# PLANT NUTRITION AND FERTILIZER USE IN RICE AND UPLAND ANNUAL CROPPING

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## 1. Plant Nutrition

Plants require chemical elements for their growth and development. Carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and iron are necessary for all plants and hence are called essential elements. in addition some elements like molybdenum, boron and chlorine are important for some plants. Plant nutrition deals with the provision of these elements to plants to enable their growth and development.

## 2. Plant nutrition in the natural habitat

In the natural habitat, plant nutrition is a natural process. Plants take in carbon and oxygen as carbon dioxide from the atmosphere for photosynthesis, oxygen as gas from the atmosphere and soil air for respiration, hydrogen and oxygen as water from the soil and other elements also from the soil. In the natural habitat there is an equilibrium between the rate of plant intake of nutrients from the habitat and the rate of release of the nutrients into the habitat by way of soil formation and decomposition of plant debris.

Early people gathered their food from the forest without upsetting this equilibrium too much or for too long a period.

## 3. Plant nutrition in traditional farming

The farming practices adopted by the traditional farmers were very close to the natural ecology. The policy followed was sustainable use of the resource base without drastically interfering with its nature and composition.

### 3.1 Lowland paddy

Until about 1950, the paddy farmers in Sri Lanka farmed wet lowlands to paddy obtaining 30-40 bushels per acre or 1.5-2 tons per hectare. Lowlands generally get enriched with accumulations of nutrients that come down from the adjacent upper slopes. From such a land, removal of 1.5-2 t/ha does not badly deplete the soil. Where depletions were observed, as in the wet zone where the soil is poor in calcium and magnesium, the traditional paddy farmers added bone meal to the soil.

### 3.2 Shifting cultivation

Uplands on the other hand do not get enriched with supplies from elsewhere. What the traditional farmer did there was to fell the nutrient rich forest, liberate the nutrients locked therein by burning, and to crop the field as long as the liberated nutrient reserve was adequate to support crop. After that the land was fallowed to forest. This system is called shifting cultivation.

### 3.3 Home gardening

The traditional farmers also developed the art of home gardening. Trees and crops were grown around the house for many reasons; easy protection, improvement of microclimate and enhanced soil fertility by domestic waste and farmyard manure. Here too the efficiency of farming depended on the low volume of food removed from it in comparison to the total biomass found in it.

## 4. Manures

With settled farming and continuous removal of crop produce from the field the farmers gradually learned the need to replenish the nutrient reserve in the soil

in order to avoid nutrient depletion and crop failure. Early farmers applied farmyard manure, household waste, human excreta, plant parts, crushed bone etc. to the soil to keep the land productive. They come from organic sources and are called manures. Manures are bulky and contribute to soil fertility not only by supplying nutrients but also improving soil structure, aeration, water holding capacity and cation exchange capacity.

## 5. Fertilizers

With advances in science and technology, the population increased the world over and the demand for food increased. In Sri Lanka the population was only 1 million in 1800 and it rose to 8 million in 1950 from where it has now doubled. Also, petroleum and mineral industries produced compounds with high concentrations of plant nutrients. They are called fertilizers. Plant breeders too increased the genetic potential of the crop varieties to respond to added fertilizer and to produce high yields. Combination of these factors led to commercial farming which involved cropping of larger extents of land, more frequently and for longer periods with high yielding varieties and resorting to fertilizer appplication.

Out of the essential elements nitrogen, phosphorus and potassium are needed in large quantities and hence called major nutrients. It is these nutrients that are generally applied in the form of fertilizer. Over the past three decades, fertilizer became the biggest single input that contributed the most to increase in crop production. Consequently application of manure became less popular.

## 6. Rice

Rice is the most important crop in Sri Lanka. It covers the largest extent of land for any single crop. In the wet lowlands, rice produces a yield of about 2 t/ha without much fertilizer because of the eutrophic nature of the lowlands and the better conditions available for dinitrogen fixation. More fertilizer is necessary in the uplands. Fertilizers generally used in paddy are urea which has 45% nitrogen, concentrated super phosphate with 45% phosphorus expressed as $P_2O_5$ and muriate of potash with a $K_2O$ concentration of 60%. Nutrient levels recommended for moderate paddy yields are 80kg N, 55kg $P_2O_5$ and 45kg $K_2O$ per hectare. Timing of fertilizer application is determined on the ease of nutrient availability, the vulnerability of fertilizer to loss, and the demand times of the crop for nutrients. Accordingly, all phosphorus and half potassium are applied at or before planting (basal dressing) and half potassium and all nitrogen when the crop is growing (top dressing). In addition, returning of paddy straw to the field and application of tree and bush loppings are recommended.

## 7. Upland annual crops

Upland annual crops differ from paddy by requiring well drained soil conditions. There are many such crops grown in Sri Lanka and the general levels of fertilizer recommended for them in kg/ha/season are as follows;

| | N | $P_2O_5$ | $K_2O$ |
|---|---|---|---|
| Cowpea, green gram | 30 | 60 | 45 |
| Maize, finger millet | 70 | 55 | 50 |
| Manioc, sweet potato | 100 | 50 | 90 |
| Cabbage | 200 | 130 | 90 |
| Carrot, beet | 215 | 125 | 150 |
| Chilli, tomato, brinjal | 150 | 125 | 100 |

Liberal dressings of farmyard manure and green manure are also recommended.