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# ADVANTAGES OF USING EPPAWELA ROCK PHOSPHATE FOR TEA

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## Introduction

Balanced nutrition for tea, plays a key role in the proper management of plantations. Sound fertilizer practices enhance productivity levels appreciably, while the cost of fertilizing varies from 6–12% of total cost of production. Hence investment in fertilizer is absolutely essential for the management of plantations as commercially viable enterprises.

In 1981, the Tea Research Institute (TRI) recommended for 100% substitution of Eppawela Rock Phosphate (ERP) for Imported Rock Phosphate (IRP) both for immature and mature plants except for nursery plants. This has significantly increased the use of ERP in the country. Looking at demand and supply trends in early 1980's, it was felt that there had been constraints in producing fertilizer grade ERP. As such the option had been granted for IRP use as well. But these constraints have now been eliminated and Lanka Phosphate Limited (LPL) is able to meet the demand.

The TRI's recommendations in relation to the use of fertilizer in tea from 1961 to date were critically reviewed recently and revisions have been proposed. A significant deviation from the previous recommendations in relation to mature and immature tea is that the Institute recommends the use of **ERP as the only source of phosphorus (P)**, except for nurseries.

## Balanced nutrition and its significance

Mature tea crop responds to considerably high rates of soil-applied nitrogen (N) fertilizers (90 to 400 kg $ha^{-1}$ $yr^{-1}$). At yield levels of 800 to 3500 kg of made-tea, harvesting removes 30 to 130 kg of N $ha^{-1}$ $yr^{-1}$. Generally, the phosphorus(P) fertilizer requirement of tea is very low (25 to 35 kg $P_2O_5$ $ha^{-1}$ $yr^{-1}$), despite the fact that tea soils are highly weathered and acidic causing its fixation. Although the conditions are conducive for P fixation, tea plants grow well with very low P inputs. The response to applied potassium (K) is generally slow to appear. Although crop removes, nearly half as much K as N, response to the former has been comparatively modest. It varies from 50 to 140 kg $K_2O$ $ha^{-1}$ $yr^{-1}$, depending on the broadly classified agro-climatic region and type of tea. Higher yields in clonal mature tea are claimed to be restricted due to limited supply of magnesium (Mg) from acid soils. Magnesium fertilizer requirement generally lies around 30 kg MgO $ha^{-1}$ $yr^{-1}$. Zinc (Zn) the most important micro nutrient, is recommended at the rates of 6 and 11 kg $ha^{-1}$ $yr^{-1}$ as zinc sulphate for fields yielding up to 2000 made tea kg $ha^{-1}$ $yr^{-1}$, and above respectively as a foliar spray.

### Role and importance of phosphorus

Phosphorus is a constituent of phosphatides such as nucleic acids, phospholipids, and co-enzymes. It is important for cell division and functions as a carrier in higher energy transformations. A deficiency of P usually results in stunted growth of the plant and the mature leaves exhibit a characteristic bluish green colouration. However, symptoms of P deficiency have hardly been observed from tea plantations.

### Experimental evidence on source of P fertilizers

The Eppawela apatite deposit was discovered in 1971 by the Geological Survey Department. Records revealed that the commercial utilisation on ERP commenced in the year 1979. During 1962 to 1978 period, the quantity of IRP used in the tea sector varied from 10 to 20 thousand metric tons as per the annual reviews of the National Fertilizer Secretariat (NFS). The TRI initiated experiments in order to study the feasibility of using locally mined material as a source of P in 1972. Based on the chemical analyses of the rock, and some preliminary investigations made at the Institute, it has been reported in 1973 that the local apatite could be used for tea.

Subsequently, extensive investigations were undertaken to compare the effectiveness of the two types of phosphatic fertilizers viz. IRP and ERP. In order to decide on the suitability of a phosphatic fertilizer, either a 2% citric acid or ammonium citrate solution is used. In these studies, a 2% malic acid solution is also used as an extractant additionally, as it was found that the roots of tea plants exude predominantly malic acid. Exuded malic acid could chelate with iron and aluminium in the soil, mobilising the phosphate for plant uptake.

The results of leaching studies of two fertilizers daily with 100 $cm^3$ of malic acid solution over a period of 20 days, indicated that malic acid extracted nearly all the phosphate (expressed as total percent $P_2O_5$) from IRP but only about 50 to 60% from ERP. This showed that IRP releases P more readily than that of ERP. However, when these two fertilizers are mixed with an acid soil that possessed a low P level, and leached with it over the same period, malic acid extracted more P over a longer period of time from ERP treated soil than that of IRP treated soil. The two types of fertilizers have reacted differently with acid soil, and this is due to fixation of more phosphorus from IRP than from ERP. Thus, the solubility of a P fertilizer in an extractant cannot be considered as the only criterion to decide its suitability for a crop.

Assessment of growth of young plants in the glasshouse was also made after treating soils with ERP and IRP at the rate of 34 kg $P_2O_5$ $ha^{-1}$ $yr^{-1}$ along with a control. The individual fresh and dry weights of entire plant and their respective components as leaves, stems, and roots separately were taken to evaluate whether any of the treatments had any significant effect on growth. Statistical analysis of the results did not show any significant difference in growth between the IRP and ERP treated plants. Soil and plant analysis showed that the two types of P fertilizers did not differ significantly in respect of their effect on the nutrient status of the soil and on the uptake of nutrients such as N, P K and Ca, and element Al. Although the effect of the two types of fertilizers on the dry weight and P uptake is not significant, trends were such that IRP and ERP increased the yield of dry matter and P uptake by the plants. This increase in fact was more pronounced in the case of ERP.

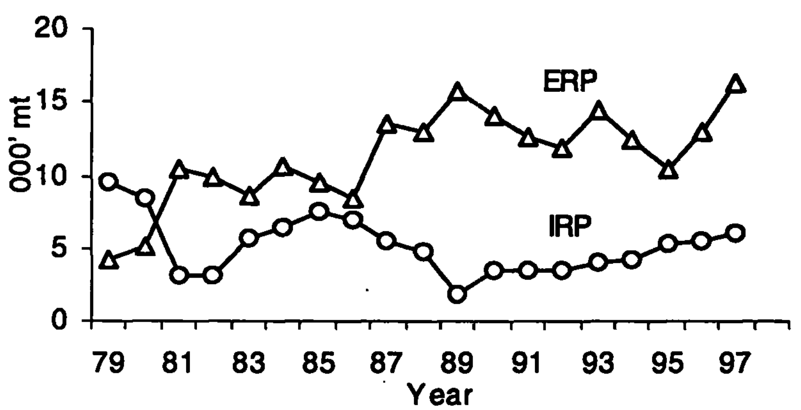


Fig. 1 - The annual usage pattern of IRP and ERP in the tea sector

## Substitution of ERP for IRP

The annual usage patterns of IRP and ERP in the tea sector is presented in Fig. 1.

In 1981, the TRI recommended for 100% substitution of ERP for IRP both for immature and mature plants except for nursery plants. This has significantly increased the use of ERP in the country. In terms of total fertilizer use in the tea sector, the rate of consumption in 1997 was approximately 162,000 mt out of which 6,000 mt was IRP and 16,400 mt was ERP (NFS annual review, 1997).

The bulk of the phosphorus requirement for tea is supplied by ERP. However, it is regrettably noticeable that a considerable quantity of IRP (6,000 mt) has been used for tea in 1997, despite the fact that the agronomic effectiveness of both ERP and IRP are similar for tea. The TRI recommends ERP based fertilizer mixtures for both mature and immature tea. The tea sector now consumes around 73% of its use as ERP, and the endeavour of TRI is to increase this to 100% ERP because the economic benefits are substantial.

The annual review of the NFS of 1997 also states that, 17,000 mt of IRP have been used while the same report states that only 11,830 mt of IRP have been imported in 1997. This trend is not only in 1997 but repeats in other years also. This confusion is further confounded because statistical data presented in the same review indicates that the wholesalers have procured 34,536 mt of ERP and only 27,800 mt have been sold to the end user. Under these circumstances, obvious question arises as to whether ERP fertilizer is sold either as IRP or mixed with IRP and sold as IRP. This aspect is being studied by the NFS.

**ERP and IRP prices**

Another important factor to be considered by the tea industry is the price difference between the ERP and IRP. At present the selling price of IRP and ERP ranges from Rs. 10,000 to 12,000 and 5,000 to 6,000 respectively (Ex: Colombo).

**Economics of ERP use**

Based on the above cost prices of ERP and IRP the cost per 1 kg of $P_2O_5$ would be Rs. 19.30 and 38.60 from ERP and IRP respectively. The present recommendation is for the use of 35 kg of $P_2O_5$ per ha per year. The cost per hectare per year from the two sources would therefore be Rs. 675.00 if ERP is used whereas if IRP is used, it is Rs. 1,350.00, the difference being Rs. 675.00 per hectare per year. It is therefore obvious that for every hectare of tea that is fertilised with IRP in place of ERP, a sum of Rs. 675.00 is wasted.

As per NFS review of fertilizer use in 2000, the quantity of IRP used in the tea sector is about 9,300 mt. However, if tea growers had used 9,300 mt of ERP as recommended by the TRI, a sum of Rs. 51 million would have been saved. In addition, approximately a sum 744,000 US$ would have been saved in foreign exchange (C & F price of IRP @ US $ 80 per mt).