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Various experiments carried out at the research institute

The world rice trade

125 countries in the world produce rice albeit in small amounts, but only three countries are considered as pure exporters? Thailand, Vietnam and Pakistan, but because of the world food crisis Australia, America and Egypt lost that capability," Dr. Dissanayake said. "To make matters worse now even the African countries are shifting to rice from yams," he added.

There are around 685000 hectares used for paddy cultivation and since there are two seasons the cropping intensity should be 200, i.e. 1300000 hectares but that is not the case. Cropping intensity is around 130-140 because of the water issue. When there is a constant water supply there is a cropping intensity of 200%.

And with this relatively low cropping intensity, Sri Lanka only produces 3.6 million metric tonnes of rice annually, and we are incapable of entering the export market because even after the best harvest there is only a little left after domestic consumption. "We export rice to several niche markets like Europe and the Middle East where there is a Sri Lankan community. Several companies are exporting traditional rice varieties," he said.

There are two ways of dealing with the drought Dr. Dissanayake said. One is to avoid the drought by using short term maturing rice varieties while the other is to create varieties that are drought resistant



T.N. N Priyadarshani

Waterless rice?

Researchers work on developing drought resistant rice varieties



Pix by Rukshan Abeywansa

By Rathindra Kuruwita

Achieving self sufficiency in rice is one of the few things that we can be proud of. Although there are over 125 rice producing countries according to the International Rice Research Institute (IRRI), Sri Lanka is one of the few countries which have achieved the daunting task of self sufficiency in rice. Although we used to import more than 50% of our rice needs in the 1950s, newly introduced high yielding varieties, new techniques of cultivation and the introduction of non carbonic fertiliser have increased the national rice production dramatically.

Climate change and effect on rice

But in the last few years the changing weather patterns have been threatening this difficulty achieved self sufficiency. While drought is affecting the rain fed cultivations in the north western province, high salinity affects the cultivations in Puttalam, Polonnaruwa, Anuradhapura, eastern province and Hambanthota areas.

According to the Director of Rice Research Institute, Bathalegoda, Dr. Nimal Dissanayake introducing new salinity and drought resistant varieties are very important because of the precarious situation in the global rice production. He added that in the next few years it will be impossible to import rice from the other countries.

"There are more than six billion people in the world and more than half that number consumes rice as their main food. 90% is produced and consumed in Asia. China, India, Bangladesh, Indonesia and Vietnam are the biggest producers and the total annual production of rice is between 630-640 million metric tonnes," he said. "But only 30 million metric tonnes or around 5% of the total production is available for sale and when we compare that with

the production and consumption of a country like China or India it is trifling amount and if there is a crisis in those countries there is no place to buy rice," he added.

Although we are self sufficient, we have to import rice sometimes especially in times of drought. Since we do not possess storage facilities we are at risk of losing our self-sustainability at an adverse drought, which other countries have been experiencing. "Even this is an exceptionally droughty Maha season and if this has an adverse effect on the crop what can we do? If we lose 30% what can we do? We have no stocks that will last a month or two," he said. "If there is a sudden drop in our production due to an extremity in weather we will be in deep trouble. We have identified salinity and drought as the main threats of the climate change. And in the last few years we have been working on salinity and drought resistant varieties and there have been notable successes," he added.

Dr. Dissanayake added that it has become increasingly difficult to import even a paltry amount of 10000 tonnes since rice cultivation in many countries have fallen victim to the effects of changing weather. "We wanted to import rice from Myanmar. But because of a sudden flood in Myanmar, another example for the sudden weather pattern change which is a feature of climate change, we could not get it," he said.

Directly affected by climate change

Out of the 685,000 hectares used for paddy cultivation, 35% of the land gets water from major irrigation schemes (water is supplied to more than 500 hectares) and those farm lands have an assured water supply, another 35% get water from minor irrigation schemes (under 500 hectares) while another 30% depend on rain water.

"Rain fed does not necessarily mean that they are in constant danger of drought, we have been farming in these areas for centuries but in the recent past the weather has been unpredictable, there has been floods in areas like Kaluthara and Ratnapura in the last few years while there has been an unexpected drought in the last December and January and many paddy cul-

"Aerobic rice is a new concept of growing rice, it is high-yielding rice grown in non-puddled soils and experiments show that it needs 50% less water than the normal varieties,"

tivations were destroyed in North Western province," he said.

Developing drought resistant rice varieties

Climate change has caused a lot of changes in the weather patterns and caused erratic fluctuations of weather. There are 46 identified agro ecological zones in the country and each region has a unique weather pattern, according to which the farming patterns of each area are formed.

"The rise in temperature and the fluctuation of rainfall is a major issue, in the past there was a bipolar rain pattern, a lot of rain in the Maha season and less in the Yala season and over the years our farmers have adapted to that method. But since these patterns have become unpredictable the farmers are facing many difficulties," he said. "The weather is subject to change like everything else, for example the average temperature has gone up by around 1% in the last 50 years or so and the rainfall has gone down a bit but that is not a real issue because the farmers have time to adapt and change the farming cycle accordingly. But the real danger of climate change is that there is an unpredictable fluctuation in weather. Rain falls in times which are usually considered as dry periods and vice versa," he added.

In the recent past, there has been a massive increase in the average temperature during flowering and maturity periods and when the temperature rises above 35 degrees paddy will not be properly fertilised, diminishing the harvest.

"Theoretically, the increase of Carbon Dioxide (Co2) would mean that photosynthesis would increase but that is not the case because the high temperature at night would mean photorespiration during the night is also high, negating the production during the day,"

he said. And unfortunately the photosynthesis mechanism of the rice plant is also not very efficient. "Plants have two types of photosynthesis mechanisms, one is C3 mechanism other is C4. Crops like maize and sorghum have the C4 which is like a diesel engine, but unfortunately rice has C3 which is less efficient. Researchers are working on introducing C4 characteristics to rice, but it's a difficult task, like an engine overhaul," he added.

There are two ways of dealing with the drought Dr. Dissanayake said. One is to avoid the drought by using short term maturing rice varieties while the other is to create varieties that are drought resistant. Over the years the researchers have been working on introducing drought resistant qualities of traditional varieties to high yielding varieties.

"If the maturity period, seed to seed, is long we need more and more water. So we have introduced a lot of rice varieties that have a short three and two and half month maturity period. The aim is to avoid the drought by anticipating dry weather patterns," he said. But since the weather patterns have become unpredictable the rice researchers have focused their attention on creating drought resistant varieties in the last four to five years.

"We always had rice varieties with adjustable qualities but they are low yielding, like Pokkali rice. In the last five years we have worked on introducing these characteristics to high yielding varieties. Pokkali is a variety that is also highly salinity resistant; it has developed mechanisms survive salinity and draught like water absorption system and a method to oust sodium. So we have used Pokkali as a foundation for many new varieties," Dr. Dissanayake said.



Dr. Nimal Dissanayake

Identifying the drought resistant varieties

The Rice Research Institute is currently conducting experiments with BG 359, 300 and 250 and some other varieties that were sent by International Rice Research Institute (IRRI) to see which high yielding varieties have better drought resistant qualities.

"We have divided the life cycle of the rice plant into several stages, active tillering, panicle initiation, first flowering, 50% flowering and maturity and we try to stop the water supply to the plants at various stages and see at which times the lack of water can have a bigger impact, also we can find plants that will be affected most," he said.

Meanwhile, field officer T.N. N Priyadarshani claimed that the drought will have the biggest on the plant between panicle initiation to 50% flowering. She added that BG 359 and 250 have shown good drought resistant qualities while BG 300 fared badly. "We have also got some Aerobic rice varieties that are also quiet drought resistant," she said.

Aerobic rice is a variety of rice that yields well when grown in unflooded fields. Although paddy is a very versatile plant that has the capacity to survive with just moisture in the soil Sri Lankan farmers use continuous flooding as a way of eradicating weed growth. But with increasing water scarcity that practice will become unfeasible in the future.

"Aerobic rice is a new concept of growing rice, it is high-yielding rice grown in non-puddled soils and experiments show that it needs 50% less water than the normal varieties," T.N. N Priyadarshani said. "Since these aerobic varieties are taller than the local varieties and it's easier to get rid of weeds. They grow higher and have droopy leaves that cover the ground and stop the growth of weed. The experiments we did showed us that there are varieties with a great potential which we will study extensively," she added.