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AUTHENTICITY AND FOOD SAFETY ISSUES IN BASMATI RICE EXPORT

Anupam Dixit[1] and Rekha Dixit[2*]

Author's Affiliation
[1]Chief Scientist & Station In-charge
Basmati Export Development Foundation (BEDF) (Under the Aegis of APEDA, Ministry of Commerce Government of India) Roorkee Road, Modipuram,
Meerut- 250 110, U.P., India
[2]Department of Biotechnology, K.V. Subharti College of Science,
Swami Vivekanand Subharti University,
Meerut- 250 005, U.P. India

***Corresponding Author:**
Anupam Dixit
Chief Scientist & Station In-charge
Basmati Export Development Foundation (BEDF)
(Under the Aegis of APEDA, Ministry of Commerce
Government of India) Roorkee Road, Modipuram,
Meerut- 250 110, U.P., India

Email:
dixit59@yahoo.co.in

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Abstract

Basmati is long grain aromatic rice which is highly favoured and fetches higher prices in domestic as well as in the world market. Though India exports both Basmati and non-Basmati rice varieties, Basmati has become a major export item among agricultural products due to increase in its global popularity and hence demand, especially in the Gulf and European countries. The significant price differences between Basmati and non-Basmati rice varieties have come out with practices to adulterate Basmati with non-Basmati varieties. Export of Basmati rice has also faced problems in the last few years in different markets such as the U.S., E.U. and Iran owing to detection of heavy metals, aflatoxins and pesticide residues.

Keywords: Heavy metals, aflatoxins and pesticide.

INTRODUCTION

Rice is the staple food of more than 60 percent of the world population. Calories from rice are particularly important in Asia, especially among the poor, where it accounts for 50-80% of daily caloric intake. Rice belongs to the genus *Oryza* and has two cultivated and 22 wild species[1]. The cultivated species are *Oryza sativa* and *Oryza glaberrima*. *Oryza sativa* is grown all over the world while *Oryza glaberrima* has been cultivated in West Africa for the last ~3500 years (2). Asia accounts for over 90% of the world's production of rice, with China, India and Indonesia producing the most. Only 6-7% of the world's rice crop is traded in the world market. India contributes 21.5% of global rice production. Worldwide there are more than 45,000 different varieties of cultivated rice with grain colour differing from white, yellow, red, brown and black including several aromatic varieties with small, medium and long grains. The International Rice Genebank (IRG), maintained by the International Rice Research Institute (IRRI), holds more than 117,000 types of rice, including modern and traditional varieties, and wild relatives of rice. Among aromatic rice varieties, Basmati is a group of premium quality of aromatic rice varieties traditionally grown from ancient time in the foothills of Himalayas stretching across the Haryana, Western Uttar Pradesh, Delhi, Himanchal Pradesh and Uttara Khand regions of India and the Punjab province of India and Pakistan. Basmati rice is different from other aromatic rice varieties mainly due to its extra-long slender grains (>6.6 mm) that elongate at least twice of their original size with soft and fluffy texture when cooked and produce a typical aroma and distinct flavour [3]. These characteristic features make. More than 75% Basmati rice is produced in Punjab and Haryana whereas Uttar Pradesh contributes about 20% of the total Basmati produced in the country. Till date there are 30 rice varieties notified as Basmati under the seed act 1966. According to the figures available with All India Rice Exporters Association (AIREA), there is continuous increase in Basmati export during last decade from 1,045 million tons worth Rs. 2,792 crore in 2006-7 to four million tons worth Rs. 19,169 crore in 2016-17.

AUTHENTICITY ISSUE

Food authenticity refers to whether a product purchased by the consumer matches the label description. A product can be authentic when it complies with legal requirements & information provided such as product standards, species identity, geographical origin, production process method. Food authenticity issues fall, in fact, into one of several categories such as economic adulteration of high value foods by cheaper but similar ingredients, mis-description and/or mislabelling of foods not meeting the requirements for a legal name or implementation of non acceptable process practices (e.g. irradiation, freezing) and/or extension of food using adulterant (water, starch)

Rice grains of Basmati and certain other long-grain rice varieties are very much similar in appearance and difficult to be discriminated from each other on the basis of morphological or physic-chemical parameters. Such practices have been reported to be prevalent in 2004 according to a survey conducted by Food Standard Agency (FSA) of UK, where a total 363 samples were collected from a range of retail outlets and catering suppliers from across the UK and analyzed [4]. Based on DNA-fingerprinting analysis FSA reported 17 % of the samples contained more than 20 % and 9 % even over 60 % of cheaper long grain non-Basmati rice. Subsequently, In order to protect the interests of consumers and trade 'A Code of Practice' for Basmati rice was developed by Grain and Feed Trade Association (GAFTA) in consultation with the Local Authorities Co-ordinators of Regulatory Services (LACORS) and the Association of Public Analysts (APA), and in discussion with the Federation of European Rice Millers, the All India Rice Exporters Association (AIREA) and the Rice Exporters Association of Pakistan (REAP).The scope of this Code of Practice is restricted to the labelling of Basmati rice. It defines Basmati not only on the basis of cooking characteristics, aroma and geographic origin, but it also designates only 15 rice varieties as genuine Basmati. It states that for packs labelled Basmati rice, the inclusion of grains of other varieties (i.e. non-Basmati varieties) should be no more than that specified in the export standards laid down by the Indian and Pakistan Export Agencies. In practice this permits the presence of up to 7% non-Basmati rice in Basmati rice for the lowest grade to allow for unavoidable mixing during harvesting/processing. Moreover, the specific variety name may be given as voluntary information to the consumer and when Basmati rice is marked with a variety, that variety should constitute at least 97% of the Basmati rice content. Since then it become mandatory for Basmati exporters to provide a DNA Test certificate for authenticity and purity of each consignment of Basmati Rice exported to EU.

FOOD SAFETY ISSUES

India was the ninth-largest exporter of agricultural products among World Trade Organization (WTO) member countries in the year 2015, a decline from the seventh position in the year 2014. While all of the major exporters of agricultural products experienced a decline in exports in the year 2015, India recorded the most significant fall (of around 19 per cent from the previous year) and China had the smallest decline (2%). A careful analysis of the nations' agriculture exports shows that the country has been facing both tariff and non-tariff barriers to agriculture product exports. Among the non-tariff barriers, food quality, safety and health-related issues have been a key barrier to the nations' agriculture exports in key markets such as the United States (US) and the European Union (EU). The data from the United States Food and Drug Administration (USFDA) shows that it rejected more imports from India than from any other country in the first five months of the year 2015. Some of the commodities that were rejected include fried and baked snacks, fresh vegetables (such as okra), fishery products (such as shrimp and prawns), instant noodles (exported by Nestle India Ltd), Basmati rice and Indian spices.

GMOs (Genetically Modified Organisms)

Food safety concerns were not associated with rice till 2006. The only issues of major concern were dead insects and foreign objects. However, in 2006 an un approved GM variety liberty link Rice 601 (LL601) were detected in US exports [5]. However, no such issues for GM contaminations in Basmati export have been reported so far. It may be due to the ban in use of any recombinant technology for Basmati genome modification in India.

AFLATOXINS

Toxic contaminants such as aflatoxins in rice not only pose a threat to individuals, but, in a worst case scenario, might threaten an entire population. Even in minor concentrations, far below acute toxicity, a number of contaminants can chronically affect human health, e. g. by causing cancer or suppression of the immune system [6]. Aflatoxins are produced by molds of the genus *Aspergillus, which* grow during storage of the grain under warm and humid conditions. High dosage of these mycotoxins can cause liver failure and death. The control of contaminants in rice is therefore of prime importance for public health, in particular in countries which depend on rice as the major staple food. Aflatoxin species of major relevance are the types B1, B2, G1, G2, M1 and M2. The major aflatoxin occurring in rice is B1. Internationally regulatory limits for aflatoxins vary. EU imposed a maximum limit of 2µg/kg for aflatoxin B1 and 4µg/kg for the sum of aflatoxins for cereals in 2006, the Food and Drug Administration (FDA) of the USA allows five times as much, with 20µg/kg for the sum of aflatoxins. In Japan, the Food Sanitation Act prohibits the sale of foods in which aflatoxin B1 is detected at concentrations higher than 10µg/kg, whereas the maximum level for the sum of aflatoxins in India is 30µg/kg. Since then more than 100 notifications on aflatoxins in rice appeared in the Rapid Alert System for Food and Feed (RASFF) of the European Union (EU). Basmati rice from Pakistan exceeded the maximum limits of the EU most frequently, followed by rice and rice products from India. The rising number of notifications concerning rice in the RASFF of EU reflects the challenges that the rice industry and the rice trade have been through since 2006.

HEAVY METALS

There were only few RASFF notifications for heavy metals such as lead and cadmium in rice. Regulatory limits of 0.2µg/kg are defined for both contaminants in rice in the EU, but are rarely exceeded. However, there are as yet no regulatory limits for arsenic in rice, neither in the EU nor in the USA. Rice is a cereal that has the tendency to accumulate arsenic in comparison to other grains and the population's exposure to this contaminant is considered a risk factor, given that it has been classified as carcinogenic and genotoxic following recent toxicological studies[7, 8]. Arsenic occurs in rice mainly in two molecular species, as inorganic arsenite and organic di-methylarsenic acid (DMA). Health risks of arsenic in rice have been largely discussed based on its inorganic arsenic content, which is considered to be more toxic than the organic DMA. Maximum limits for inorganic arsenic in rice are currently under discussion in the EU and the USA and extensive risk assessments are ongoing. China and Iran have already defined a regulatory limit of 0.15 mg/kg and 0.12mg/kg, respectively.

PESTICIDES

Export of Basmati rice has faced problems in the last few years in different markets such as the U.S., E.U. and Iran owing to detection of pesticide residues exceeding the prescribed maximum residue limits (MRLs). Globally there are over 1300 different chemical compounds that have been used at some time for plant protection or which are still in use[9]. Specifically, at present 67 pesticides that have been banned in the US, the EU and other nations are still in use in India. Some major plant protection agents used in rice are herbicides like oxadiargyl and quinchlorac, insecticides like deltamethrin, Imidachlorpid and buprofezin against the stem borer and leaf folder, and fungicides like tricyclazole, Isoprothilane, Hexaconazole and propiconazole etc. against blast, dirty panicle, brown spot and sheath blight. Presence of pesticide residue in rice is adversely affecting export of rice to various nations as it failed to meet with their food standards. Following rejection of such rice, a number of rice exporters have suffered huge loss. Decline of Basmati rice export is not affecting the economy of the nation but also demoralising farmers to adopt crop diversification.

The most recent example is of Tricyclazole. A single 120-gram spray of this common fungicide, against leaf and neck blast disease in paddy, hardly costs Rs 150-170 per acre. But with the European Union (EU) deciding not to allow import of any rice having Tricyclazole levels above 0.01 parts per million (ppm) from January 1, 2018, farmers would find it difficult to spray the generic chemical sold under assorted brands like ‘Sivic’, ‘Baan’ and ‘Beam’. The existing tolerance limit stipulated by the EU (which accounts for about 3.5 lakh tonnes of India’s total annual Basmati shipments of 40 lakh tonnes) for Tricyclazole is one ppm or 1 mg/kg; 0.01 ppm will make it 1mg/100 kg. Similarly, the U.S. does not permit the presence of residue of Isoprothiolane beyond 0.01 mg/kg. Therefore, paddy farmers are required to be selective in use of pesticides keeping in view the target market. Lack of Good Agriculture Practices (GAP) among farmers is also one reason for contamination of rice with chemical residues. It is only the farmer who can control the presence of residue by following Good Agricultural Practices (GAP). There is a need to emphasise that the farmer has to use pesticides properly if he does not want his produce to be rejected by the exporter. It meant that the farmer has to spray the pesticide before flowering and not after harvesting.

An alternative approach to pesticide application is to “breed Basmati rice for disease resistance”. This involves transfer of specific disease-resistance genes, from both traditional landrace cultivars and wild relatives of rice, into existing high-yielding rice varieties [10]. Scientists from Indian Agricultural Research Institute (IARI), New Delhi have transferred the ‘Pi9’ gene into its popular Pusa Basmati-1 variety. This gene, sourced from *Oryza minuta* (a wild relative of *Oryza sativa*, which is the normal cultivated paddy), provides “very high resistance” against leaf blast and “moderate resistance” against neck blast fungus. The resultant variety, which is called Pusa Basmati-1637, combines Pusa Basmati-1’s high-yielding trait with resistance against a fungus that infests the leaf and neck nodes of the rice plant’s main stem, from where the grain-bearing ear heads (panicles) emerge. They have also developed and released two new varieties, Pusa Basmati-1718 and Pusa Basmati-1728, both of them incorporating the *Xa21* and *Xa13* genes that confer resistance to the bacterial blight pathogen. The first variety is basically Pusa Basmati-1121 and the second one Pusa Basmati-1401, containing both these genes obtained from *Oryza longistaminata* (another wild relative of rice) and BJ1 (a traditional land race), respectively.

CONCLUSION

To conclude, Indian government should take some corrective actions immediately. The pesticides and chemicals that are banned in developed countries should be phased out and not subsidised. State agriculture department should work with agriculture institutes and universities to train farmers to adopt GAP. There is also need for training of exporters, small and medium processors and other supply chain agents through programmes such as the India-EU Capacity-building Initiative for Trade and Development (CITD) project to upgrade their knowledge about the requirements of the importing countries. Further, Agricultural and Processed Food Products Export Development Authority (APEDA), which was set up to promote agriculture exports under the department of commerce, has recently taken up the role to set up a traceability system known as the TraceNet for various agricultural products including Basmati Rice.

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