

## Uptake Pattern of Phosphorus in Rice related to modes of application.

By

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### ABSTRACT

A study was undertaken to compare the uptake pattern of soil and foliar application of phosphorus at 20, 40, 60 and 80 kg/ha. The various phosphorus fractions were estimated in the samples. Total acid soluble phosphorus accumulated more at higher phosphorus levels but proportionately decreased towards the ageing of crop. As regards, RNA and DNA phosphorus, phospholipid and phosphoprotein, there was no significant difference due to the level of phosphorus.

### INTRODUCTION

Phosphorus is present within the plant as ortho-phosphate ion with organic compounds. Takahashi *et al.* (1956) showed that application of superphosphate did not increase phosphorus content proportionately. Tsuji (1964) studied the total acid soluble phosphorus and reported that ester phosphorus was more in oat than in rice. Study on phosphorus fractions in tobacco as affected by phosphorus application by Kakie (1969) indicated that inorganic phosphorus was increased with the concentration of phosphorus but the other residual phosphorus fractions showed initial increase up to 7 ppm phosphate concentration and remained unaltered up to 120 ppm.

### MATERIALS AND METHODS

Pot culture studies under glass house conditions were undertaken with the variety Co. 34 Rice. The

levels of phosphorus is in the form of monocalcium phosphate ( $\text{Ca H}_2 \text{PO}_4$ ) was given as top dressing.

Levels of $\text{P}_2\text{O}_5$	Soil application $\text{P}_2\text{O}_5(\text{kg/ha})$	Foliar application ( $\text{P}_2\text{O}_5\text{kg/ha}$ )
Control	—	—
$T_1$	20	20
$T_2$	40	40
$T_3$	60	60
$T_4$	80	80

Foliar spray of aqueous solution of the above concentrations of monocalcium phosphate was given at the rate of 50 ml per pot on the 25th day after transplanting. Soil application was done on the same day as top dressing at the same rate. The leaves were taken for analysis at 30, 60, 90 days after transplanting which corresponded to vegetative flowering and harvesting stages. The samples were analysed for phosphorus fractions viz., total acid soluble

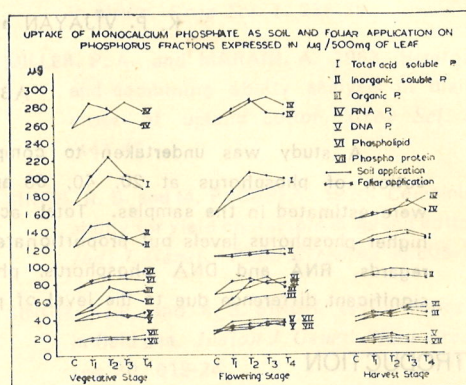
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phosphorus, inorganic soluble phosphorus, organic phosphorus, RNA phosphorus, DNA phosphorus, phospholipid and phosphoprotein according to the method of Hogue *et al.* (1970). Quantitative determination of different fractions obtained was carried out as per the methods of Sumner (1944).

## RESULTS AND DISCUSSION

In all the treatments the total acid soluble phosphorus proportionately increased upto flowering stage and decreased towards the ageing crop in both soil and foliar applications. However, foliar application had a slightly better effect in enhancing the values particularly upto flowering stage. The content of acid soluble inorganic phosphorus in the leaf was high to start with and decreased as plants aged. The high levels of phosphorus did not in any way influence the phosphorus content in both the modes of application with regard to the acid soluble organic phosphorus. Foliar application was efficient in increasing the values of phosphorus in all the stages of crop growth. In both the applications, the content of RNA phosphorus showed that there was an increase in the values at the flowering stage. Between the levels of phosphorus there was no precise indication to make significant on RNA phosphorus although soil application showed a slightly higher value, while DNA phosphorus was comparatively low. In respect of each treatment, the content of phosphorus decreased towards the harvest due to soil as well as foliar applications. In both the modes of application, the levels of phosphorus

increased the content of phospholipid and phosphoprotein till flowering followed by a decrease at harvest stage (Fig 1).



The fact that the total acid soluble phosphorus decreased progressively towards the ageing of crop clearly indicated that phosphorus absorbed at later stages of crop could not be incorporated into acid soluble phosphorus as reported by Hogue *et al.* (1970). Further it could be inferred that beyond certain level phosphorus did not show any indications of utilisation of inorganic phosphorus, though, this is contradictory to the findings of Kakie (1965). A gradual decrease in organic phosphorus towards harvest stage revealed that a part of organic phosphorus was involved for the synthesis of nucleic acid and such an observation lend support to the finding of Fujiwara (1967) in rice. The two modes of application, did not influence the range of phosphorus level significantly, relating to RNA and DNA phosphorus. Irrespective of the mode of application, phospholipid and phosphoprotein increased progressively till

the flowering stage and such higher levels of phosphorus did not proportionately contributed to the synthesis of the phosphorus fractions.

#### ACKNOWLEDGEMENTS

The author is thankful to the Tamil Nadu Agricultural University for permitting the publication of this material, which formed a part of M. Sc. (Ag.) Dissertation. The author express his gratefulness to the I.C.A.R. for the award of Junior Fellowship.

#### REFERENCES

- FUJIWARA, A. 1974. The specific roles of nitrogen phosphorus and Pottassium in the metabolism of rice plant. The mineral nutrition of the rice plant. The Johns Hopkins press. Baltimore. Meryland 93-105.
- HOGUE, E., G. E. WILKOX and CANCLIFF. 1970. Effect of soil phosphorus levels on phosphate fractions in tomato levels. *J. Amer. Soc. Hort. Sci.* 95 : 174--76.
- KAKIE, T. 1969. The phosphorus fractions in tobacco plants as affected by phosphate application. *Soil. Sci. Pl. Nutri.* 15 : 81-5.
- KASAI, Z. and K. ASADA. 1960. Translocation of mineral nutrition in higher green plants. Part 10-Behaviour of phosphorus absorbed at each growth stage in ripening of rice plants. *J. Sci. Soil Japan* 30. : 479-82.
- SUMNER, J. B. 1944. A method for the colorimetric determination of phosphorus. *Science* 100 : 415.
- TAKAHASHI J., M. YANAGISAWA, M., KONO, F., YAZAWA and YOSHIDA. 1956. Studies on nutrient absorption by crops; *Bull. 4. Nat. Inst. Agric. Sci. Japan* (B) pp. 1-83.
- TSUJII, H. 1964. Acid soluble phosphorus later contents of developing rice and oat shoots. *Bot. Mag. Tokyo.* 77 : 247-52.