Fertilizer Production, future projections and consumption:

N is the most yield limiting nutrient in Indian agriculture (63% samples low 26 % medium in available N) followed by P (42 % low & 38 % in medium) and potassium (13 % low and 37 % medium). In micronutrients, 36.5 % and 23.2 % of Indian soils deficient in Zn and B respectively. Similarly, Iron Mn and Cu deficiencies are prevalent in 12.8, 7.1 and 4.2 % soils, respectively. Fast increasing incidence of Mn deficiency, particularly in coarse textured low organic matter soils of rice based cropping system is a matter of concern (Indian Journal of Fertilizers, April 2018). Seventeen nutrients namely carbon (C) hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulphur (S), Zinc (Zn), copper (Cu), manganese (Mn), iron (Fe), chlorine (Cl), boron (B), molybdenum (Mo) and nicle (Ni) have been recognized so far essential for plant growth. Out of these, C, H and O, classified as structural elements, constitute approximately 95 % of the plant dry matter. Remaining 14 elements classified as major (N, P, K, Ca, Mg, S) and micro nutrients (Fe, Mn, Zn, Cu, B, Ni, Mo and (Cl) constitute 5% of the total dry matter respectively. Plant requirement for micronutrients compared to macronutrients is 1 million to 1 thousand times less. But these are as essential as are the major nutrients because in absence of 1 Mo atom in plant, 1 million N atoms cannot organize themselves to produce that plant.

Soil fertility depletion is a cause of concern for Indian agriculture. There exists a gap of about 10 million tonnes of nutrients (NPK) between the removal of nutrients by crops and their addition through fertilizers. The use of plant nutrients per hectare is relatively low and imbalanced, and this is one of the major reasons for low crop yields in India.

The estimated annual available nutrient (NPK) contribution through organic sources is about 5 million tonnes, which could increase to 7.75 million tonnes by 2025. Thus, organic manures have a significant role to play in nutrient supply. In addition to improving soil physico-chemical and biological properties of soil, the supplementary and complementary use of organic manure also improves the efficiency of mineral fertilizer use.

India's consumption were 17.4 Mt N, 7.0 Mt P_2O_5 and 2.40 Mt of K_2O in 2015-16. India's agriculture operates with net negative balance of 2.3, 2.1 and 8.6 Mt per year with respect to N, P and K respectively. (Indian Journal of Fertilizers, April 2017).

India's food grain requirement to feed the estimated population of 1 400 million by 2025 will be 300 million tonnes (based on rice, i.e. unhusked paddy rice). There will be a corresponding increase in requirement of other crops such as cotton, sugarcane, fruits and vegetables. The country will require about 45 million tonne of nutrients (30 million tonnes for foodgrains and 15 million tonnes of nutrients for other crops) from various sources of plant nutrients, i.e. fertilizers, organic manures and biofertilizers. The further increase in crop production will have to come from an increase in yields as there is limited scope for increasing cultivated area. The yields of the majority of the crops are relatively low and there is great potential for increasing them through the increased use of inputs such as fertilizers. Fertilizer use will remain key to the future development of agriculture. Important issue specific to K fertilization in India is whopping negative K balance and country's total dependence on imports to meet the K demand in agriculture. In case of phosphorus, the dependence on imports is to the tune of 92%. Therefore, there is an urgent need to explore the indigenous sources of P & K to at least partially meet the country's large requirement. Other strategies like use of on and off farm K rich sources and use of potassium solubilizing microorganisms (KSM) including *Bacillus mucilaginous* can supplement the crop requirements for K. Recent reports suggest that India

has vast resources of polyhalite, glauconite, mica waste, other K–containing rocks and minerals, etc, that can successfully be utilized for meeting the K needs of crops and minimize the imports. Use of AM-fungi and K solubilizing microbes in organic system is also an attractive option.(Indian J of fertilizers , April, 2017).

As regards, fertilizers requirement, the expected requirement of Urea, DAP, MOP and NPK complex fertilizers were 17.40, 5.16, 1.7 and 5.01 million MT during 2019-20 respectively. To fulfill the requirement of fertilizers, there is a need for positioning of fertilizers in time. Imports of fertilizers especially of urea which is canalized should be made in time to fill the gap between demand and domestic production. Indian fertilizer industry has been performing onerous task of ensuring availability of fertilizers in every nook and corner of this vast country both with indigenous production and imports (Indian of fertilizers, Nov., 2019).

The handling of increasing quantities of fertilizers will put pressure on storage and handling facilities and transport. Products and practices that improve fertilizer-use efficiency will need special encouragement. Fertilizer promotion will have to include activities that promote not only increased rates of use but also better balances between the nutrients and higher efficiency. Attention also needs to focus on the availability of credit, an essential factor in ensuring the availability of fertilizers to farmers.

India will continue to be a major importer of raw materials, intermediates as well as finished products. The fertilizer product pattern is unlikely to change in the near future, and urea and DAP will continue to dominate fertilizer production. Attention will need to focus on ensuring the availability of good-quality micronutrient fertilizers.