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Urea and TSP Saving Technology: BRRI-Organic Fertiliser

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Due to the growing population and industrialisation, waste management has become a major global challenge. In our daily lives, we generate enormous amounts of waste, which disrupt environmental balance. To address this problem and build an environmentally friendly world, the "3R" (Reduce, Reuse, Recycle) concept has become a well-known global model. The core philosophy of this concept is to consider waste not merely as "garbage" but as a "resource".

The first "R", Reduce, means minimising resource use. The second "R", Reuse, ensures the sustainable use of materials. The third "R", Recycle, focuses on producing new products from waste. Essentially, the main objective of this theory is to prevent the waste of natural resources through a "circular economy". This article shares the story of how BRRI transformed waste into organic fertiliser through recycling.

Like the rest of the world, waste management is also a major issue in Bangladesh. In large cities, including Dhaka, high population density leads to the generation of huge amounts of organic and inorganic waste daily. Due to limited collection and processing capacity, this waste becomes a source of environmental pollution instead of being converted into resources. However, with proper planning, developed countries successfully produce organic fertiliser from waste through proper management.

From 2015 to 2025, analysis of various government and research data shows that in 12 city corporations across Bangladesh, approximately 17,000 tonnes of waste are generated daily. In Dhaka alone, about 6,465-8,000 tonnes of waste are produced daily (about 0.61 kg per person per day). Chattogram generates about 2,135 tonnes per day, Khulna about 1,000 tonnes, Narayanganj about 1,000 tonnes, and Gazipur about 4,000 tonnes per day. Because household, market, and industrial waste are not properly separated, recycling and composting become difficult. Moreover, the country has a limited number of modern landfills, material recovery facilities, biogas plants, and compost plants, and environmental management at existing sites is often inadequate. Research indicates that nearly 80% of Dhaka's daily organic waste is suitable for composting. When composted with rock phosphate, phosphorus availability increases, making it possible to completely eliminate TSP fertiliser in crop production.

Food security in Bangladesh largely depends on rice. About 8.82 million hectares of land are cultivated with rice, requiring large quantities of chemical fertilisers, approximately 3.8 to 5.0 million tonnes annually. In 2024 alone, about 4.7 million tonnes of fertilisers, including urea, TSP, DAP, and MOP, were imported. Excessive chemical fertiliser use and intensive cropping have significantly reduced soil organic matter. Ideally, soil should contain 5% organic matter, but in many parts of Bangladesh it is less than 1%. To address this issue, the Soil Science Division of the Bangladesh Rice Research Institute (BRRI) developed BRRI-Organic Fertiliser by combining 10 environmentally friendly bacteria, decomposable kitchen waste, 5% rock phosphate, and 15% biochar.

After long-term field trials in the Aus, Boro, and Aman seasons, initiatives have recently been taken to commercialise BRRI-Organic Fertiliser. The recommended application rate is 1 tonne per hectare in the Aus season and 2 tonnes per hectare in the Boro and Aman seasons. Results show that using this fertiliser allows complete elimination of TSP and approximately a 30% reduction in urea application without yield loss.

The government provides substantial subsidies for urea and TSP fertilisers every year. Chemical fertiliser production consumes natural gas and emits harmful greenhouse gases. Research shows that producing one kilogram of urea or TSP emits about 6.5 kg of carbon dioxide (CO_2). The use of BRRI's organic fertiliser in rice cultivation reduces 30% of urea and eliminates TSP use, while converting market and kitchen waste into organic fertiliser, thus reducing environmental pollution.

Dr Umme Aminun Naher, Chief Scientific Officer of BRRI's Soil Science Division, stated that the primary raw material for TSP or DAP fertiliser is rock phosphate. Since rock phosphate is not easily soluble, it cannot be directly applied to short-duration crops like rice. However, phosphate-solubilising bacteria living in the soil can dissolve rock phosphate quickly, making it available to plants. The inclusion of 15% biochar in the fertiliser directly adds carbon to the soil, improving soil quality. Research also indicates that continuous use of chemical fertilisers reduces the population of beneficial soil microorganisms, such as nitrogen-fixing and phosphate-solubilising bacteria. The use of BRRI-Organic Fertiliser increases beneficial microbial populations in the soil.

Dr Umme Aminun Naher initiated this research during her PhD at the University of Putra Malaysia in 2005. She developed the biofertiliser using nitrogen-fixing and phosphate-solubilising bacteria combined with composted waste from peat and palm oil industries. For this innovation, she won first prize in 2012 in a competition organised by the United Nations' International Science, Technology and Innovation Centre for South-South Cooperation (ISTIC) and The World Academy of Sciences (TWAS). Her dream was to return home and develop a unique organic fertiliser for Bangladesh. She emphasised low-cost technology to solve soil fertility problems, increase productivity, and reduce reliance on expensive chemical fertilisers for smallholder farmers.

Nitrogen is the most essential nutrient in rice cultivation and is typically applied as urea. However, only 30-50% of applied nitrogen is utilised; the rest is lost through ammonia volatilisation, nitrous oxide emissions, and nitrate leaching. Phosphorus is the second most important nutrient, typically applied as TSP or DAP. Rock phosphate is the natural source of these fertilisers. Direct use of rock phosphate reduces greenhouse gas emissions and production costs, but due to its slow solubility, phosphate-solubilising bacteria are needed to make it plant-available.

During the 2023-24 Aman and Boro seasons, research at BRRI, Gazipur, showed that applying 70% nitrogen (N), 0% phosphorus (P), 100% potassium and sulphur (K & S), along with BRRI-Organic Fertiliser, increased economic profitability by approximately 1.89 times. This demonstrates that replacing chemical fertilisers with BRRI-Organic Fertiliser can reduce production costs, ensure higher profits, and decrease dependency on chemical fertilisers.

On February 9, a memorandum of understanding was signed between BRRI and ACI to commercialise the fertiliser. Under the agreement, BRRI will transfer the production technology of BRRI-Organic Fertiliser to ACI PLC. ACI will produce and market high-quality organic fertiliser for farmers and establish its own factory and modern laboratory to ensure production efficiency and quality.

This organic fertiliser is not merely an alternative to chemical fertilisers; it is a transformative innovation for Bangladesh's rice production system, ensuring economic savings, environmental protection, and long-term food security. With proper policy support and widespread adoption, this technology can bring sustainable transformation to the country's agricultural sector.

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