MARKET TESTING AND CONSUMER ACCEPTANCE OF IRRADIATED RICE (*Oryza sativa indica* Linn.)

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Abstract. Special grade A fragrant rice (Jasmine rice) of 13% moisture content was obtained from a local miller in Bangkok. Low density polyethylene, 29.5 cm in width × 45 cm in length and 200 micron in thickness, was used to pack the rice with a net weight of 5 kg. The irradiated food label was printed on one side of the bag to comply with food control regulations. The color and the ink for marking, were tested for gamma radiation compatibility. A total of 800 bags of rice, with a total gross weight of 4,000 kg, were irradiated at a minimum absorbed dose at 0.5 kGy for insect disinfestation. Radiation treatment was carried out using a multi-purpose, carrier type gamma irradiator, Model JS-8900, Serial No. IR-155, located at the Thai Irradiation Center.

Irradiated rice was distributed on a weekly basis to food stores in Bangkok and Pathum Thani, as well as to various governmental organizations and interested individuals. The product was sold at 60 bahts per bag (approx. US$ 2.4) to retailers. Various commercial brands of non-irradiated rice of 5 kg size, were available in the market at 52 to 78 bahts per bag (approx. US $ 2.08 to 3.12), depending on quality and brand name. During the distribution, a leaflet of educational information was given to the consumer. A simple questionnaire used in the marketing trial indicated that 72% of the consumers bought irradiated rice because of the good quality of the product based on visual inspection, and 28% of them were willing to try the new product. Most consumers preferred irradiated rice to chemical treatment (fumigation) for insect disinfestation. However, most consumers were not sure if they would like to buy irradiated rice again unless its cooking quality was acceptable. Market testing of irradiated rice in the upper-class market or supermarket was unsuccessful because of limitations in the sale and service conditions. To meet the requirement of the supermarket retailer, irradiated rice had to be supplied on a monthly basis, with the term of payment after 30 days.

1. INTRODUCTION

Rice is a major economic crop and main food for the Thai people. In 1996, Thailand produced 22.016 million tons of rice with a total farm value of 104,384.020 million bahts (estimated 4,175.368 million US$) [1]. Rice is among the top ten export commodities [2]. In 1996, six (6) million tons of rice and rice products were exported with a total value of 50,403 million bahts (estimated 2,016.12 million US$) [3].

Milled rice or white rice is susceptible to attack by many common stored grain insects. These are the rice weevil, maize weevil, the rice moth, red flour beetle, confused flour beetle and saw-toothed grain beetle [4]. In a tropical climate, these insects multiply rapidly and can cause severe damage during storage within a short period of time. Fumigants such as methyl bromide and phosphine are commonly used to control infestation. To be effective, the rice packaging must be opened or punctured to allow the penetration of the chemical into the rice package. Therefore, after fumigation and during the storage, the opening of the rice package will allow the reinfestation by insects. Apart from this fumigants are highly toxic to the user and to the environment, and difficult to handle, causing toxic chemical residue in the commodity. Methyl bromide is also known as an ozone depleter [5] and harmful to the environment. Ionizing radiation, namely, gamma rays from cobalt-60 or cesium-137 (≤5 MeV), X-rays (≤5 MeV) from X-rays generated machine and electron beams (≤10 MeV) from an electron accelerator, is recommended as an alternative mean for insect disinfestation [10]. A minimum radiation absorbed dose of 0.5 kGy can control the insect infestation [6–10]. A minimum dose of 0.16 kGy was recommended for controlling rice weevil in industrial application [4]. The appropriate and acceptable dose treatment for the cereal ranged from 0.5 to 1.0 kGy [11–13].

Since 1994, at least 37 countries have approved irradiated food and about 225 kinds of food and agricultural products have been approved. Presently, there are 13 countries that have approved irradiated rice [5].

Previous work on the "Control of Rice and Mungbean Irradiation Processing and Marketing Trial", established that irradiated rice was accepted by the consumer. A regular packaging size of 5 kg was recommended. [12]. This work was a continuation of the latter project and aimed to scale-up the volume tested under project "Market Testing and Consumer Acceptance of Irradiated Rice". All important factors involved in marketing rice, i.e. packaging material, the label, consumer groups, consumer information and consumer attitude toward irradiated rice were also determined.

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2. MATERIALS AND METHODS

2.1. Rice used

Export quality, special grade A white rice (Jasmine rice) of 13% moisture content was obtained from a local miller in Bangkok in 100 kg or 50 kg bags. The rice used was newly milled, unfumigated, and free from contaminants and live infestation based on visual inspection. A total volume of 4,000 kg was obtained from the factory.

2.2. Packaging material

The plastic bag used for a 5 kg package of rice was a low density polyethylene bag, 25.5 cm in width × 45 cm in length and 200 micron in thickness. Two different types of ink markings (printings) on the polyethylene bags were obtained from the plastic bag factory. One type was a regular surface coating ink and the other was laminated surface coating ink. The bags were pre-tested for radiation compatibility of the ink markings at a minimum dose of 1.0 kGy to observe if the color and the tensile strength were affected by radiation.

2.3. Design of packaging material label

The Office of the Food and Drugs Administration (OFDA) approved irradiated rice and the use of the irradiated rice label for market testing purposes. The design of the product label, in compliance with regulations, included the international logo of irradiated food, the name of the product, the purpose of irradiation, irradiation date, license number, date of irradiation, the name and the address of the rice producer and the name and the address of the contract irradiator. Apart from the details required, the color of the marking and the size of the label were not restricted. In this test, the size of the label was 23 cm. in width × 30 cm in length and the printing was in green, except for the yellow dot in the middle of the international irradiated food logo. The design of the label was part of the consumer education and marketing aspect It was attractive and informative, giving the consumer a choice. The specific name of the rice, "Jasmine Rice" was largest in print and was located on the top of the package above other information details.

2.4. Preparation of the consumer pack of rice

The rice from item 2.1 was repacked in the designed polyethylene bag of 5 kg net weight. The preparation of a total of 800 bag of 5 kg each (4,000 kg) was handled by the TIC.

2.5. Rice irradiation

An aluminum tote box, size: 59 cm × 122 cm × 128 cm was used to contain the 5 kg packages of rice for irradiation following the loading pattern and the process control previously studied [13]. Two batches of rice, 400 bags each, were treated at a minimum absorbed dose of 0.5 kGy to control insect infestation [6–11], using a commercial scale, carrier-type gamma irradiator located at TIC. The total of 800 bags with a net weight of 5 kg, were irradiated.

2.6. Consumer target groups

Each batch of irradiated rice was distributed on a weekly basis to local food shops in Donmuang District, Bangkok and Klong Luang Distric, Pathum Thani Province, housewives, and various government institutions and hospital. A supermarket, namely Foodland Supermarket Company was also approached. Most of the target groups were acquainted with irradiated fermented pork sausage, therefore, it was not difficult to introduce a new irradiated product to them.

2.7. Consumer education

Detailed information was provided on the label of the package of rice and represented the major information source for consumers. Additional information was given in the form of leaflets (Fig.1) distributed to the consumers who purchased the rice.

2.8. Price of rice

The irradiated rice was sold at 60 bahts per bag of 5 kg (estimated US $2.4 each), while various varieties of non-irradiated rice were available in the market at a price ranging from 52 to 78 bahts. The availability of various kinds of rice in the market provided wide choices for the consumers.

2.9. Collection of information on consumer attitude

Along with the distribution of irradiated rice, a simple questionnaire was randomly given to 100 consumers. The results are shown in Table I. Other information was also obtained from consumer remarks, such as competitive price, confidence in the distributor and confidence in the OFDA license.

TABLE I. CONSUMER RESPONSE TO QUESTIONNAIRE ON IRRADIATED RICE

Question	Answer	Percentage of answer
Why do you buy irradiated rice?	• To try it out	28
	• Good quality based on appearance	72
Rice has to be fumigated for disinfestation before marketing. Between the use of toxic chemicals and radiation (no residue) which one will you choose?	• Toxic chemical	0
	• Radiation	100
Will you buy irradiated rice again?	• Yes	0
	• No	0
	• Not sure	100

3. RESULTS AND DISCUSSION

The 5 kg package of irradiated rice was acceptable to the consumers. The attractive and informative label caught the attention of the consumers. It took about 12 weeks to sell a batch of 400 bags of 5 kg each. The leaflet of educational information on irradiated rice was also of interest to the consumers. It was found that 72% of the consumers bought irradiated rice because of the high quality of the product based on visual inspection, and 28% of them were willing to try out the new product. Most consumers preferred irradiation treatment to toxic fumigants since radiation treatment does not result in a toxic residue [14]. However, they were not sure if they would buy irradiated rice again unless cooking quality of irradiated rice was acceptable. This study revealed that high quality of the rice was the most important factor for consumer acceptance. Other important factors involved were the size of the package, the quality of the bag, the attractive marking of the label and the educational information provided.

Market testing of irradiated rice in the supermarket was not undertaken due to the service requirements set up by the private sector. The TIC had to supply irradiated rice to a supermarket, namely, Foodland Supermarket, on a monthly basis with one month for the term of payment. The TIC is a non-profit government owned organization which is not authorized to handle research work as a full-scale commercial undertaking. In addition, considerable time, budget, and manpower were required to supply the rice on a monthly basis. The large volume of production of rice for irradiation also required a large space for production and storage, including manpower and transportation.

4. CONCLUSION

High quality fragrant rice was prepared in good quality packaging material with an attractive marking of the irradiated food label. The rice was contained in a 5 kg package and irradiated at a minimum dose of 0.5 kGy for insect disinfestation. Four tons (800 bags) of irradiated fragrant rice were distributed to various consumer target groups. The consumers accepted irradiated rice because of the high quality of the product, its attractive packaging and informative irradiated food label. There was no consumer resistance to irradiated rice. However, most consumers were not sure if they would buy irradiated rice again unless its cooking quality was acceptable. The achievements of this research work were as follows:

- Identification of a suitable packaging material for rice, including a suitable irradiated food label.
- Identification of rice quality acceptable to the consumer and of the acceptability of the 5 kg size consumer package, as recommended.
- Identification of procedure for the commercial radiation processing of rice.
- Identification of consumer target groups who were acquainted with irradiated food in the local market, namely, irradiated fermented pork sausage (Nham).
- Dissemination of educational information for irradiated rice and other irradiated food products by various means.
- Collection of consumer attitudes on irradiated rice.
- Identification of no consumer resistance to irradiated rice.
- Large-scale market testing of irradiated rice was not found feasible due to the limitations of service conditions required by the private sector.

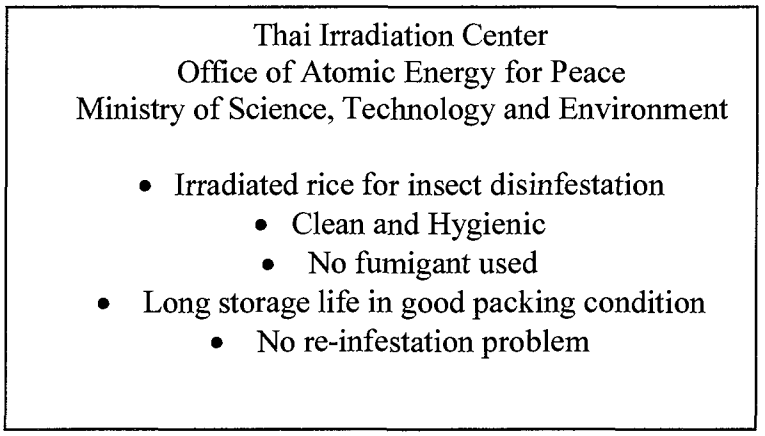

Fig 1. A leaflet of consumer information on irradiated rice.

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