

Hybrid rice – privatising a seed paddy industry

By Nadeera Seneviratne

Most Sri Lankans would not like to see even a single rice seed thrown away. We'd take care that at least a cat or a dog gets that last bit of rice that would otherwise go waste. Embedded in these practices is the respect which most Asians have towards the plate of rice that is placed before one or the pot of rice that boils each day in every household.

But rice has not been easy to obtain of late. It is the livelihood of more than 1.8 million farm families, that is say, 9 million individuals and more than 30 per cent of the total labour force in Sri Lanka is directly involved in rice or rice related activities. Sky rocketing prices mean however that at present, the farmer gets Rs 8 for a kilo of rice which sells at more than Rs 30 at the market. Now, 'authorities', no shortage of foreign experts among them, tell us that the rice yield has to increase by 0.6 t/ha from the present 3.5 t/ha within the next five years to achieve self-sufficiency. And that this cannot happen unless the government adopts a strategy of drastically increasing yield because further expansion of rice area [of about 830, 000 ha] is not possible.

So there are those who come forward with alternatives, backed by foreign experts. For instance, the former Director of the Rice Research and Development Institute [RRDI] at Batalagoda, Dr M. P. Dhanapala and others reckon, that the country's semi-dwarf inbred varieties possess 'low and stagnating yields' which 'limit the scope for increasing production'. The only way, they tell us, is to opt for hybrid rice. We could not speak with Dr Dhanapala because he is now working for the International Rice Research Institute [IRRI] in the Philippines. What IRRI means is that we should voluntarily destroy our existing traditional base for paddy cultivation. This is to be done by artificially creating a non-existent rice seed industry in the private sector. Already, the Department of Agriculture [DOA] has been directed by this government to transfer its expertise to Chemical Industries Colombo [CIC] Ltd. which set up a seed farm one and a half years ago after 'purchasing' [according to a RRDI source] some government farms. The expertise that this company has brought into the production of seed paddy lies in the marketing of petro chemical products such as pesticides and paints - the stuff you apply on walls. In any case the department has been asked to help them set up a seed farm in Thalawa.

China had discovered a hybridisation process for rice as well in the early seventies and IRRI has appropriated some of that expertise. Multi-national companies have since come into markets where countries have opted for hybrid rice, making paddy farmers dependent on them for their seed. India and the Philippines have private seed paddy companies which they operate on a small scale. In Egypt, despite the productivity of inbred rice being very high, hybrid rice has been introduced, perhaps to manipulate a market produce that would be otherwise only partly controllable.

There are many not so salient features to hybrid rice that provide for the

creation of a private seed paddy industry. To grow a commercial hybrid rice crop, farmers will need fresh seed every season. Second generation [F2] seeds of hybrids do not carry hybrid qualities, a naturally unwelcome situation for a seed vendor and which makes seed saving fruitless in a country which is reportedly ninety-four per cent seed saving. The cost of hybrid seed production is high - the US of A has been among the countries which have found the high cost of seed production one of the factors that has hindered its commercial application. The technology may make a country dependent on IRRI or another foreign country for the cytoplasmic-genetic male sterile [CMS] line.

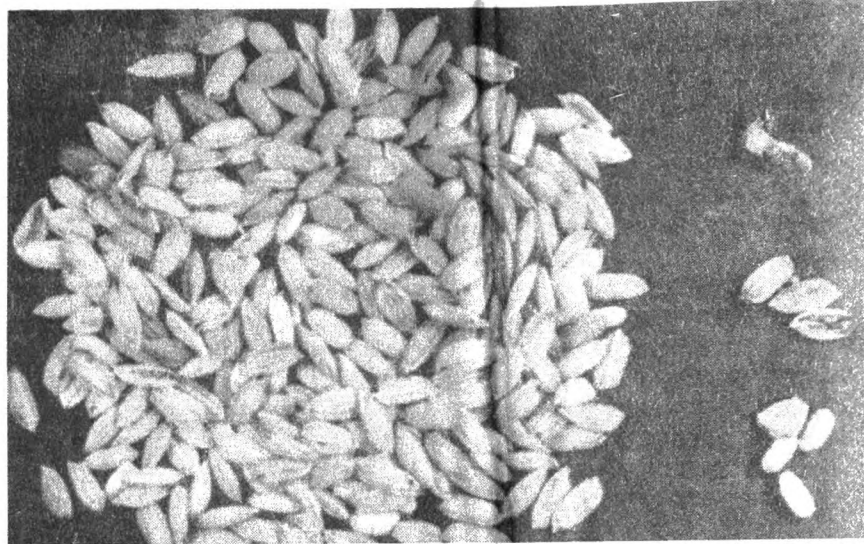
The seed farm established by CIC, a subsidiary of Imperial Chemical Industries [ICI] has been used for some of the experiments on hybrid rice in Sri Lanka. Acting Director of the RRDI, D.S. De Z. Abey Siriwardena says that the CIC farm has been chosen for the mass production of hybrid rice seed paddy once varieties are released by the RRDI. Later other private seed companies will be brought in, he said. The RRDI had chosen CIC he said as it is currently producing the institute's seed paddy varieties. Other large agro chemical MNCs like Aventis, Monsanto and RiceTec would be without doubt eyeing the Sri Lankan scene with renewed hope. Monsanto for example tried to move into Sri Lanka thirty years ago.

'We are at the moment experimenting with Chinese varieties of hybrid rice as they are more high yielding than the IRRI hybrids and we are also developing hybrids of our own,' Mr Abey Siriwardena said. He said that it would not be possible to train farmers on the technology. However, our farmers have been using high-yielding varieties developed by our scientists since the late 1950s and the department has supplied hundreds of our farmers who produced seed paddy certified by them.

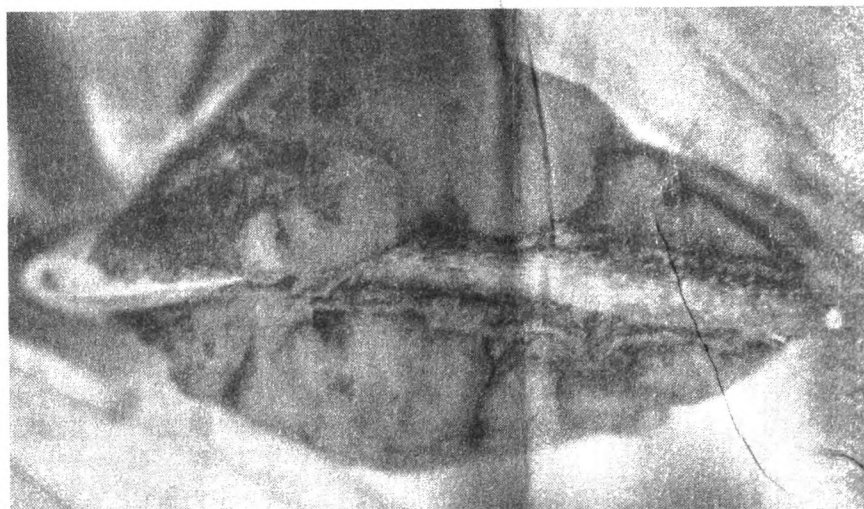
The production process behind hybrid rice seeds is complex. The technology is based on the concept of heterosis or hybrid vigour, obtained by crossing two genetically dissimilar parents. Heterosis is the tendency for cross-breed individuals to show qualities superior to those of both parents. The resultant seeds of this process must have a higher yield rate and better yield-related traits. It is only 'occasionally' that hybrid seed varieties display a yield over the high yielding inbred rice varieties.

There are three ways of producing hybrid rice seeds. One, called the three-line system has been experimented with here. The remaining two are called the two-line and one-line systems. The three-line system is so-called because it depends on three lines: The cytoplasmic-genetic male sterile line, the maintainer line and the restorer line. CMS lines have abortive pollen, a feature first found naturally in the Wild Abortive [WA] variety of China in 1970. The maintainer line [also known as the B line] is used to multiply the CMS line and the restorer [R] line is used to 'restore' fertility to the CMS line and thus produce hybrid seeds.

A paper delivered at this year's Annual Symposium of the Department of Agriculture in September titled 'Recent developments in hybrid rice



Hybrid seed paddy from The Peoples Republic of China showing infestation with caterpillar, bunted grains, dehusked grains and stones.



Hybrid seed paddy imported from The Peoples Republic of China infected with *Ustilaginoides virens* showing abnormality. [Pictures courtesy of 'ASDA 2000, Proceedings of the Annual Symposium of the Department of Agriculture']

research in Sri Lanka' by S. W. Abeysekera and D. S. De Z. Abey Siriwardena of the RRDI claims that the institute under an ADB funded IRRI-RRDI project titled 'Development and Use of Hybrid Rice in Asia' has found through field tests carried out in Batalagoda in 1999 yala season that five IRRI bred CMS lines [IR58025A, IR 62829A, IR 69623A, IR 64608A, IR 68887A] and one Indian CMS line [PMS 11A] are 'adaptable and stable under local conditions'.

The abstract to the paper states that six first generation [F1] hybrids [Bg HR1, BgHR2, Bg HR3, Bg HR4, Bg HR5, and Bg HR8] out yielded the standard check, Bg 357 variety [the most recently developed high yielding variety released by the RRDI] by 27-45 per cent. Except for Bg HR8, all of them and also Bg HR7 had shown 'standard heterosis' [advantage of hybrid over check variety Bg 357] at Field Crop Research and Development [FCRDI], Mahailuppalam and Bg HR8 had shown a higher heterosis at Batalagoda, indicating sharp location specific 'suitability'. Mr Abey Siriwardena said however that only a 20 per cent increase in yield was possible.

On September 19 of this year, the Department of Agriculture launched the country's first hybrid rice seed production and cultivation training programme for government officers and private sector entrepreneurs conducted by four Chinese scientists from central China's Hunan Rice Research and Development Centre. CIC officials had been trained, Mr Abey Siriwardena said. It was opened with the good wishes of Minister of Agriculture D.M Jayaratne, who is inno-

cent of any acquaintance with plant breeding but states that hybrid rice technology can increase the country's yield by 20 per cent, a figure associated with China's yield increases as a result of the successful hybrid seed industry that was developed there. We mustn't forget that the WA line was naturally found in China, a feature that is not existent in Sri Lanka's identified rice varieties.

Not all the six out yielding hybrids are obtained by utilising the CMS lines that were identified with a high pollen sterility and out crossing rates [OCR - the percentage of the fertile spikelets over the total number of spikelets]. Performance of IRRI and other international rice hybrids at the CIC Seed Farm and Agriculture Research Station, Girandurukotte in 1999/2000 maha season showed a standard heterosis over check variety Bg 357.

But as to how far these varieties would be locally adaptable is questionable.

At the same symposium, Premala Jeyanandarajah and Yasamali Gamage of the National Plant Quarantine Service, Katunayake presenting a paper on 'Fungal Infections in Imported Seeds' detected *Tilletia barclayana* and *Ustilaginoides virens* [pictured] among others in consignments of hybrid rice seed imported from the People's Republic of China for crop 'improvement' programmes. Rice, being the staple food of Sri Lanka, is of the utmost importance to the economy, and its protection from possible ravages by introduced pathogens was identified as being of special significance.

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