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FERTILIZERS AND ENVIRONMENTAL IN INDIA AGRICULTURE CONTEXT

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Use of chemical fertilizers is an integral part of the package of practices for raising the agricultural production to a higher place is almost universally accepted. Studies conducted by the Food and Agricultural Organization of the United Nations have established beyond doubt that there is a close relationship between the average crops could not be fully met with the use of organic manures like FYM, neem cake, castor cake, groundnut cake, etc. for want of their availability in adequate quantities.

The amount of fertilizer nutrients ($N+P_2O_5+K_2O$) used in India during the year 1950-51 was 69,800 tonnes, which increased to 7,84,600 tonnes in 1965-66. The 'Green Revolution' (a seed cum fertilizer revolution) period started around this time, the fertilizer usage increased rapidly. In the next 10 years, the fertilizer consumption quadruped to 2.9 million t in 1975-76, which further rose to 20 million tonnes in 2009-2010. In 2025 the food gain requirement for India's 1.4 billion people will be about 300 million tonnes (Mt). This production level will require about 30 M t of nitrogen (N), phosphorus (P) and potassium (K), including 8.6 Mt of P_2O_5 (Tiwari, 2001).

The intensity of fertilizer consumption varies greatly between the regions, from 40.5 kg/ha of total nutrients in Rajasthan to 184 kg/ha in Punjab. Urea accounts for 82 per cent of total nitrogen consumption and di-ammonium phosphate for 63 per cent of phosphate consumption. Six crops (rice, wheat, cotton, sugarcane, rapeseed and mustard) consume about two-thirds of the fertilizer applied. The irrigated area, accounting for 40 per cent of the total agricultural area, receives 60 per cent of the fertilizer applied.

Enhance crop productivity : Presently, India is the second largest consumer of nitrogenous and phosphotic fertilizer and fifth in potassium usage. Thus, India uses worldwide large quantities of fertilizers in agriculture, without which it would have not been able to produce the food grain and other agricultural commodities and other agricultural commodities needed to sustain its burgeoning population, which crossed the billion marks in the year 2000 AD and demands 225 million tonnes of food grain on the restricted cultivable land area of 142 million ha. Eventhough, India has breakthrough in food grain production but it was far away from China's production and productivity. Indeed, the comparison of fertilizer in food grain production. Almost all the crops productivity were enhanced by fertilizer application.

A strong link between fertilizer consumption and food grain production is evident in developing country like India. Food grain production was doubled from 108 million tonnes in 1970-71 to 206 mt in 2005-06 (Anonymous, 2007) owing to increase in the productivity in almost all the crops. There has been little change in the cultivated area under food grain crops during this period. Fertilizer alone is considered to account for nealry 50 per cent of this increased productivity. Undoubtedly, fertilizers are used not only for food grain production, but also for other crops such as oilseeds, sugarcane, tea, coffee, etc. At his juncture, use of fertilizers in Indian agriculture to improve crop productivity is inevitable and can not be replaced to any great extent by any other means of meeting crop nutrition.

For obtaining maximum crop yield with maximum benefit to the cultivators, it is most essential that the crop plants should be fed properly with all nutrients. Soils deficient in particular nutrients must be supplied with fertilizers containing those plant nutrients. Plants require 16 essential elements for their normal growth and

development. The essential elements exist as structural components of a cell, maintain cellular organizations, function in energy transformations and in enzyme reaction. Apart from these physiological roles, nitrogenous fertilizers are required for good growth, phosphorus for good tillering, potassium for disease resistance and quality produce, zinc for correcting 'Khaira' disease in rice, iron for correcting 'yellowing' in groundnut, copper for correcting 'exanthema' disease and 'dieback' in citrus etc.

Fertilizers are relatively safer than pesticides. However, all the quantities of fertilizers applied to the soil are not fully utilized by plants. About 50 per cent of fertilizers applied to crops are left behind as residues. Though, inorganic fertilizers are not directly toxic to man and other life forms, they upset the existing ecological balance only under improper management. The nutrients leached out from the fields are found in excessive quantities in rivers, lakes and coastal waters.

One of the bacteria of most concern is *E. coli* O157:H7. It has been estimated that there are about 70,000 cases of infection and more than 60 deaths each year caused by this particular bacterial strain (Snyder and Bruulsema, 2002). Algae blooms occur when the nutrient load is high, and these smother other aquatic vegetation and also interfere with the oxygen supply in the water bodies. This phenomenon may lead to loss of fish life. Among the major synthetic plant nutrients, nitrogenous fertilizers cause most harm. Contamination of the environment arises because not all the fertilizer applied is taken up by the crop and removed at harvest. In tropical climate, the maximum recovery in dry land crop is 50-60 per cent and 40 per cent in rice because much of nitrogen is lost into the atmosphere in the form of ammonia.

Eutrophication of water bodies is due to higher nitrate and phosphate concentrations, increasing levels of nitrates in drinking water sources, accumulation of heavy metals such as lead and cadmium in soils and water resources are the principal causes of environmental concern due to fertilizer use in agriculture. In the nation wide survey, it was found that many streams and more than 20 per cent of wells contain 10 to 50 mg or even more of nitrates per liter of water. The contamination is caused by domestic sewage leaking to the ground water. The nitrates in drinking water can lead to several ailments. Blue baby syndrome in infants, gastric and other forms of cancer have been related with nitrates in drinking water or diet.

Another hazard associated with excessive use of fertilizers is the gaseous loss of nitrogen into the atmosphere. High doses of carbon dioxide and ammonia that escape into the atmosphere both from fertilizer manufacturing plants and soils affect human health. Further, the oxides of nitrogen have been reported to adversely affect the ozone layer, which protects the earth from UV radiation and heating up of earth.

The oxides of nitrogen cause respiratory diseases like asthma, lung cancer and bronchitis. Arsenic, ammonia are waste stream components of nitrogen manufacturing plants while fluoride, cadmium, chromium, copper, lead and manganese are waste stream components of phosphate fertilizer industry. If these waste streams of components are not properly disposed, they cause harm to human beings and animals with contamination of air and water (Snyder and Bruulsema, 2002).

The keeping quality of perishables like vegetables and fruits get declined with excess use of fertilizers particularly nitrogenous fertilizers.

For obtaining maximum crop yield with maximum benefit to the cultivators, it is most essential that the crop plants should be fed properly with all nutrients. Soils deficient in particular nutrients must be supplied with fertilizers containing those plant nutrients to improve the fertilizer use efficiency.

Thus, it is important to know which plant nutrients are lacking in a soil. Simple and elaborate tests have been developed by the agricultural scientists to estimate the nutritional requirements of soils and crops. These methods are known as diagnostic techniques. Fertilizer requirement is known by different diagnostic techniques like by plant observation, by plant analysis through plant tissue tests or rapid tests or whole plant analysis, biochemical methods and by soil testing by chemicals.

In general Fertilizer Use Efficiency (FUE) in India is low and it is even more so in the farmer's field condition mainly because of poor management practices. It has been estimated that even 1% increase in the recovery rate of nitrogen would result in a saving of 1.5 lakh tonnes of nutrient equivalent to over a million tonnes of food grain production. As fertilizer production is energy intensive process, FUE is important not only on the part of agriculture production but also towards the saving of input energy. Thus, balanced fertilization is essential for optimizing yields, increasing profits, and improving the efficiency of fertilizer applications (Johnson *et al.*, 1999).

Looking of these, The Fertilizer Association of India, New Delhi, based on the discussion on "Economics of Fertilizer use" gave the following recommendations :

– The fertilizer recommendations should be based on soil test values.

– Balanced use of fertilizer should be advocated for better economic returns.

– Use of introgenous fertilizer in split doses economizes fertilizer use.

– Micro-nutrient deficiencies should be corrected

as and when needed.

– Fertilizer schedule should be adopted for crop sequence instead of a single crop.

– To get maximum benefit from the applied fertilizers, crops should be irrigated at the critical growth stages.

Selection of suitable fertilizers, carriers for a crop under a given soil and agro-climatic condition, applying optimum quantity based on nutrient supplying capacity of soil and plant nutrient demand at right time with right method, balanced use of fertilizer nutrient to replenish the depleted nutrients and proper co-ordination between the scheduling of fertilizer and irrigation result in improved fertilizer use efficiency. Understanding soil characteristics like nutrient status of soil, forms of nutrient in the soil, nutrient losses and transformations in the soil, soil organic matter, soil moisture status, soil physical condition and crop characteristics like nutrient uptake efficiency, rooting pattern, crop rotation etc. will pay towards the non-hazardous safety use of fertilizer.

Ways of improve fertilizer use efficiency?: Crops vary in their response to nutrients. For example wheat has ahigher demand for phosphorus than corn or soybean. Apply the fertilizer that best combines per acre value and good yield response. Individual nutrient element fertilizer use efficiency (FUE) can be possible to increase with intergrated manner rather than just blanket application. Pre-plant incorporation of forage legumes, remove weeds that complete for nitrogen, drain the soil select fertilizers in relation to soil type, crops and stage of application. In intensive cropping system legume crop rotation, incorporation of quick rotting crop residues. In temperature and humid environments soil injection either in fall season or pre plant was advisable. Further, nitrification inhibitors, urease inhibitors, plastic coated particles, sulfur coated urea, urea formaldehyde combinations and potassium azide can support in improving nitrogen use efficiency. Phosphatic fertilizers applied at planting, placement of water soluble fertilizer in a narrow and below the soil surface reduces the potential for surface runoff losses. For severe K deficit soils gradual build up through external application, incorporation of stalks/stem, leaves and cobs may reduce quantity of K fertilizer requirement. Most of the micronutrients can be met with crop residues and balanced application of major nutrients. These are more pronounced in intensive cultivated areas.

The growing challenge for agriculture is to find ways to increase crop yields and improve nutrient use efficiency while stabilizing nutrients not removed in harvested crops.. in crop residues and, ultimately on soil organic matter. Nutrient management must be site specific and cost effective to protect the viability of Indian agriculture. At the same time it must also include considerations for the protection and conservation of natural resources viz., soil, water and air protection from surface runoff, leaching, and gaseous emissions. There is no meaning if crop production systems based on sound nutrient management cannot sustain optimum yield production and environmental production.

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