The Daily Star
CELEBRATING 26 YEARS OF
Journalism without Fear or Favour
MONDAY FEBRUARY 27, 2017
FALGUN 15, 1423 BS

Sustainable rice production

Bangladesh has more than tripled the production of rice in the space of 45 odd years.

PHOTO: ANURUP KANTI DAS

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Last time the world witnessed a phenomenal growth in agricultural productivity was back in the 60s. What American biologist Norman Borlaug initiated in Mexican wheat fields during the mid-20th century, the first breeder of then newly established International Rice Research Institute (IRRI), Dr Peter Jennings, did the same for rice. Together, these two men brought a phenomenal change in rice and wheat production thereby ushering in a Green Revolution, long being credited for averting a billion deaths.

Dwarfing of wheat and rice plants, thereby turning the world's two of the most consumed staples highly yielding, was a game changer. It saw Mexico becoming a net wheat exporter by 1963, India and Pakistan literally doubling their wheat baskets between 1965 and 1970, Borlaug winning a deserving Nobel in peace in 1970 and nations across Asia, Africa, Latin America and elsewhere benefiting from semi-dwarf 'Miracle Rice' IR8.

IRRI's hand in helping the rice-eating world through breeding better varieties of rice began shortly after the Ford and Rockefeller Foundations established the Institute with the help of the Philippine government in 1960. IRRI scientists sought to replicate in rice what had been done in wheat in Mexico, and successfully bred IR8—a semi-dwarf variety that journalists dubbed 'Miracle Rice' because it could produce twice the amount of rice grains that tall varieties produced. IR8 has been credited with averting a humanitarian crisis that would have otherwise plunged the world's poor into abject hunger. Since then, more than 900 IRRI varieties have been released in 78 countries, across five continents. Some of these were bred to be resistant to insects or diseases, and they can withstand poor soils.

In November 2016, IRRI celebrated the 50th anniversary of the official release of the semi-dwarf rice variety IR8 to Asia and the world. It became popular with farmers because it had short growth duration and a high-yield capacity related to its response to nitrogen fertiliser.

Since that time (the mid-20th century) the world has seen its population grow from 2.5 billion (1950) to 7.4 billion (2016) and its per capita arable land nearly halve from 0.37 hectares (1961) to 0.197 (2013).

Half of today's world population depends on rice for survival, and, owing to predicted population increases and a general trend towards urbanisation, per hectare of land that currently provides enough rice to feed 27 people will need to support 43 by 2050.

In December 2021, Bangladesh will celebrate 50 years of independence. Keeping that timeframe in consideration, Bangladesh's Vision 2021 rightly set goals: a) to become a participatory democracy; b) to have an efficient, accountable, transparent and decentralised system of governance; c) to become a poverty-free middle-income country; d) to have a nation of healthy citizens; to develop a skilled and creative human resource; e) to become a globally integrated regional economic and commercial hub; and f) to be environmentally sustainable; and to be a more inclusive and equitable society.

More importantly, attaining autarky in rice, the staple, is not enough to proclaim ourselves food self-sufficient. We need a reality check here. After rice, maize emerges as the second most important cereal crop relegating wheat into third position in Bangladesh.

In 1971, we had a population of 75 million and our food production was a little over 10 million metric tonnes. Thanks to adoption of modern farm technologies, policy support, better breeds and inputs and above all a hard working farming community, today we grow over 35 million metric tonnes of cereal crops.

So it's true that since the Borlaug and Jennings days, the world's food production grew dramatically keeping pace with an alarmingly faster rate of population growth. To cite a country-specific example, we can easily refer to the Bangladesh scenario. Over the past four decades, Bangladesh succeeded outpacing the population growth rate with its growth in rice output. The country has more than tripled the production of its staple in the space of 45 odd years.

But questions arise whether we have reached a plateau - where any further growth in farm outputs would be too hard to achieve. We have a large population base and despite a falling population growth rate, it'll take a few more years before we get stabilised by the time farmlands continue to get scarcer thanks to rapid urbanisation, industrialisation and infrastructure developments.

Achieving self-sufficiency in rice at this point of time is no way perpetual. History shows we have reached such points in a few occasions in the past when output matched the demands but again we did slip back - not because of any production decrease rather, because of population increase.

More importantly, attaining autarky in rice, the staple, is not enough to proclaim ourselves food self-sufficient. We need a reality check here. After rice, maize emerges as the second most important cereal crop relegating wheat into third position in Bangladesh. We're still not able to meet the total domestic requirements of maize thanks to a huge feed demand triggered by a burgeoning fish and poultry industry. And over 75 percent of our annual wheat demands are met by imports.

Currently, more than 790 million people in the world do not have enough to eat, and over 280 million, in other words, nearly a third of food-starved people, live in our part of the world (South Asia). Producing enough food does not necessarily guarantee people's right to food. To make sure people have rightful access to food all the time, ensuring its availability, stability, accessibility, sustainability and adequacy is equally important.

Standing at this crossroads, we need to revisit the whole range of farming issues - how sustainable the heavily input-driven production system is, how prudent it is to overexploit our fast depleting groundwater table and what would be our coping mechanisms to face impacts of climate change in the farm sector.

Prior to Green Revolution we had rain-fed rice like Aman and Aus but thanks to introduction or irrigated dry season rice Boro during the winter there has been phenomenal growth in the staple output. But for that to happen we started sinking millions of shallow and deep-set pumps to draw water from underground and irrigate the Boro rice. At the same time we started using chemical fertilizers and pesticides. We had also advanced in farm mechanisation thereby dwindling the numbers of our draft animals, which were also a big source of dung, the natural manure.

Climate-induced stresses are becoming all the more challenging. Extreme weather conditions like prolonged flood, shorter winter, drought and salinity pose huge challenges. Too much mining of groundwater in the north (greater Rajshahi, Rangpur-Dinajpur region) for irrigating rice lands creates vacuums underneath, giving more inroads for the southern saline water to seep in. To some count a tenth of our cultivable lands are saline-prone to varied levels.

To address these challenges scientists have taken up an uphill task of developing various crop varieties that can withheld stress conditions and are genetically better bred giving extra vigour and higher productivity.

Growing rice with less water

It takes 14 million litres of irrigation water to produce six tonnes of Boro rice on one hectare of typical farmland in Bangladesh. A farmer has to burn 250 litres of diesel to run a shallow pump, owned or hired, to irrigate this single hectare of paddy field. If translated into minuscule unit, each kilogram of rice reaches our plates from the farm at the expense of 3,500 litres of immensely valuable fresh water.

One Bangladeshi agronomist took it upon himself to see what difference he could make in terms of water conservation and save the country from an ecological disaster. Irrigated-rice Boro contributes 55 percent of Bangladesh's nearly 35 million tonnes of yearly rice output and heavily sucks on a rapidly depleting groundwater.

Professor Moshiur Rahman, who teaches agronomy at Bangladesh Agricultural University (BAU) in Mymensingh, negated the notion that rice in dry season has to grow in puddle condition, soaked field and in standing water. Rahman wanted to challenge the notion and began with an on-campus experiment back in 2006-07. In the last 10 years, Rahman reached out to plots of many farmers in six rice-rich districts, and reached a conclusion—rice can be grown using less than half the irrigation water in Boro season.

Rahman and his team conserved water by not growing seedlings in the nursery. They, rather, directly sowed in the dry field by plowing furrows and did not puddle or soak the field with water, thereby saving some water as well. They didn't keep standing water in the paddy field during the period between panicle initiation and grain-filling. In the direct-seeded Boro rice technology, Professor Rahman said, what farmers are required to do is keep the seeds soaked in water for 24 hours and then incubate the soaked seeds for another 30 to 40 hours prior to sowing in the paddy field. From the results of his experiments with the direct-seeded rice technology in Rajshahi, Rangpur, Dinajpur, Tangail, Netrokona and Mymensingh over the last 10 years, Rahman showed statistical evidence that in the most conservative estimate, 50 percent less water was required for growing rice with equally productive yield.

If further tweaking makes the water-conserving rice production system work fine, then it will definitely be a great relief for rice-rich northern region of Bangladesh that has long over-exploited groundwater in irrigation. Around 88 percent of total fresh water is used for agriculture in the country and rice production accounts for 73 percent of that water. The UN Food and Agriculture Organization (FAO) stated in a report, "In some parts of the country, particularly the Barind Tracts in the northwest region, there are already symptoms of deterioration in the natural hydrological regime. Declining groundwater levels have affected water quality causing it to affect soils, the growth of agricultural crops, flora and fauna and to increase health hazards."

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