varieties are included in the different clusters, and the no more cultivated are excluded. The assumption for this is the likeness of the varieties in the same cluster, in particular in respect of the cooking quality. Generally, the Italian consumers choose and buy a type of rice referring to the variety name, as years go the name of some rice varieties become famous and identify typologies of rice. When a cluster includes more varieties, a seller can freely mark the package containing a rice variety with the name of any variety included in the same cluster, in practice the most famous one.

Clustering is performed considering only the morphological traits of the grain. Dimensions, shape, pearl presence and dimension, are the parameters taken into account to include a variety in one cluster or in another, no chemical and physicochemical parameters have been considered until now.

The results we obtained on the characterisation of the Italian varieties, show that varieties with similar morphological traits but very different cooking quality, are included in the same cluster; the results obtained are discussed and a proposal is suggested to change the rules of Italian market rice, taking into account also some chemical and physicochemical parameters.

Keywords

-  .Rice quality, cooking quality, rice trade, rice standard
-  Italy.

Present norms for the domestic trade of Rice

In Italy, the domestic trade of rice is regulated by a law dating back almost forty years and by an annual decree of the ministry of agriculture. It is provided that when a product labelled "rice" is sold, it has to be identified by a variety name, and it has to contain grains of only one variety. Limits for broken grains, extraneous matter and defective grains are also fixed. Consumers choose and buy a type of rice referring to the variety name. As years go by, the name of some rice varieties becomes famous and identifies typologies of rice. To avoid disorientating consumers with tenths of variety names, varieties are subdivided into homogeneous clusters (11 are now provided) and the rice of each variety into a cluster can be sold using the name of each variety included in the same cluster, in practice the name of the most popular variety is used. Each year, clusters are updated deleting the no more cultivated varieties and including the new ones.

Rice Qualities in Italy

Traditionally, the domestic consumption of rice was directed to "risotto", the typical Italian dish, for which long and large grain varieties are preferred, and to soup, for which short and medium grain varieties are preferred.

In few years, rice consumption has changed very much : parboiled rice (25% in 1996) and the demand for ready-to-eat and ready-to-cook products have increased. A great number of new varieties have been registered and, at present, more than one hundred varieties are registered : the actually cultivated are about eighty, but only about $\frac{1}{4}$ of them are grown on 1000 ha or more.

In 1997 paddy fields are estimated to cover about 230,000 ha : 25% are short grain varieties, 13% are medium grain varieties, 8% are long-B (indica type) varieties, 29% are long-A varieties normally used for parboiling and 24% are long-A varieties normally used for "risotto".

The Quality Concept

Rice utilisation is so large and different that it is not easy to state a single quality concept. Being used as whole grain and not as flour like other cereals, the general aspect of rice, the percentage of broken grains, of damaged grains and so on are all important quality factors. On the other hand important quality factors are also those related to specific utilisation. In this context, a type of rice has got an higher or lower quality only in relation to its utilisation.

The Criteria for Quality

The different agronomic and phytopathological conditions require many different varieties, but this has not to involve an infinite number of grain qualities. It is necessary to cluster the varieties into homogeneous quality groups according to the different rice utilisation. In this context the quality criteria utilised to state homogeneity among varieties are basic.

Until now criteria based on morphological traits and subjective judgements have been used in Italy to cluster varieties. These criteria are more and more unsuitable to cluster varieties taking into account their cooking or processing quality. While morphological traits and subjective judgements are suitable to state quality according to the damaged grains, extraneous matter and so on, they are insufficient to evaluate cooking qualities connected with chemical and structural components.

The Quality Evaluation

Looking for some parameters useful in practice to better characterise the different types of grain, and then to cluster varieties in more homogeneous groups, some parameters were analysed on 57 rice varieties cultivated in Italy. Since the environmental conditions affect practically all the grain characteristics, all the determinations were repeated for 3 crop

seasons, to evaluate a range for each varieties. The considered parameters were : length and width of the raw and the cooked rice, time of gelatinization, amylose content, hardness and stickiness of the cooked rice, protein content, alkali spreading value, water absorption and solid loss during cooking.

A detailed discussion on all the obtained results exceed the time of this report. Some observations on the parameters we consider more interesting for clustering the varieties are discussed in the following.

The varieties we considered included short grain, medium grain (with both slender and bold shape) and long grain (with both slender and bold shape); each type included varieties with vitreous grains and not. All people agree that the dimensions of the grains together with the presence of the pearl and its dimension, are very important quality factors for the consumers' direct visual impact and for their consequence on rice cooking and palatability. So these characters have always to be considered clustering rice varieties.

The time of gelatinization is an objective way to determine the time necessary to gelatinise the rice grain, so it can be useful to compare varieties according to their cooking time. The mean value among the 3 crop seasons we considered (fig. 1) ranges from 14.6 minutes of the Vela variety to 22.1 minutes of the Strella variety. Long and short time of gelatinization are recorded both for big and small grain types. Although the variability among samples of the same variety is quite large (1-2 minutes in most cases), many varieties are well distinguishable from the others. Since varieties in the same cluster should have a cooking time as similar as possible, this parameter could be usefully considered when varieties are clustered.

Regarding the amylose content, the mean value of the 3 crop seasons ranges from 15.8% of the Cervo variety to 26.4% of the Thaibonnet variety. On the basis of all our results (fig. 2), a relevant consideration is evident : there are not values in the range from 20.7% to 22.3%. This gap is remarkable also for the rice hardness values. Considering the mean values of the 3 different crop seasons, the amylose content (fig. 3) shows high correlation with the rice hardness values ($r = +0.939^{***}$, $n = 57$); there is a high correlation also in each crop season. But, if we consider only the varieties with an amylose content below the gap or only those above the gap, the correlation with hardness is very lower ($r = +0.529^{***}$, $n = 38$, and $r = +0.470^{**}$, $n = 19$), and in some years it is not statistically significant. A quite similar picture we noted for the rice stickiness values, taking into account that the correlation with the amylose content and the rice hardness is negative. The amylose content is generally considered a very important parameter for rice quality, and considering also the above relations, it should be included among the criteria used to cluster varieties in homogeneous groups.

If we consider the varieties cultivated in Italy for their time of gelatinization and amylose content, in addition to their morphological parameters, we could understand why some varieties cause problems and some others became famous. Table 1 shows some parameters and the ranges of the values we registered for the main varieties of the first cluster, the short grain one. Balilla is the most famous variety, Selenio and the other short grain varieties are used to replace this variety. A great part of this type of rice is transformed to ready-to-eat products, but Elio variety (18% of the short grain cultivated surface) proved in many cases to be unsuitable and caused several problems. The amylose content of Elio is $22.8\% \div 23.2\%$, that is, four or five percentage points more than the other varieties of the same cluster, as well as the time necessary to gelatinise the grains is 2÷3 minutes shorter. Clearly this varieties is not homogeneous with the others included in the same cluster.

Rosa Marchetti is a very appreciated variety, but unfortunately it is almost disappeared owing to phytopathological problems. The other varieties in the same cluster are quite similar to Rosa Marchetti for the morphological traits, but their time of gelatinization is 2÷6 minutes shorter than that of Rosa Marchetti (table 2). Also in this case the cluster is not homogeneous.

Table 3 shows the most popular varieties used for "risotto", all with large grains. The most popular variety is Arborio, but the most famous and expensive are Carnaroli (a long and large grain variety) and Vialone nano (a medium length but large grain variety). Arborio and Volano belong to the same cluster, even if the latter is a little longer and larger, the cluster can be considered homogeneous. Carnaroli and Vialone nano were included in separate clusters on the basis of subjective judgements. The higher amylose content of Carnaroli, as well as the hardness and stickiness values, confirms that this variety is different from the other long and large grain varieties. In the case of Vialone nano some other medium grain varieties have got similar amylose content, but they are more slender or need more time for gelatinization.



Proposal for Updating the Norms

The results of our work confirm once more that there are many aspects for which rice from different varieties could not be considered qualitatively homogeneous. The prohibition of selling as "rice" a mixture of different varieties - as provided by the Italian rules - avoid consumers finding grains with different cooking characteristics in the same packet of rice. On the other hand the permission of selling the rice of one variety with the name of each variety included in the same cluster requires that clustering is done not considering only the morphological characteristics to avoid selling very different product with the same name. Many of the parameters we determined, and others more, could be surely useful to better characterise the different type of rice. On the basis of this work we suggest that the norm for clustering the varieties in

Italy provides at least the determination of the amylose content, for its relation with the hardness and the stickiness of the cooked rice and the determination of the time of gelatinization of grains, for its relation with the cooking time.

Table 1.Characteristics of the main rice varieties of the first cluster (short grain)

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Varieties	Balilla	Selenio	Elio
length, mm	4.78 ÷ 5.13	4.85 ÷ 4.92	5.00 ÷ 5.25
width, mm	2.90 ÷ 3.03	2.82 ÷ 2.90	3.00 ÷ 3.20
shape (length / width)	1.6 ÷ 1.8	1.7	1.6 ÷ 1.8
amylose content, %	19.0 ÷ 19.6	17.4 ÷ 19.4	22.8 ÷ 23.2
gelatinization time, minutes	17.9 ÷ 18.4	18.4 ÷ 21.4	15.4 ÷ 16.8

Table 2.Characteristics of the rice varieties of the third cluster

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Varieties	Alpe	Lido	Rosa Marchetti
length, mm	5.77 ÷ 6.11	5.64 ÷ 5.81	5.81 ÷ 5.88
width, mm	2.57 ÷ 2.64	2.50	2.77 ÷ 2.81
shape (length / width)	2.3 ÷ 2.4	2.3	2.1
amylose content, %	14.6 ÷ 16.4	15.6 ÷ 19.7	16.7 ÷ 17.3
gelatinization time, minutes	18.9 ÷ 19.6	16.2 ÷ 18.0	21.4 ÷ 22.0

Table 3.Characteristics of the main rice varieties used for risotto

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Variety	Arborio	Volano	Carnaroli	Vialone nano
length, mm	6.84 ÷ 6.93	6.88 ÷ 7.27	6.65 ÷ 6.93	5.42 ÷ 5.75
width, mm	3.29 ÷ 3.31	3.40 ÷ 3.49	3.05 ÷ 3.08	3.22 ÷ 3.39
shape (length / width)	2.1	2.0 ÷ 2.1	2.2 ÷ 2.3	1.7
amylose content, %	17.0 ÷ 18.7	18.3 ÷ 19.4	22.1 ÷ 22.8	22.5 ÷ 22.9
gelatinization time, minutes	17.0 ÷ 18.8	17.1 ÷ 18.1	17.7 ÷ 18.4	16.0 ÷ 16.8

Figure 1. Time of gelatinization of 57 rice varieties cultivated in Italy during 3 different crop seasons

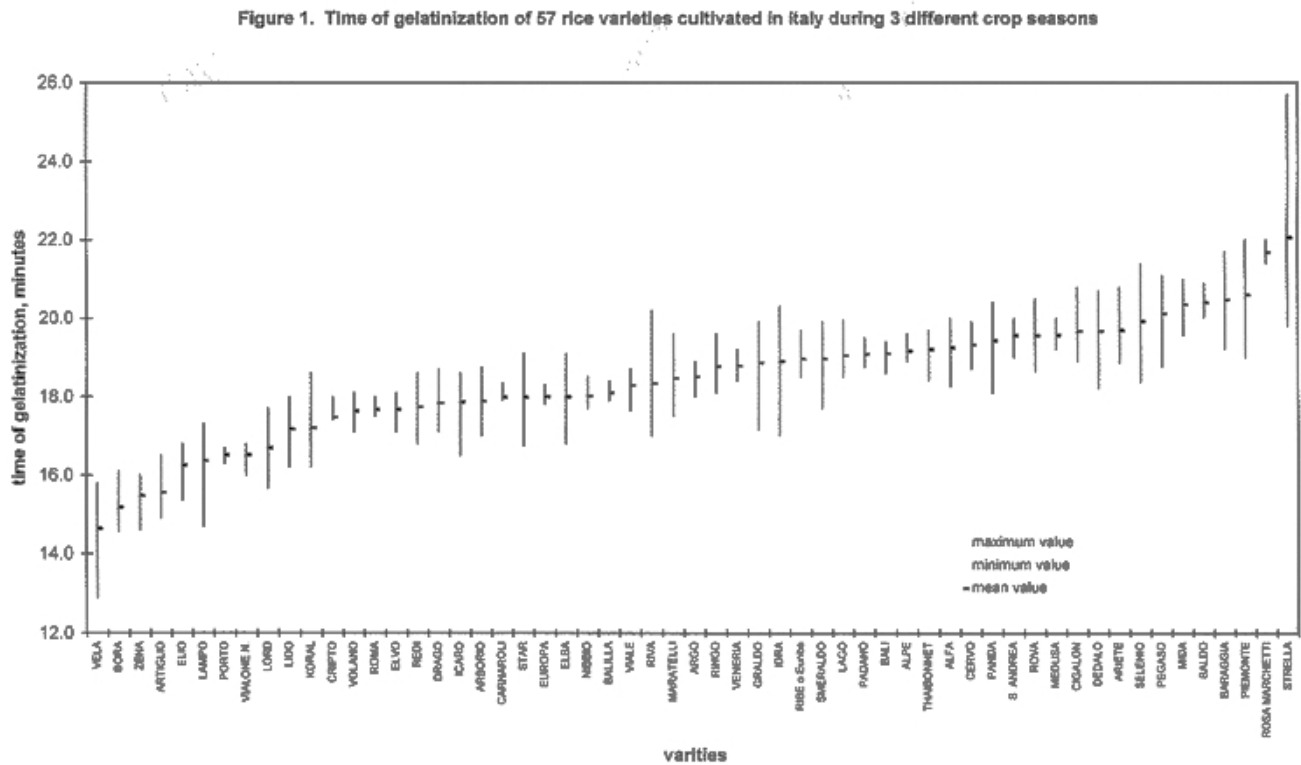


Figure 2. Amylose content of 57 rice varieties cultivated in Italy during 3 different crop seasons

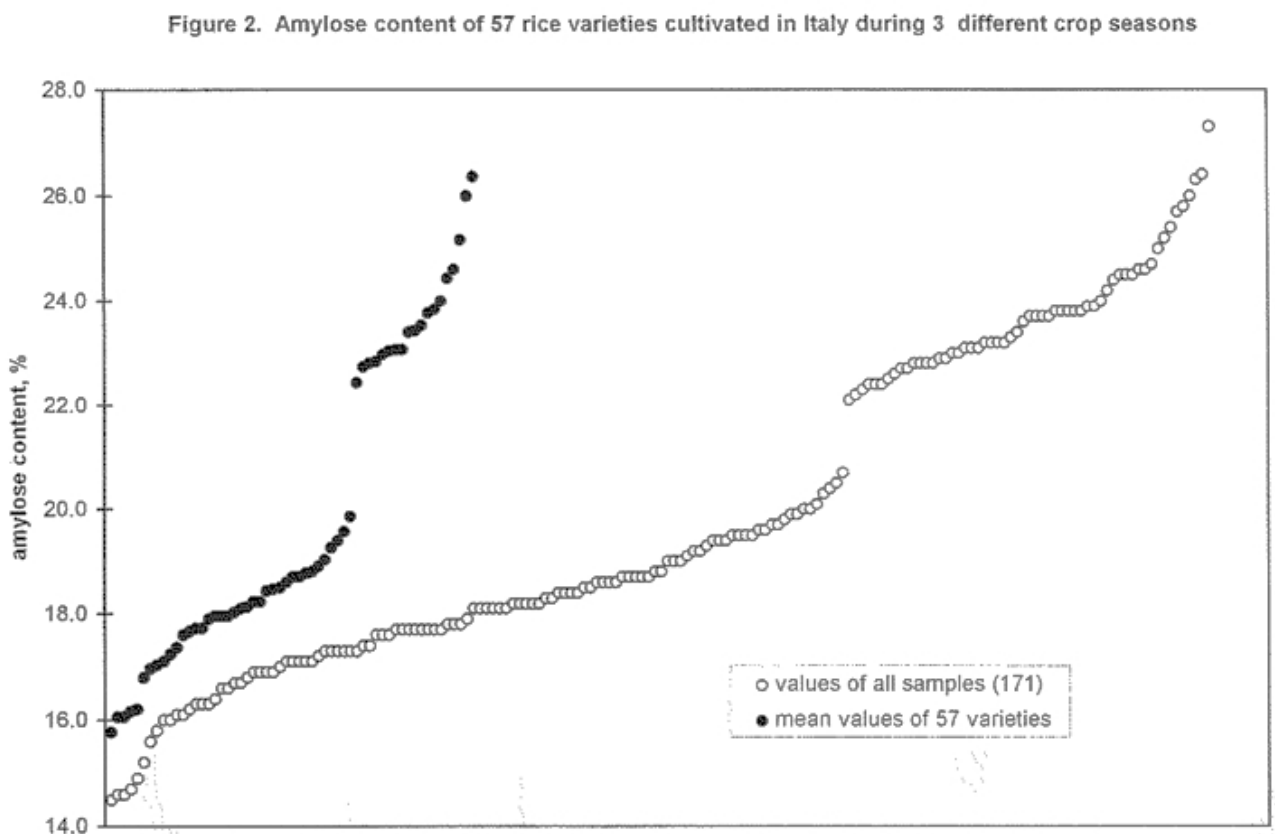
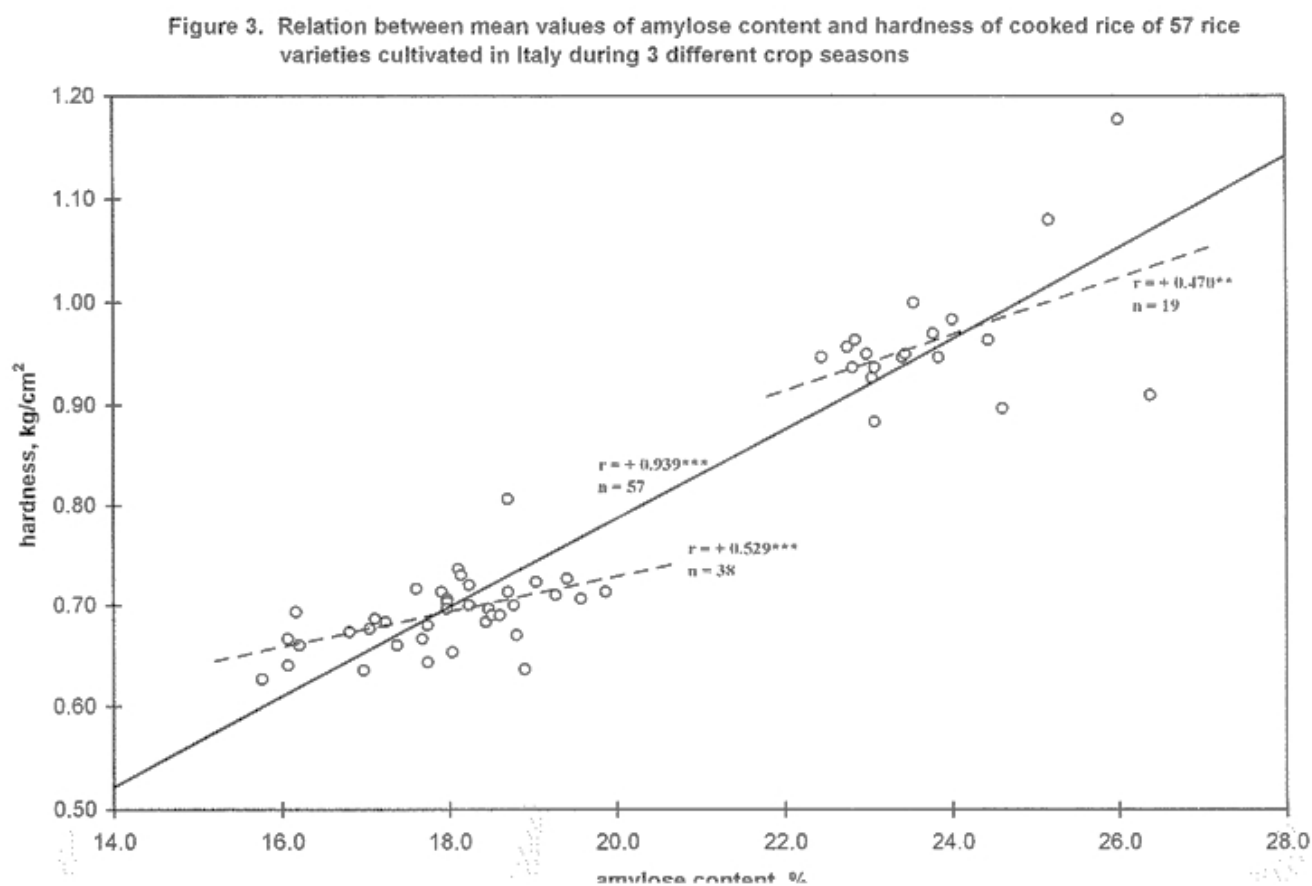


Figure 3. Relation between mean values of amylose content and hardness of cooked rice of 57 rice varieties cultivated in Italy during 3 different crop seasons



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