We can grow more

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BEING an agriculture-dependent economy with a growing population, and having one of the world's lowest land-man ratios with further aggravation due to loss of and non-agricultural use of land, the most important issue in Bangladesh agriculture is to ensure enhanced and sustained growth in crop productivity.

Given the growth potential in food grain production, every effort needs to be taken to materialize this and facilitate agriculture to play its due role in the economy of the country. But there exists some major constraints, affecting realization of growth potential in cereal crops.

There are wide gaps between the potential and realized yields for cereal crops in Bangladesh. Studies indicate that the yield potential achievable at farmers' management of the existing HYVs of rice is more than 4 tons/hectare milled rice, whereas, the average majority of farmers is little over 3 tons/ha.

The same relative magnitude of yield gaps occurs with other crops. For example, the average yield of potato is 12-14 tons/ha, whereas the yield potential is about 25 tons/ha. Thus the foremost priority for Bangladesh is to accelerate and sustain crop productivity growth by closing the yield gaps.

This will basically require vertical expansion or increase of yield, meaning intensification and diversification and thereby making room for growing other crops.

This is one of the major challenges for growing food crops to feed the increasing population, producing industrial crops and crops for export market, in a country with the lowest and decreasing per capita cultivable land.

Yield gap assessment

Crop yield is a function of environment and genotype of the variety used. To improve the yields of certain genotypes, technologies are being developed at the research stations. These technologies are adopted in the farmers' fields to harness benefits in production and profit.

But the full benefits of the technologies are seldom realized by farmers, because the environmental conditions, cultural practices and inputs used in the research stations are better than those of the farmers' fields.

Farmers cannot use the recommended inputs and adopt technology management because of their poor socioeconomic condition (dearth of cash, family labour, etc) and other associated factors (timely availability of quality inputs, hired labour, etc).

Thus the potential yields of the varieties in the research stations cannot be obtained in the farmers' fields. This difference between the potential yield at the research station and that usually obtained in the farmers yield is called the yield gap (JICA 2005).

This gap is to be reduced for improving production at the farm level. For this, an understanding of the factors contributing to yield gap is a prerequisite. In the farmers' plot a number of factors contribute to the crops to reduce the yield and thus cause the gap.

Closing the gap

This gap is due to physical/environmental factors like flood, draught, cold and heat injury, hailstorm, salinity, etc. Even biological factors like disease, insects, etc and socio-economic factors like lack of working capital, non-availability of input, unfavorable price of input and output, etc. and the risk in adoption of technology, poor cultural practices are all contributing to the yield gap(Ibid.).

In the Bangladesh context, it is not possible to increase the area under crop as it is decreasing year after year. The solution lies in raising yield per unit of land. Experiments are being conducted, technologies are being developed and experiences are getting accumulated to overcome the bottlenecks of reducing the yield gap. Some of the successful experiments are mentioned below:

Yield of rice in Bangladesh is low and it is half of the yield received by the farmers of South Korea, Japan, and China. Fertility of the soil is one of the prime causes of this low yield.

To meet the demand of food for the growing population, cultivation of HYV seeds with increasing cropping intensity, use of chemical fertilizer are being practiced in Bangladesh, which results in the degradation of soil nutrition and soil health.

Balanced use of fertilizers according to the soil characteristics and requirement of particular crops can maintain the quality of the soil and raise the crop production to the extent of 30 to 40 percent. Facilities for testing the soil are getting available. The Soil Resources Development Institute (SRDI) has identified the soil characteristics of the country, and indicated the types of crops that can be grown according to such characteristics.

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BRAC and some private sector agencies have also developed facilities for testing the soil. BRRI has developed a small Soil Safety Kit to test the soil and the mechanisms for calculation of fertilizer requirement. Farmers are motivated to avail the facilities and services, test the soil of each of their plots and determine the type and amount of fertilizer to be used.

Besides, the Integrated Plant Nutrition Supply (IPNS) system, a judicious combination of chemical fertilizers, organic manure and bio-fertilizers is being advocated in cases of soil degradation due to constant use of chemical fertilizers.

Amount of fertilizer use and the pattern of its use have a role to play on yield. Soil nutrients are integrated with one another. Imbalanced supply or shortage of one nutrient leads to inactivity or deficit of the other. Complete fertilizer is the easiest method to balance supply of nutrients.

This helps yield increase as well as quality. When urea, phosphate, potash and other chemical fertilizers are mixed proportionately according to the requirements of a particular plant it is called a complete fertilizer. This complete fertilizer has synergistic effect, which is a lot more than the combined effects of individual uses of all the four fertilizers.

This mixture contains exact proportion of important nutrients required for a plant. The result is that soil quality is enriched and productivity is increased leading to reduction in the yield gap. Results of fertilizer demonstration by the Department of Agricultural Extension showed that the use of complete fertilizer gave additional yield of 1,967 kg rice/ha in Boro rice cultivation compared to 766 kg with only nitrogen, 1,300 kg with nitrogen and phosphorous, 1,546 kg with nitrogen, phosphorous and potassium (BRRI 2006).

In Bangladesh, the emphasis so far was on cultural practices and adoption of HYV seeds for raising the production of rice. But farmers have a tendency to use the same seed from their plot for years together, which might have degenerated after two or three uses.

They do this to avoid spending on seeds due to lack of knowledge on the affect of seed degeneration and lack of calculation on the benefit that may be derived from the investment on quality seeds. Since quality seeds can give 15-20 per cent increased yield, the supply of such seeds by BADC to all categories of farmers has to be ensured. Hybrid seeds of cereals opened the door for further possibility of raising production to the extent of 15-20 per cent more than the HYV seeds.

Out of 8.2 million hectares of cultivable land, about 5 million is brought under Transplanted Aman (T. Aman) crop cultivation. Being dependent on rain fed conditions, T. Aman suffers from draught due to erratic and uneven distribution of rainfall in about 4.2 million ha in 254 upazilas in 46 districts.

Yield loss in T. Aman due to draught varies from 15 to 60 per cent according to intensity of draught (BRRI 2006). Supplementary irrigation particularly during the tiller, vegetative growth, panicle growth and flowering stages of a plant can save the situation.

For this, farmers are being motivated to adopt supplementary irrigation in T. Aman, and appropriate technological interventions and logistic supports are being provided. DAE has accumulated experiences in motivating the farmers to adopt supplementary irrigation, water management, organic matter management of the soil, and adoption of appropriate cropping pattern, varieties of rice, and cultural practices, etc. during this season. This experience is to be reproduced on a countrywide basis.

Disease and pest attack damage on average 10-15 per cent crops. Constant use of pesticides raises the resistant capacity of pests and insects and kills some useful insects. Besides, it raises the cost of cultivation and damages the environment.

Emphasis is given on integrated pest management (IPM). DAE with the support of donors like DANIDA, FAO and UNDP is implementing IPM in about 250 upazilas of the country through motivation and training of farmers and publicity. It is necessary to bring the entire country under IPM.

Investigation has found that seedling has bearing upon yield rate. In Boro season, the highest grain yield was recorded with 20-day old seedlings from December 15 to January 31 planting and after that a 35kg/ha reduction in yield for 1-day increase in seedling age.

Grain yield reduction rate for Boro rice was 20 kg/ha for each day increase in seedling age during February plantation. Considering production constraints, 40-45 day-old seedlings could be utilized in Boro season without much reduction in grain yield during December 15 through February plantings.

This can be extended to another 10 days for the cooler region. In haor region, 19 day-old seedlings gave the highest yield. In T. Aman season, the optimum seedling age is 29 days during July 15 to August 31 planting. Under late T. Aman conditions (September 1-15), the optimum seedling age was 50 days. In Aus season, 13-day seedlings gave the highest grain yield (BRRI 2006).

Irrigation efficiency has a bearing upon water loss prevention and increasing production. In research management 1,800 liter of water is required to produce one kg of rice, but in farmers' management, water requirement increases to 4,000 liters. This is a great loss of water that can bring more areas under irrigation.

High irrigation cost is one of the basic reasons of higher cost of production of rice in Bangladesh. Farmers believe that rice fields require continuous standing water. But research is finding that yield does not decrease if rice fields are kept dry for three days in between two consecutive irrigations.

At least 25-30 per cent of irrigation water can be saved through this method. Other researches have also found that the practice of keeping the land under continuous shallow submergence (about 5 ±2 cm) throughout the crop growth period was conducive to save water and higher yield compared to deep submergence of 10 ± 2 cm, which is very common practice with the farmers.

In draught prone north-west part of Bangladesh, the yield of T. Aman can be increased up to 1.0 1.5 t/ha by mitigating draught through 2-3 supplemental irrigation and thereby increase 2-3 million tons of rice production in Aman season. In the salinity prone southern and coastal area, 1 million ha of land can be brought under Boro cultivation by utilizing less saline water from rivers and canals, collected at the beginning of dry season, by using existing conservation structures. Thus land productivity can be increased in Bangladesh by producing two rice crops instead of one Aman (BRRI 2006).

Reasons for yield gap and the potentials for minimizing such gap so far discussed shows that new knowledge and technology are getting available to raise the crop yield.

It is the responsibility of the training institutions and implementing agencies to be in touch with the research institutions, get the new findings, arrange training for the farmers on the new technology and transmit the same to them.

In addition to the new knowledge and technology, farmers will need new inputs and credit for adoption of the same. Such services can be arranged by public sector agencies, NGOs and private sectors (dealers of inputs and other service providers).

Sub-Assistant Agricultural Officers (former Block Supervisors) and upazila Agriculture Officers of DAE can play a vital role in farmers' training and arranging inputs. A coordinated planning and effort at the grassroots level particularly at the Union Parishad (UP) level under the leadership of the UP Chairman may be a positive step.

The government is developing a complex at the UP level with facilities for office room of the staff of Nation Building Departments (NBDs), training hall, office room for the UP Chairman, Secretary and seating arrangement for the UP members.

The complex Japan International Cooperation Agency (JICA) has developed is being utilized by the link-model composed of Union Coordination Committee (UCC) as a coordinating mechanism, Union Development Officer (UDO) as a coordinator of UCC and Village Committee as a group of village representatives.

This has facilitated the support and services of the staff of NBDs, UP, NGOs and private sector agencies through arranging training and information flow to the villagers, provision of services and participatory planning and implementation of projects by the villagers themselves. Efforts to close the yield gap through replication of the link-model may be worth trying.

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BANGLADESH RICE KNOWLEDGE BANK

An on-line opportunity to serve the farmers

DR MUSHERRAF HUSAIN and DR NOEL P MAGOR

THE Bangladesh Rice Knowledge Bank (BRKB) is an electronic hub of rice production technology knowledge. It is an on-line digital library to deliver up-dated information on modern rice cultivation. The BRKB is accessible through internet explorer(http:// www. knowledgebank-brri.org), CD-ROM and print.

The knowledge bank has been developed to help fill the yawning knowledge gap between research and impact. Improved access to technical knowledge underpins improvement in crop yield. The knowledge gap between research and impact is one of the main causes of the yield gap existing in the country.

The yield gap, which ranges from 1-3 tons per hectare in case of rice, is actually the gap in yields between research managed and farmer managed plots. This suggests that the country's food production can be substantially improved with the existing production technologies, provided that farmers are up-dated with current technological knowledge.

However, besides knowledge, the input and management gap is another reason for yield gap in Bangladesh. For example, farmers may have the knowledge that younger seedlings planted early in the season give better yield, but they may not be able to practice this knowledge due to physical and environmental constraints, e.g. too much stagnant water during the monsoon does not allow transplanting of younger seedlings.

Again, the cold during the winter does not allow transplanting of younger seedlings as they grow slowly. Similarly, farmers may have the knowledge about what fertilizers to use, in what quantities and at what time, but they cannot afford the fertilizer due to capital shortage or unavailability in the market.

Scientists may not have much to do to help the farmers apply the inputs as required. However, they obviously have a great role to play in communicating the correct technological knowledge to the farmers to help them improve their productivity and quality of life. The on-line knowledge bank has been developed to serve this purpose.

The BRKB scope and potential:

Agricultural knowledge networking is considered to be vital for poverty reduction. Information and communication technology (ICT) offers a very powerful tool for capturing and disseminating information to those who are starved of it.

The Bangladesh Rice Research Institute, in collaboration with the International Rice Research Institute, is harnessing that power through the development of the rice knowledge bank. ICT is known as the information super-highway.

Simply capturing information is of no use unless it is applied. To make information applicable, unification and standardization of knowledge is essential. This will facilitate sharing of knowledge among the various agencies concerned.

1. This knowledge bank captures and standardizes rice information generated by any source, either public or private. That is, technology knowledge generated by organizations other than BRRI is also captured and distributed.

2. The KB is also a potential repository for non-rice enterprises. Since the farmers are concerned with the farming system information on non-rice crops, livestock and fisheries, integrated pest management, agro-forestry etc. can also be distributed through the BRKB.

3. The BRKB materials would be available in both English and Bangla. The Bangla version will satisfy the needs of the extension field staff and farmers.

4. The knowledge bank can be efficiently utilized for training and extension. Extension workers can easily prepare extension-teaching materials using the BRKB

5. The knowledge bank, a digital library, can also be utilized by the graduate students and university professors for research and teaching purpose. The English version will be of particular importance for this.

6. The BRKB will be a tool for imparting rice production training to extension officers and field extension workers of both government and non-government organizations.

7. The BRKB is a dynamic repository of rice knowledge, which will be always up-dated at regular intervals. This will facilitate uploading of the latest research findings in the BRKB web. However, the CD-ROM and the print version may not always be so.

8. The knowledge bank communicates rice information from three channels.

a) Internet: Up-dated version of the BRKB contents is available on the internet for global access. Thus, the BRKB is a "single source" publication. This also facilitates the monitoring of visitors' opinions and frequency of hits on the web address.

b). CD-ROM: However, the BRKB is also available on CD-ROM. Therefore, it is not a problem if some one does not have an internet connection.

c). Print-out: The users of the BRKB can have access to it in print-out form. Either the entire BRKB, or any part(s) of it, can also be downloaded from internet or CD-ROM. Thus, the printed materials can be easily used for training the farmers. The knowledge bank is, therefore, a powerful and sustainable means of communicating technological information to all users in the medium most suitable for them.

Contents and Forms of Information in the Knowledge Bank:

The knowledge bank contains a home page, which guides the user to the desired topic. There is a section allocated for current news of relevance, a section on population and rice in Bangladesh, and rice production technological information. All the technological information on rice cultivation has been presented in the form of;

1) Fact sheets -- one to two pages description of a single technology, e.g. a rice variety or an establishment method etc. The fact sheets are for particular use by the field extension staffs and farmers;

2) Reference manuals -- detailed description of technical information which can be utilized by the graduate students, scientists, professors and senior extension personnel;

3) Technical information and;

4) Farmers materials -- leaflets, folders, posters etc.

These materials can be used by the extension staff for training the farmers.

What characterizes the BRKB?

The knowledge bank has its distinct characteristics.

1) It is focused. The focus is currently on rice. It provides materials on rice training and extension. However, it may potentially focus on non-rice information.

2). It is credible. The BRKB materials are authentic. Scientists having expertise on a particular subject prepare the fact sheets and other materials. These are endorsed by a technical committee for rice at BRRI.

3) It is value-added. The BRKB materials are prepared with the understanding that scientific information is communicated to non-scientist audiences. Materials are, therefore, prepared for easy understanding and application. These are always rich in photos and videos.

4) It is demand-driven. Contents of the BRKB are developed to meet the demands of the farmers, i.e. the information the farmers are waiting for.

Progress and present status

The knowledge bank was initiated in 2004. Now it contains two complete rice production training modules for boro and aman seasons, with support from the European Commission Funded FoSHoL project and IRRI.

The modules accommodate some 210 fact-sheets covering almost all essential aspects of modern rice cultivation technologies. However, some of the fact-sheets are common for boro and aman season. In the meantime, three 4-day training sessions have been successfully conducted at the Bangladesh Rice Research Institute using the BRKB based training modules.

The recent training course and the BRKB aman rice production training module have been formally launched by the honorable Minister for Agriculture, M K Anwar. He advised the scientists to up-date the information of the knowledge bank regularly.

He stated that the knowledge bank would help transfer rice knowledge to farmers. The minister expressed the view that the BRKB on-line network may be initially extended to 100 Upazilas. The farmers there shall be able to gather all agricultural knowledge through extension workers.

ICT offers a powerful means of developing and delivering knowledge. Using this opportunity, the Bangladesh Rice Research Institute, in collaboration with of the International Rice Research Institute, is packaging its 35 years of rice research knowledge for on-line dissemination to extension workers and farmers.

It is anticipated that the BRKB knowledge network would significantly fulfill the long desired need for rapid dissemination of agricultural knowledge to farmers, which will eventually help improve the lives of rural people.

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