



The Daily Star

Special Feature July 19, 1993





A Super Super Rice

On Its Way Soon

Abby Tan writes from Philippines

new super rice will become a reality by the end of the century - just in time to meet Asia's population boom and a predicted food shortage

Scientists at the International Rice Research Institute (IRRI), 60 kilometres south of the Philippines capital of Manila, have announced development of a prototype that holds the promise of a dramatic increase in world rice produc-

The breakthrough came 26 years after the first "miracle rice," IR8, was developed at IRRI. That heralded the Green Revolution and subsequent higher-yielding, pest-resistant varieties have helped avert famine in Asia. No famine has hit the region since the early 1970s.

The still unnamed super rice plant will have 60 per cent edible rice and 40 per cent straw, a more vigorous root system, sturdy, thicker stems and 25 to 30 per cent higher yield than current species.

The most popular strain cultivated in many Asian countries, IR46, yields 10 tonnes per hectare. The super rice will

yield up 13 tonnes per hectare. It is the result of crossbreeding from 150 varieties taken from five countries -China, Japan, Burma, Thailand

and Indonesia.

affected root growth, intensive irrigation that led to water logging and salinity build-up. He said: "There are changes in the soil chemistry and this affects

the yield over time." Added to this are government cuts on investments in irrigation infrastructures and fewer subsidies on agriculture inputs like fertilisers. The Green Revolution, Pingali pointed out, enjoyed wide success largely due to massive government

The IRRI will attack related scientific problems as well. Director-General Dr. Klaus Lampe said: "We are growing rice and rice and rice ... perma nently, sometimes three crops a year. We may use the second crop to grow non-rice." The Institute, set up in 1960 as a philanthropic endeavour of the Rockefeller and Ford Foundations to help the newly independent countries of Asia, now moves from seed-based technology to knowledge-based technology.

IRRI has the world's largest rice gene bank. Some 80,000 samples of cultivated and wild rice species are kept at sub-zero temperatures in vacuum packs

for 50 years. Samples are being sent to the world's largest gene bank, the National Seed Storage Laboratory at Ford Collins,

Asian Rice Economy

Climate, Technology and Consumption

by Mahbub Hossain and Alice Laborte

N spite of the impressive growth in rice yields all over Asia, the difference acterized by floods, droughts in yields across countries is and variable ramfalls. Also, the still very large. It varies from traditional varieties are much 1.4 tons in Cambodia to about less responsive to chemical 7.8 tons in North Korea. The fertilizers than the modern difference in yields is largely rices, so the scope of profitable due to variations in agrouse depends on the rate of climatic and socio-economic adoption of modern varieties. factors which have influenced The farm household surveys the adoption of modern note that the same farmer who varieties, the use of agrouses very little fertilizer in trachemicals and the state of ditional varieties apply fertilizer development of infrastructure. in modern varieties at rates China, Japan and South Korea closer to the level recommended have the highest rate of adopby extension agents. The potion of land augmenting techtential of increasing rice pronology - irrigation, modern duction through application of varieties and chemical fertilizchemical fertilizer has remained ers - and therefore have the highest level of yields. The The first instalment, published last week, dealt with yields are also high in these countries due to the low presimportance of rice in national economy and trends in rice sure of insects and diseases, production. longer day length and

favourable sunshine due to the

location of rice growing area in

the subtropics and temperate

zones. On the other hand,

adoption of modern varieties

and rice yields are still low in

the humid and subhumid

tropics, such as Eastern India

Bangladesh, Myanmar, Thail-

and and Indo-China countries.

India, the most densely popu

lated regions in Asia, the oppor

tunities for increasing irrigated

area which is the main vehicle

for the adoption of modern va-

rietics, have been severely lim

ited by the highly unfavorable

are serious social Issues.

The relationship between the

level of rice vield and the use of

national prices the fertilizer

paddy price ratio is about 2:1,

so raising rice yields through

larger use of chemical fertilizers

is still highly economical. The

difference in fertilizer consump-

tion across Asian countries is

substantial; from almost negli-

gible in Myanmar, Thailand,

Cambodia and Laos, to less

than 100 kg in Bangladesh and

India, to over 300 kg in East

Asia. It appears from the data

that there is a vast potential of

increasing rice production in

South and Southeast Asian

countries through increase in

the consumption of chemical

ever, highly risky in unfavorable

production environments char

Fertilizer application is how-

ISTORICALLY, rice has

I tradition, culture, rites

and rituals of the Bangladeshi

people. It became the staple

source of carbohydrate because

the agroclimatic environment

was favourable for its growth.

tinent started in 1910 in what

was then the Agricultural

Laboratory at Teigaon, Dhaka.

Early efforts were made to in-

crease indica rice production by

improving yield and grain qual-

ity with better agronomic prac-

tices. During Pakistan times

there was a shortage of rice

and coarse rice produced in

West Pakistan was sent to East

Pakistan to meet the foodgap.

As a result, it was possible to

devote large areas of land in

East Pakistan to jute produc-

tion which was the major for-

exchange earner of

BRRI rice wheat power thresher modified in 1993.

Rice research in the subcon-

been associated with the

fertilizers.

physical conditions.

In Bangladesh and Eastern

unexploited in many parts of Asia not only because of socioeconomic factors such as unfavourable input/output prices and the lack of purchasing capacity of the small and tenant farmers, but also due to agroclimatic factors such as water-

logging, droughts, and climatic

variations that constrain the

adoption to modern varieties

(David and Otsuka 1992). In order to assess the role of agro-climatic factors in explaining the differential performance across Asia with regard to the increase in crop yields, we have classified the major rice growing

Rice is the single major staple food and an important source of agricultural income, particularly in low income

Asian countries including Bangladesh. Bangladesh, like other nations of the region, has achieved an

impressive growth in rice production, and has been able to increase rice supplies much faster than the growth

of population. The variation in rice yield across countries is still large and it is associated mainly with the

variation in fertilizer consumption and the rate of adoption of modern rices. The growth in demand may slow

down due to urbanization, rapid increases in per capita incomes, and the high levels of per capita rice

consumption. The growth in rice supply may, however, slow down faster because of the decline in rice area,

closing of the yield gap in irrigated systems, decline in profitability, increasing concerns about environment

protection and non-availability of high-yielding technology for the unfavorable ecosystems. The struggle for

averting serious food crisis is not yet over, particularly for South Asia, where underemployment and poverty

quality food such as bread, fish and meat.

China, rice continues to be the

dominant staple grain, con-

tributing 40 to 75 per cent of

the total calorie intake. Studies

on consumption patterns show

that the per capita rice intake

largely depends on the level of

income. At very low levels of in-

come, rice is considered as a

luxury commodity and with in-

creases in income, people tent

to substitute low cost sources of

energy such as coarse grains

and sweet potatoes for rice. But

at high levels of income rice be-

comes an inferior good; as in-

comes rise further, consumers

substitute rice for high-cost

In a recent article, Ito et al (1989) argue that in Asia ricc has already become an inferior good, i. e. the per capita rice consumption has started declining. By estimating a complete demand system in two stages where the rate of urbanization is included as an additional explanatory variable besides per capita incomes, David and Huang showed that the downward trend in rice consumption in some countries in Asia is largely due to urbanization, and that the

relatively low for rice. A 10 per cent increase in the price of the commodity will reduce its demand by 6 per cent for wheat, 5 per cent coarse grains and only 2 per cent for rice. This result confirms the average Asian consumers strong preference for rice so that when rice prices increase, they respond only marginally by substituting wheat or coarse grains for rice in the diet. So given a certain shortfall in supplies, rice prices will have to increase faster in order to clear the market, than in the case for wheat or coarse

price elasticities are high for

wheat and coarse grains but

Urbanization has a strong influence on the pattern of consumption of cereal grains. The demand elasticities of urbanization show that a 10 per cent increase in urbanization will reduce per capita consumption by I per cent for rice and by 5 per cent for coarse grains, but will increase the consumption of wheat by about 5 per cent. Thus, the observed increase in the per capita consumption of wheat in countries with high incomes and rapid economic growth, in contrast to the pattern found for rice, is mainly the result of the changes in food habits due to urbanization and only partially the outcome of in-

come growth. The countries which have reduced per capita consumption are Japan, Republic of Korea,

Asia Still Leads

Largest Producer and Exporter

A Special Correspondent reports from Rome

SIA still leads the world in rice production, the crop that feeds one-

The Food and Agriculture Organisation (FAO) of the United Nations reports that world rice production today is about 480 million tons. More than 90 per cent of these come from Asia.

Of the world's total rice harvest, only 12 million tons go to the international market. China, the world's largest rice

Dr Gurdev S. Khush a principal plant breeder at the Philippine-based International Rice Research Institute (IRRI), says rice production must increase by 70 per cent in 30 years to feed the world's growing population. "As population increases," he says, "so must rice production."

According to Dr Khush, IRRI is currently seeking new varieties with 25 per cent higher yield potential and with yield stability. And they must use



Manual pump developed by BRRI in 1977, which received

President's Gold Medal in 1981. producer, harvests 187 million tons of rice annually. India closely follows with a yearly rice production of 110 million tons, then Indonesia (45 million tons per year), Bangladesh (27 million). Vietnam (22 million), Thailand (20 million), and Myanmar (14 million). The Philippines produces about 10 million tons of rice annually.

In Asia, the world's largest exporter of rice is Thailand, which sells abroad about 4 million tons annually. Pakistan follows with exports of 1.3 million tons of the 4.3 million tons of rice it produces a year.

Other Asian countries which ship rice overseas are Victnam, China, India, Myanmar and Indonesia.

Although Asia is the world's top rice producer, other countries in the region import the cereal. Among rice-importing nations are Iran, Saudi Arabia, Syria, Singapore, Sri Lanka,

Yemen, Hong Kong, Malaysia

the Philippines, India and

China.

Rice provides more than half of the daily food for one of every three persons living on earth

Although most of Asia is now self-sufficient in rice, the world's population -- and thus, the demand for rice -- will increase by 2 to 3 per cent annually at least until the year 2020 when population growth stabilises. By then, the world will have 8 billion people, 4.3 billion of them rice eaters.

minimal inputs like fertiliser. trrigation and pesticides.

"Insect- and disease-resistant and drought-tolerant rice varieties will be the foundation of a sustainable, high-yielding rice production system," says Dr Khush. IRRI's main emphasis in

controlling insects, diseases and weeds in Integrated Pest Management (IPM), the use of non-chemical tactics as pest control to maintain high yields and maximise farm profits with minimal use of pesticides.

One of the foundations of IPM is "helpful insects" - the diverse communities of predators, parasites, and pathogens in every rice field that, if recognised and protected will control most pests.

Dr Dale G. Bottrell, head of IRRI's Entromology Division, reports IPM is now adopted as the main pest control strategy in Indonesia, India, Malaysia, Vietnam and the Philippines.

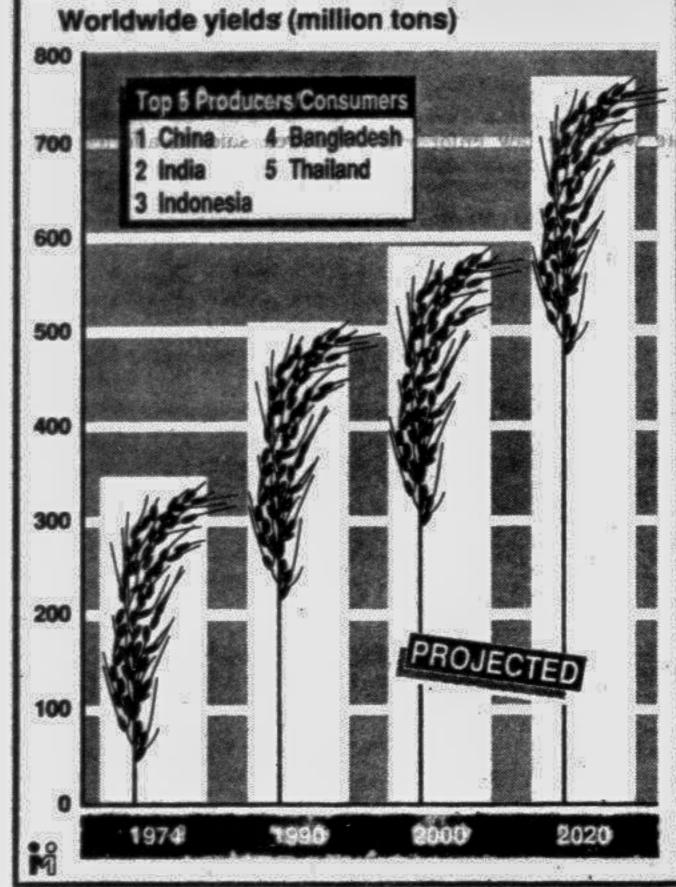
Rice is probably the world's most diverse crop. It is grown as far north as Czechoslovakia and Manchuria and as far south as Uruguay and New South Wales, Australia. Rice grows at more than 3,000 metres elevation in Nepal and Bhutan. Some rice varieties thrive in water as deep as four metres, absorbing nutrients through nodal roots on their stems. These can be found along India's Brahmaputra and other mighty rivers of Asia.

- Depthnews Asia

subsidies of fertilisers.

Colorado, in the United States,

Raising rice



IRRI started breeding the species in 1989. Experimental lots in Los Banos are to be planted this year to multiply the seeds. Testing will continue in

the next five to seven years. "The super rice will be ready by the turn of the century," said Dr. Gurdev Kush, chief of genetics at IRRI, who has been with the Institute since 1966 when IR8 was introduced.

Ninety per cent of the world's rice consumers live in Asia. The International Food Policy Research Institute in Washington predicts a food shortage at the end of the decade when the world population would hit 6.2 billion. Food production by then may not keep pace with population

Current rice production in Asia, which is growing at 60 per cent; is slightly ahead of the 55 per cent population growth. Khush said: "We hope that the new rice will lead to increase productivity so the gap between food production increase will be

World rice production by the end of the century will be 580 tonnes per year. "This is just enough for population growth," he noted. "But in the 21st Century, that won't be enough unless new strains come in."

A crucial problem is stagnating productivity. Dr Prabbu Pingali, IRRI agricultural economist, pointed out that production in India's Punjab state has been stagnate since the 1970s. In two states of southern India, it fell drastically

from the 1970s to 1988. He attributes the causes to lower nitrogen output from fertilisers, increases in pests that where they can be preserved for

The IRRI gene bank assures continuity of Asia's rice species. They could be lost in times of war and civil strife. Dr Michael Jackson, head of IRRI's gene bank, said samples of Cambodian rice were recently repatriated to Phnom Penh to help farmers grow again the species they lost during the country's two decades of civil war. The same was done for Sri Lanka and two states of India.

Samples of the cereal have been sent over the years to IRRI by rice-producing countries for research and safekeeping. The IRRI has a unique role in perpetuating forever the cultivation of rice, which began 10,000 years ago. Jackson explained: "We hold the materials in trust. That trusteeship requires us to provide storage conditions for long-term preser-

The gene bank assures that the super rice can be adapted to other rice-producing regions of South America, Africa, Europe and the US.

The development of super rice is IRRI's top priority, said Dr Lampe, despite Institute funding problems. The IRRI has evolved from a purely US mission to a multilateral concern that involves the World Bank, the Asian Development Bank, the European Community and individual donor countries. -Gemini News

The writer is a Singaporean Journalist specialising in economic and political affairs. She has been based in Manila since

zones (AEZs) and estimated the modern inputs shows that one kg of intensity of fertilisers contrend in rice yields. sumption would increase rice (unhusked) yields on the margin in about 11.4 kg. At inter-

The highest yield has been achieved in the subtropics, where most of the rice land is irrigated. The progress has, however, remained slow in subhumid tropics which has variable production environments and rice production suffers from abiotic stresses such as floods, droughts, and erratic rainfalls. Rice scientists have had limited success in developing higher yielding varieties suitable for the adverse environments in the

regions into five relatively ho-

mogeneous agro-ecological

Trends in Consumption: **Income and Price** Effects

Cercal grains account for two-thirds of the calorie intake in the average Asian diet. Except in Pakistan and the northwestern part of India and

Pakistan Efforts were made to

improve rice cultivation in the

country through the introduc-

tion of japonica varieties and

Japanese method of cultivation.

But neither the varieties nor the

cultivation methods suited the

agro-ecological and socio-eco-

nomic conditions of the coun-

on rice hybridization (indica x

japonica) achieved no fruitful

result. Later in 1966, the then

East Pakistan Government

sanctioned the East Pakistan

Accelerated Rice Research

Institute scheme. At the early

stages, research centred on the

introduction and use of exotic

progeny and pedigree lines col-

lected from the International

Rice Research Institute (IRRI) in

the Philippines. Subsequently,

in 1970, the East Pakistan Rice

Research Institute was estab-

A project sponsored by FAO

negative income effect cannot be generalized for Asia as a whole. They showed that the threshold level of income at which consumers starts substituting rice for other foods has not yet been reached for the major rice producing and consuming countries, such as China, India, Indonesia, and Bangladesh. These four countries account for over 70 per cent of the total rice consumption, and still dominates the growth in demand for rice in

The estimates of the income and price elasticities derived from the David and Huang study shows that for Asia as a whole, the income growth induced demand for foodgrains is still positive. A 10 per cent increase in per capita income will increase per capita consumption by 3.4 per cent for rice, 3.2 per cent for wheat and 1.8 per cent for coarse grains. Therefore wheat is not a preferred cereal over rice. The own and cross come Asian countries. The countries which have experienced a high rate of increase in per capita rice consumption are Indonesia (40 per cent), Cambodia (36 per cent), Korea DPR (30 per cent), Nepal (27 per cent), China (21 per cent), Myanmar (16 per cent) and India (16 per cent). Most of these countries have however achieved high levels of consumption of cereal grains and further increases in income may contribute only marginally to growth in rice consumption. The income induced demand for rice is likely to be strong only in South Asia.

Malaysia and Thailand; all of

them are middle and high-in-

The writers are Head and Research Assistant respectively in Social Sciences Division of International Rice Research Institute, Manila, Phillippines. Dr Hossain was the former Director General of Bangladesh Institute of Development Studies.

BRRI and Modern Rice Technology by Dr. S A Miah

lished. After liberation it was renamed the Bangladesh Rice Research Institute (BRRI) by Parliamentary Act No. X of

BRRI has made significant achievements since its establishment in 1970 for which it is well known in the world rice community.

BRRI's breeding strategy deviated from the original IRRI concept of dwarfism for high yields and began to develop varieties that suited the local agro-ecology. New intermediate plant types were developed that produce high yields but yet meet farmer needs for cattle feed and roofing materials.

Development of MV rice. Of the 26 varieties BRRI has so far developed, 13 are for both the Aus and Boro seasons, 8 for the T Aman season, 3 are for the single rice-cropped low-lying haor areas to be grown during the Boro season, and 2 for rainfed upland areas prone to drought IR5, IR8, IR20 and Purbachi were brought from outside the country and tested for adaptability in the agro-cli-

matic conditions of Bangladesh before recommendation. Pajam, an exotic variety, is also considered as an MV rice. The recently released BR22 and BR23 are photoperiod sensitive and can be planted after floods as late as early October. Most of the

BRRI developed MV rices are resistant or moderately resistant to important pests and diseases like tungro, bacterial leaf blight (BLB) and blast.

Some of the BRRI varieties, such as BRI, BR3, BR4 and several other advanced lines, have been adopted as varieties in Burma, India, Nepal, Shri Lanka, Vietnam and in some African countries.

BRRI scientists have organized and conducted survey and monitoring tours to collect data on the nature and extent of pests and diseases affecting rice production. A total of 175 species of insect pests and 31 diseass affecting rice have been identified and their distribution mapped in different regions and scasons. Integrated pest management practices have been developed.

Soil and fertilizer management. An approach has been developed for the determination of appropriate doses of different fertilizers based on the nutrient supplying capacities of soils, target yields and fertilizer utilization efficiency.

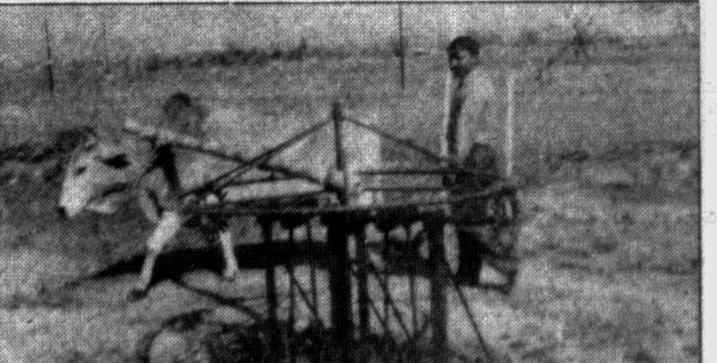
Rice-based cropping systems. Research has been conducted to improve the production and income from traditional farming systems by fitting MV rice into them. BRRI scientists have developed 14 new cropping patterns for five major

land-type zones in Bangladesh. Experiments have show that without losing any time for turn-around (for rotting stubble), a second rice crop can be immediately planted in the same field. Contrary to belief and practice that Boro should be transplanted during November-December, it has been shown that in a flood-free situation, Boro can be transplanted as late as early February. BRRI has developed a low-cost

diaphragm pump which can raise water up to a height of 3-5m at the rate of 210-230 lit/in. An animal-driven pump, which

tiller, an animal-driven seeddrill for rice, a rice-cum-wheat thresher and a groundnut sheller are in the final stages of development and will soon be available for farmer use.

During 1971-72 to 1986-87 MV rices produced 73.29 million tons of clean rice. The total value of MV rice in 1986-87 alone (7.07 million tons) was more than Tk 66,800 million at Tk 350,00 per maund. Rice production was 15.4 million tons during 1986-87 compared to 9.93 million tons in 1971-72. The average production growth rate was 2.97per cents per annum. Had there been no MV



Animal pump developed by BIRRI in 1984,

can utilize idle cattle power during the off-time of the year has also been developed with a lifting capacity of about 170/225 lit/min from a depth of 3-7m. Other agricultural machinery, including a power

rice and only traditional rice varieties were grown during the last 16 years, the production of clean rice would have been less by 40.11 millions tons.

The writer is Research Coordinator of BRRI.