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Alternate Potassium Fertilizing Sources for K Economy in India

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Abstract

India attained self-sufficiency in food grain production. But it has to increase the production and productivity to meet the increasing demand. Potassium plays an important role in enhancing crop growth and productivity. The ratio of N, P and K fertilizers consumption is not optimum over years. Most of the potash fertilisers are imported from other countries. To reduce the import of K fertilizers, alternate K sources should be explored. Some of the natural sources such as glauconite and feldspar and the industrial by products like fly ash and rice husk ash may be exploited to meet the K demand in India.

Introduction

India's total food grain production in 2020-21 was around 303 million tonnes. Much of desired increase has to be attained by increasing productivity per unit area. The relationship between fertilizer use and food grain production is weakening year after year. Stagnation in food grain production and productivity is a matter of great concern in addition to number of other factors like imbalanced and inefficient use of fertilizers. Between the years of 2004-05 and 2009-10, the total consumption of fertilizer has increased by 43% while food grain production has increased by 10% only. K consumption has maintained pace of growth and has touched a record of 3.33 million tonnes in 2009-10. Consumption of potash increased by merely 15 kg/ha during last 27 years from less than 2 kg in 1971-72 to 17.1 kg in 2008-09 (Kinekar, 2011).

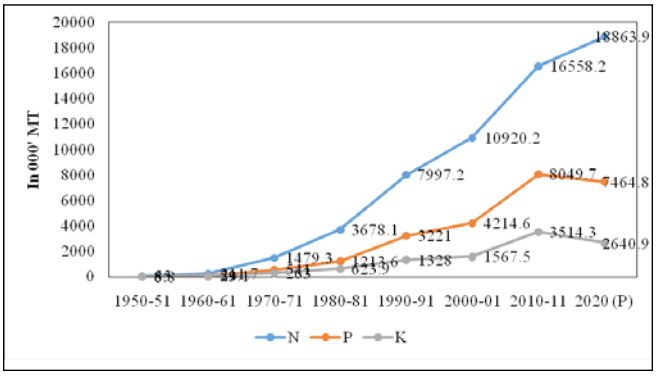

Figure 1: N, P and K consumption In India (Data Source: Fertiliser Association of India)

Annual consumption of potassium was around 6 thousand tonnes in 1950's and increased from to 624 thousand tonnes during 1980's to 3514 thousand tonnes during 2010 then potassium consumption started declining (Figure 1). NPK consumption ratio distorted from 7.0:2.69:1 in 2000-01; 4.7:2.29:1.0 in 2010-11; again 7.1:2.83:1.0 in 2020 (Figure 2).

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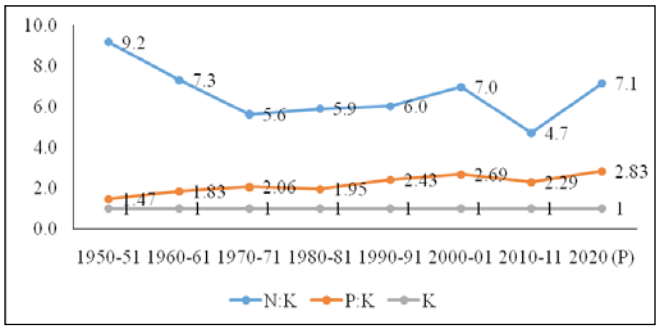

Figure 2: N:P:K consumption ratio in India (Data Source: Fertiliser Association of India)

Potassium Cycle in Soils

Potassium is essential to all forms of plant and animal life. Soils may contain 5 to 75 tonnes per hectare of total K in the surface soils; however, most of the potassium is chemically bound in insoluble mineral forms and is unavailable or slowly available to plants. Commonly, potassium refers to various K-bearing minerals like potassium chloride or Muriate of potash which accounts for 96 percent of the world's potash capacity followed by potassium sulphate, potassium nitrate and potassium magnesium sulphate.

Potassium in soil is existing in four forms according to the availability of the K for uptake by plant roots. It may be present dissolved in the soil water, adsorbed onto particles of clay and organic matter or may be held within the crystal structure of clay particles. The natural minerals undergo the dissolution and release K to crops. To enrich the soil K reserve different alternate K sources can be tried.

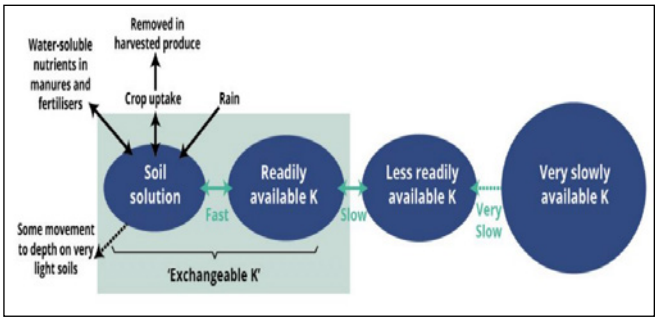

Figure 3: Potassium cycle in soils

Natural Potash Alternatives

Potassium silicate minerals like feldspars and feldspar-bearing rocks can supply potassium but not equal terms with conventional muriate of potash. Feldspar from a potassium bearing rock that can be ground to a fine powder to enhance soil interaction to release potassium. Biotites are useful for a soil with small cation exchange capacity. Potassium silicate mineral products can partly or completely replace the conventional potashic fertilizers but needed in large volumes. Glauconite or greensand as an alternative source of potassium is also being tried in some countries. Glauconite as a natural K source is eminently useful in improving soil fertility and sustained crop productivity as well as ensuring food security with environmental safety. It is also a predominant source of K along with calcium, magnesium and micronutrients. The physical and chemical characteristics represent its potentiality as a nutrient source as well as soil amendment. Due to its low cost, accessibility, and lower contamination, glauconite is best suitable in soil health management and economic perspective. Indeed, Glauconite will provide an effective, economic and alternative indigenous source of K fertilizer to the Indian agricultural sector if it is used judiciously (Rakesh *et al*., 2020). Calcined glauconite used as an alternative potassium source.

Industrial by Products as Sources of K

Agricultural activities produce large waste materials which pose a serious threat to environment with regard to waste disposal. Exploitation of rice husk ash on an industrial scale, its use in agricultural soils seems to be the most reasonable alternative for the disposal of this residue and source of potassium. Fly-ash also has great potential due its high concentration of elements of potassium.

Other Indigenous Sources of K

Crop residue, manures, wood ash and seaweed as well as K biofertilizer are the potential substitute of commercial K fertilizer for sustainable agriculture in the developing countries.

A wide range K concentrations was found in manures and composts since the source of raw materials and methods of preparation are highly variable. Due to a large variation in K contents, it is always advisable to analyze the K content before application. The importance of wood ashes in agriculture is mostly determined by the K content which varies from 5 to 7% (Hue and Silva, 2000).

Seaweeds, multi-cellular algae harvested from the sea is a good source of K. Seaweeds can accumulate a significant amount of K because on an average 0.4 g L^{-1} K is present in the seawater. The seaweed biomass can be used directly as a natural K fertilizer as it contains on an average 2% K in readily available form (Hue and Silva, 2000).

Conclusion

In India, the total potash requirement is imported from other countries. To reduce the import of potassium fertilizers from other countries, the natural resources and industrial by products without affecting the soil quality can be widely explored for the efficient utilization of K resources there by it can help the Indian economy by curtailing K import.

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