Chapter I

INTRODUCTION

Limited availability of additional land for crop production, along with declining factor productivity of major food crops are the major concerns of feeding a world population expected to exceed 7.5 billion by the year 2020. Decreasing soil productivity on account of ill management of soil is another issue with reference to sustainability of agricultural production at current levels. Future strategies for increasing agricultural productivity will have to focus on using available nutrient resources more efficiently, effectively, and sustainably than in the past. Integrated management of the nutrients needed for proper plant growth, together with effective crop, water, soil and land management, will be critical for sustaining agriculture over the long term.

In order to meet the food demands on a rising population in the first decades of the 21st century, farmers must manage nutrients and soil fertility in an integrated way. Required yield increases of major crops cannot be attained without ensuring that plants have an adequate, balanced supply of nutrients. Integrated nutrient management (INM) is an approach that seeks to both increase agricultural production and safeguard the environment for future generations. It is a strategy that incorporates both organic and inorganic plant nutrients to attain higher crop productivity, prevent soil degradation, and thereby help meet future food supply needs.

Among cereals, rice and wheat are the most important crops, which account for about 60 per cent of world’s human energy requirement. In India as well as in Himachal Pradesh these are the major food grain crops. In India, total area under rice is 43.66 million hectares and wheat is 26.99 million hectares with production of 91.79 million tonnes and 72.14 million tonnes of respective crops (Fertilizer Statistics, 2006). However, agricultural scenario with respect to the cultivation of these crops in Himachal Pradesh is quite different. Wheat occupies first position in acreage, covering about 369.8 thousand hectares, whereas rice crop is cultivated on 79.5 thousand hectares with the production of 687.45 thousand metric tonnes and 109.13 thousand
metric tonnes, respectively (Anonymous, 2007). Therefore, the average yield of 1.85 t/ha of wheat and 1.3 t/ha of rice are far below the national average of 3.13 and 2.77 t/ha, respectively. The most important factor for low productivity is the inadequate and imbalanced use of chemical fertilizers coupled with scarcity of irrigation water.

The fertilizer consumption in India including Himachal Pradesh is grossly unbalanced, tilted more towards N, followed by P. This has implications on yield response to fertilizer as it decreases the crop quality and adversely affects the overall soil fertility and productivity. The over or imbalanced use of major plant nutrients and neglect of organic manures which otherwise provide balanced supply of nutrients to plants, rendered micro-nutrients deficiencies resulting into decreasing trend in fertilizer use efficiency.

With the increase in the use of chemical fertilizers consequent upon the introduction of high yielding varieties of crops and adoption of intensive crop rotations, the agricultural production has undergone a great change. It is evident from the fact that over the past three decades, additional nutrients applied as fertilizer have been responsible for 55 per cent increase in yield of food and fibre crops in the developing countries. However, development of plant nutrient management to increase the quantity of plant nutrients in farming systems and thus crop productivity is a major challenge for food security (Singh and Singh, 2003). There is a big gap between the annual removal of nutrients from the soil by the crops and soil erosion and the nutrient inputs from external sources.

Increase in the cost of fertilizers, deterioration of soil health and productivity due to continuous use of large quantities of chemical fertilizers, resulting in environmental pollution and concern for sustainable agriculture with emphasis on ecologically friendly inputs have resulted in the renewed interest on integrated plant nutrient supply systems. The basic concept underlying the integrated plant nutrient supply system is the maintenance of soil fertility, sustaining agricultural productivity and improving farmer’s profitability through judicious and efficient use of fertilizers, organic manures and biofertilizers to the extent possible. Green manures, farm yard manure (FYM) and crop residues are important sources of organic matter. Adequate availability of FYM, one of the best organic sources, is seriously constrained by the use of dung as fuel in India. As an alternative, the green manure crops like dhaincha, sunnhemp, cowpea etc. have the advantage of vigorous growth habit, N-fixing capacity and the ability to withstand a wide range of soil conditions. Green
manuring is a practice of turning green biomass in the soil to improve the soil physico-chemical as well as biological properties suitable for plant growth. Green manures are excellent and reliable alternative to chemical fertilizers for sustainable agriculture. They add high organic matter and improve the soil fertility and productivity. Green manuring also increases organic carbon and improves physical properties like infiltration rate, bulk density and water content at field capacity. Beneficial effects of organic manures like FYM and green manures are universal, they help in improving the physical properties of the soil and perform different functions at its different stages of decomposition.

It has been reported that bulky organic manures/green manures when used in conjunction with fertilizers, efficiency of both the sources is increased. This is much more important where there are chances of washing away or leaching of the nutrients due to continuous flooding of water during the heavy rainy season. Incorporation of green manure increases root density and grain yield of wheat after rice, as it improves the physical properties of the soil. Therefore, it is necessary to study the integrated use of organic manures and mineral fertilizers in arresting the decline in productivity through the correction of marginal deficiencies of secondary and micro-nutrient elements and its beneficial influence on the physical and biological properties of soil. The problem needs experimental quantification and solution to yield limiting factors. Keeping in view, an ongoing experiment entitled, “Effect of long term integrated nutrient management system on soil and crop productivity in rice-wheat crop sequence” since 1991 was continued at Bhadiarkhar Farm of Department of Agronomy, CSK Himachal Pradesh Krishi Vishvavidyalaya during the year 2005-06 and 2006-07 also with the following objectives:

1. To monitor the changes in production levels in relation to different nutrient management systems over the years,

2. to develop suitable integrated nutrient supply and management system in cereal-based cropping sequences,

3. to study long-term effect of conjunctive use of fertilizers and manures on system productivity and soil properties.