STUDIES ON THE EFFECT OF RADIATION ON MANAWTHUKHA RICE (MAHSURI-M)

PhD (DISSERTATION)

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ABSTRACT

Studies on the effects of radiation on Manawthukha rice (Mahsuri-M) were conducted by using both neutron and gamma sources. This study was carried out in three steps; (i) earthenware pot scale cultivation (Laboratory scale); (ii) field cultivation semi – pilot scale (field dimension of each plot 2 m x 2 m) and (iii) field cultivation pilot scale (field dimension of each plot 2 m x 6 m). Investigation was carried out in four aspects; (i) control (non – irradiation); (ii) gamma irradiation with Co – 60 and Cs – 137 sources; (iii) neutron irradiation with Am (Be) source for one hour and (iv) neutron irradiation with Am (Be) source for one day. The control and irradiated rice grains were cultivated during the year 2003 and 2004.

Parameters such as radioactivity of rice before cultivation and after harvesting, crop yield, agronomical characteristics such as plant height, leaf width, panicle length, number of tillers with panicle, grains per panicle and 1000 - grain weight were studied. Elemental content of various harvested rice samples were investigated by EDXRF spectrometry and atomic absorption spectrophotometry. Protein content was investigated by employing Kjeldahl – Auto – Vapor – Still method. Cooking and eating quality of rice were investigated through amylose content by using colorimetric method, gelatinization temperature by using alkali dispersion method, and gel consistency by using culture tube.

In all cases of irradiation methods, harvested rice was found out to be free from radioactivity. The yield increased in all cases of irradiation. The increase in yield for gamma irradiation method was highest with yield improvement of about 50%. In all cases, content of potassium and phosphorus were found to be very

much higher than other elements such as iron, calcium, manganese and zinc. Content of phosphorus was higher than potassium. This was more pronounced in the case of harvested rice obtained by gamma irradiation. Protein content (7.12%) of harvested rice obtained by gamma irradiation method was the highest. The range in amylose content was between 25% to 30%. Gelatinization temperatures of harvested rice obtained by various methods were found out to be between high and intermediate (70 - 74°C for 90% of starch granule dispersion). In each case, harvested rice had hard gel consistency. The length (average 4.10 mm) and breadth (average 2.25 mm) of harvested rice grain obtained by gamma irradiation method was found to be greatest. Elongation ratio (average 1.29) for gamma irradiation was found out to be lowest. Taste of cooked rice for both control and irradiated cases were found to be equally good. From these observations, gamma irradiation method is found to be most suitable for actual cultivation of high yielding Manawthukha rice.

Keywords: ***Manawthukha Rice, Gamma Irradiation, Neutron Irradiation, Genetic mutation***