

## **Rice: the Main Grain**

Research and Script: Dr. Ramesh Dutta Sharma

Translation: Dr Sukanya Datta

### Characters

1. MALE VOICE:
2. FEMALE VOICE:
3. DAUGHTER (11-12 years)
4. Ma: (30-35 years)

### Specialists

1. Prof. M. S. Swaminathan
2. Prof. N.K Singh
3. Prof. Asis Dutta
4. Dr. S.K. Sharma
5. Dr. T.K. Adhya
6. Director, Directorate of Rice Research, R, Hyderabad
- 7. Project-in –Charge IGAU, Raipur**

### Drama

DAUGHTER : Mummy, I am ravenous...you did say you are making rice pulav.

Ma : Yes I am...it is almost ready.

DAUGHTER : Almost ready...how much longer must I wait for it to be completely ready?

Ma : Just one more whistle and it will be done.

DAUGHTER : Will it work if I whistle?

Whistles.

Ma : Don't be silly...I mean the pressure cooker should whistle.  
The pressure cooker whistles

DAUGHTER : The whistle! At last some one has blown the whistle.

Ma : laughing...Yes...finally.

Sounds of the pressure cooker being placed on the table and opened .

Ma : Ok...the pulav is ready to be eaten.

DAUGHTER : (happily) What a lovely aroma.

Ma : And why not? It is the Pusa basmati rice.

DAUGHTER : What do you mean Basmati...bas means stink in Hindi...do you mean this rice stinks?

Ma : (Sound of crockery) Stink? Dear me no. I mean this rice is aromatic. Fragrant. Now eat.

Sounds of spoon and plate as rice is served.

DAUGHTER : Mummy! You have added all sorts of vegetables to the rice. I can see peas, tomato, carrots and God knows what else!

Ma : Oh! And should I have served you plain rice? That would have provided you with just the carbohydrates. What about the proteins, vitamins and minerals that you need?

DAUGHTER : But you have ruined the rice, Ma. I hate peas, anyway.

Ma : I think you have studied Biology in vain. It was you, wasn't it, who just yesterday told me that your books say you must eat a balanced meal? Now, the carbohydrate will no doubt come from the rice, but the protein will have to come from the peas.

DAUGHTER : Why should the protein come from the peas?

Ma : Well, for us vegetarians, the legumes or pod-bearing vegetables are what provides the most proteins. For example, peas, Bengal gram, red kidney beans or rajma, mung beans or moong daal etc., are great sources of protein, as are peanuts and soyabean.

DAUGHTER : But why can't we get proteins from rice?

Music indicating end of scene

Music indicating new scene.

Male Voice (MV): It is not as if rice has no protein. But the amount of protein in rice is extremely low. However, rice is a good source of carbohydrates. About 30 grams of rice grains, cooked to give one bowl of rice or pulav, provides about 110 calories. A balanced meal calls for at least 45-65 percent of the total calories to come from carbohydrates; 10-30 percent to come from proteins and 20-35 per cent to come from fats and oils.

Female voice (FV): This is why, traditionally at least, the combination of rice and daal or lentils has been part of our diet. Daal meets the protein requirements of the body. An adult needs 30 grams of protein every day. Peas contain 20-25 per cent proteins.

MALE VOICE: Rice with its husk still on is called paddy. Ice is a cereal. The word cereal comes from the name of Ceres, the Roman Goddess of Agriculture and Harvest. Interestingly, all cereals are called Dhaanya in Hindi and the term derives from the word Dhaan meaning Rice.

FEMALE VOICE: Rice cultivation originated in India. Excavations not just at Mohenjo daro but at 38 other sites have yielded fossilized rice grains...blackened with age.

FEMALE VOICE: The word rice is *arici* in Tamil. Do you know how Rice became *arici*?

MALE VOICE : I'll tell you. The Oxford Dictionary says that when the Arab merchants traded with South India, they carried not only rice but took its Tamil name also with them. This name was corrupted to Al-ruz in Arabic.

FEMALE VOICE: I have read that Al-ruz became Arroz in Spanish; Oryza in Latin, Oreezis in Greek, Reise in German, Riz in French, Riso in Italian and finally, RICE in English.

MALE VOICE: The father of lord Gautam Buddha was Shudhodhana...did you know that it means Pure Rice?

FEMALE VOICE: They say that when Gautam was meditating a low-caste girl called Sujata brought rice –pudding for him. He felt rejuvenated on eating the rice pudding and soon afterwards gained enlightenment...and became Buddha, the Awakened One.

MALE VOICE : Rice spread in the wake of Buddhism and this is how the practice of rice cultivation spread to Sri Lanka, Thailand, Burma or Myanmar, Indonesia, Philippines, Cambodia, Vietnam, and China. 90 per cent of the entire rice yield of the world comes from Asia. From Bhutan to Uruguay, more than 100 crore farmers toil in rice fields to feed the millions of the world.

FEMALE VOICE: Rice is grown in about 120 countries of the world. The International Rice Research Institute is located at a place called Los Baños, near Manila the capital of Philippines. This is an internationally reputed institute and has made immense contributions towards increasing rice yields across the world. The varieties of rice that have been developed here have ranged from IR-8 to IR 70 and more. The genetic diversity of rice has greatly aided the development of these new varieties.

MALE VOICE : The International Rice Research Institute IRRI was set up fifty years ago in the year 1960. This year it is celebrating its Golden Jubilee. The great Indian scientist Dr. M.S. Swaminathan was the Director General of IRRI from 1962-1987. From him we have come to know:

1. What has been the contribution of IRRI in increasing rice production around the world through its high yielding varieties?
2. What was the role of Rice germplasm biodiversity in breeding of improved varieties?
3. How many wild and traditional varieties of rice available in different countries were used to produce IR-36 which covered almost 90% area under Rice cultivation in the world? How was a new plant type of Super Rice developed?
4. What is the status of developing more nutritious varieties of Rice?
5. What is the contribution of the MS Swaminathan Research Foundation in conserving and using biodiversity of Rice? How plant biodiversity is helping in developing rice varieties which can withstand salinity, drought and high-temperatures.
6. Will discovery of Rice Genome increase the chances of developing a rice variety that is rich in protein?

FEMALE VOICE: A rice cell contains 12 chromosomes that contain the genes that control all its traits. The genome of rice has also been deciphered.

MALE VOICE : Ten countries around the world joined hands to crack the rice genome. India was one of the countries. India was given the responsibility of studying the 5<sup>th</sup> chromosome and to read the triplet codes of the four letter DNA alphabets as they occurred on this chromosome.

FEMALE VOICE: What do you mean, letters, alphabets and codes...you sound as if there are some words that are written inside the rice plant.

MALE VOICE : You could say that. The great variety of plants and animals that we see owe their biological diversity is due to the differences of their DNA. DNA uses a language of its own. It is a code that guarantees that only a babool tree and not say, a mango tree will grow from the seed of a babool plant that you may have planted in the soil .

FEMALE VOICE: No wonder they say, as you sow, so shall you reap.

MALE VOICE : The different codes of DNA ensure that we have an enormous biodiversity of plants and animals. The human DNA has a long lineage and is passed from parents to their children.

FEMALE VOICE: Yes I do know that we, humans have 46 chromosomes on which there are 300 crores of the letters that make up DNA. The human genome has been cracked as well.

MALE VOICE : Yes and if we were to print all these letters it would become a book equal to 300volumes of the Encyclopedia Brittanica.

FEMALE VOICE: Yeah! And if you began to raed it aloud you would have to go on for a hundred years.

MALE VOICE : yes, but now let us ask ICAR's National Professor N. K.

Singh about the rice genome and how many letters that make up the DNA was found on it during the sequencing of the genome. Dr. Singh is National Professor of Genomics at the National Centre for Plant Biotechnology that is located at PUSA. He gave us answers to questions such as:

1. How many countries contributed to the Rice Genome Project?
2. What was India's responsibility?
3. How was this work completed?
4. What comes next after deciphering the rice genome?
5. Is it possible to make rice varieties hardy enough to resist, diseases, pest-infestations, drought, floods and also high in protein?

FEMALE VOICE : Prof. Asis Dutta has contributed enormously towards creating rice variety with high-protein. He established the Institute of Plant Genomic Research and was its first Director. He is, at present, a National Professor at this Institute.

MALE VOICE: During ritual fasts, many eat laddus made out of amaranthus or Ram-dana. Ram dana contains 16 per cent protein and is extremely nutritious.

FEMALE VOICE: Prof. Asis Dutta first identified the gene that was responsible for protein production in Ram dana. Then he engineered this gene into the potato so that these became protein-rich too. He also engineered this gene into rice. He tells us all about his work:

1. How did you get the idea to transfer the protein-producing gene from Amaranthus (Ramdana) to Potato and then to Rice?
2. What is the status of this research now?
3. Is it safe to eat this GM Potato and GM Rice?
4. Has anybody else in the world attempted to increase the protein content of Rice?

5. When do you expect to release Hight Protein Rice for cultivation?

MALE VOICE : Producing about 9 crore tons of rice per year, India is the world's second largest rice producer. It is expected that in 2010-2011, India will produce about 9 crore 60 lakh tons of rice.

FEMALE VOICE : This financial year, that is in 2010-2011, it is expected that the total rice production in the world will be 46 crore tons.

MALE VOICE : It is anticipated that during 2009-2010 rice will be cultivated over 420 lakh hectares of land in India. Because of poor monsoons in 2009, rice was cultivated only over 360 lakh hectares in India and the total output was only 8 crore 75 lakh tons.

FEMALE VOICE : India is the leading producer as well as the leading exporter of Basmati rice.

MALE VOICE : For the last two years there has been a ban on the export of non- Basmati rice. However, because of warm relations with neighbouring Bangladesh, One lakh tons of non-Basmati rice has been exported to it.

FEMALE VOICE : The world's largest rice exporting countries are Thailand and Vietnam.

MALE VOICE : Much of Vietnam's rice fields were devastated by the defoliant and herbicidal Agent Orange that USA sprayed on it.

FEMALE VOICE : However, Prof. M.S. Swaminathan sent the seeds of traditional varieties of Vietnamese rice from the Gene Bank of IRRI or The International rice Research Institute to the country. The new generation of young Vietnamese farmers were given advanced training in agricultural practices. Prof. M.S. Swaminathan was Director General of IRRI in those days.

MALE VOICE : Simultaneously Vietnam was given assistance to set up

its own Rice Research Institute. In next to no time, Vietnam first became self-reliant in rice production and then, overtook Thailand to become the world's largest rice producer.

FEMALE VOICE : The gene banks of IRRI stock rice varieties from all the countries in the world, including India. It stocks more than 80 thousand varieties of rice. About 40,000 of these are from India.

MALE VOICE : Thus these varieties represent a genetic treasure trove and a farmer may source seeds that encode just about any trait that he desires in the variety he wants to cultivate.

FEMALE VOICE : India too has her own national gene bank where the germplasm of about one and a half lakh agricultural cultivars is stored. These seeds are stored at a temperature 50 degrees below zero ensuring that they do not lose viability. The gene bank is located in such a way in basement that not even an atomic explosion can ruin the stored seeds.

MALE VOICE : Improved cultivars of rice, traditionally grown varieties as well as wild types are stocked here. Director, National Bureau of Plant Genetic Resources tells us about this national gene bank of India.

1. How many different varieties of rice does the national gene bank store? How many of these are indigenous and how many have been imported?
2. How many varieties of the rice stored here have traits such as being disease resistant, pest resistant, drought and flood resistant?
3. Do some species of rice have medicinal properties? How many are aromatic varieties?
4. What are the recent acquisitions of rice varieties?

FEMALE VOICE : Rice is polished in rice mills to remove its husk so that the

grain appears white. However the traditional method of milling did not remove the brown top layer. This is the layer which contains 80 percent of minerals and vitamins such as Vitamin B and vitamin B2 . Consumption of highly polished rice led to an epidemic of Beri-beri in the Philippines in 1948 and 24,000 people died. After that it became customary to enrich rice with vitamins. This brought down the number of deaths to zero in 21 months.

MALE VOICE : now the rice mills do the job of enriching rice with vitamins. The process of doing so has been refined. The traditional method of making par-boiled or sella rice is a process that preserves the levels of nutrients in rice and the rice is nutritious.

FEMALE VOICE : many indigenous species of rice are on the verge of extinction because the newer varieties have taken over. An example is the kala namak variety from eastern Uttar Pradesh. Steps are being taken to conserve such varieties.

MALE VOICE : Similarly cultivation of Dehradun basmati has shrunk to one limited field and steps are being taken to extend the area under its cultivation. The desired traits of basmati rice have been introduced into newer varieties and these are being cultivated as the yield is more.

FEMALE VOICE : To tell us more about aromatic rices we have Dr. A.K. Singh of Genetics Division of the Pusa Institute.

1. When did the Pusa Institute begin work on enhancing the quality of basmati rice such as Basmati 370 and to exploit the enormous biodiversity to improve yield?
2. How was the biodiversity of the indigenous varieties made use of?
3. How were varieties such as Sabarmati and Pusa basmati 1 developed?

4. You developed the fragrant varieties such as Sugandh-1, Sugandh-2, Sugandh-3, Sugandh-4 etc and then, also, the high yielding PUSA 1121 variety. How did you engineer the indigenous gene that governed aroma?
5. What are the special qualities of these aromatic rices? How do they rate on the nutrition front? What is the level of protein, vitamins and minerals in these?
6. Are you working to develop rice species with increased amounts of proteins, vitamins and minerals?

Music to indicate change of scene

MALE VOICE : Dr. T. K. Adhya of the Central Rice Research Institute in Cuttack, Orissa, is discussing about the conservation of the biodiversity of the indigenous varieties of rice, and the efforts that have been taken in this direction.

1. Dr. Adhya, Chanakya Kautilya has mentioned about a variety of rice called Paustik in his book Arthashashtra. Apparently this variety took only 60 days to reach maturity. Your institute has created the Sathi variety that also reaches maturity in 60-70 days. Have you taken the help of indigenous varieties to create Sathi?
2. How have you exploited the existing biodiversity to create the many high yielding varieties in your Institute?
3. You have created a variety that keeps growing even as flooding occurs so that the variety keeps above the water level. What are the other desirable traits of this high-yielding variety?
4. What are the efforts being made in the Institute to enhance the nutritive value of rice? What are the anticipated results of your research?
5. Do you maintain a rice gene bank? How many varieties do you have in your store? What are the kinds that you are conserving? What steps are you taking to ensure that indigenous rice varieties do not go extinct?

FEMALE VOICE : This was Dr. T. K. Adhya, the Director of the Central Rice Research Institute, Cuttack. Let us now go over to the Directorate of Rice Research, Hyderabad to learn from

the Director, what steps are being implemented to conserve the biodiversity of rice and to enhance its utilization.

1. Sir, the Central Rice Research Institute, was established quite early on at Cuttack. Why was there a need to set up the Directorate of Rice Research? Has it been given the mandate to conserve the biodiversity of indigenous rice varieties of Andhra Pradesh and to facilitate its utilization?
2. At this point of time there are at least 45 Agricultural Universities in the country and most are engaged in research on cereals such as rice. How is synergy established among all these establishments?
3. What are the main achievements of the Directorate of Rice Research and what is the direction of the research that is being carried out here?
4. There is a lot of excitement about the Golden Rice because it is believed that it will be able to compensate for the Vitamin A deficiency and thereby prevent night blindness in children. Have you evaluated the Golden Rice? Will India take up the cultivation of Golden Rice?
5. IRRI or the International Rice Research Institute has created varieties of rice that are rich in iron, minerals, and vitamins by regular means of fertilization, that is to say these are not GM crops. Have you evaluated these crops? When can the consumers expect to find these varieties in the market?
6. Have you exploited the biodiversity of rice to carry out any research here?

MALE VOICE : Let us now go over to the Indira Gandhi Agricultural University at Raipur, in Chattisgarh. With assistance from the Rockefeller Foundation a **live** gene bank has been set up here that is the repository of about 30,000 indigenous Indian varieties of rice. A large part of India's biodiversity of rice would vanish forever if these varieties

went extinct. So these varieties are still being cultivated to ensure they do not go extinct.

FEMALE VOICE : The Director of this Project will provide more information on this.

Project Director's statement

MALE VOICE : You have how steps are being taken to conserve the biodiversity of rice in India and at the international level too and also how this biodiversity has been, and is being, used to create newer and better varieties of rice. Not only are these varieties high-yielding but desirable traits such as disease-resistance, resistance to pests, drought and flood tolerance etc., from wild types and traditionally grown cultivars of rice have been genetically incorporated into them. Some have also have enhanced nutrient-levels.

FEMALE VOICE : The outer brown layer that is removed from rice during polishing to make it white rice, contains about 80 per cent of the cereal's Thiamine or vitamin B-1. Polishing removes it just as it removes Niacin or vitamin B-3 and Riboflavin or vitamin B-2. Efforts are being made to develop rice grains that will contain the vitamins not on the outer layer but in its core. Genes that will enhance mineral and vitamin content of the grain are also being incorporated into the rice. It is the natural biodiversity that is being used to improve the productivity of a major crop such as rice, so that the food security and nutritional security of the burgeoning global population can be guaranteed.

MALE VOICE : Thanks to such efforts, we may hope that some day the

men and women labouring in the rice fields will no longer have to tearfully beseech the clouds to bring the much-needed rains to water their crops.

Music.

Hindi song...repeat and fade

(We take pain to sow the grain,

Come clouds...bring rain...

Come clouds...bring rain)