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Response of transplanted rice to levels, splits and timing of NPK application: Effect on losses and partial balance of P and K

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ABSTRACT

The effect of levels, splits and timings of NPK application on losses and partial balance of P and K in transplanted rice (*Oryza sativa* L) was studied at Agricultural Research Station, Gangavathi, Karnataka, during *kharif* 2000 and summer 2001. Leaching losses of both P and K were significantly higher under 250:55:104 kg NPK ha^{-1} compared to 150:33:63 kg NPK ha^{-1} and under only N splits compared to NPK splits. Leaching losses of both P and K were significantly higher during early cropping period, especially from planting to active tillering stage, irrespective of season. Application of fertilizers even at RDF level resulted in significant build up of soil P. Partial net K balance was negative under both the levels of fertilization and seasons. Application of 250:55:104 kg NPK ha^{-1} through NPK splits up to beginning of grain filling stage recorded significantly higher grain yield and lower P and K leaching losses during both the seasons.

Key words : Transplanted rice, Phosphorus, Potassium, Leaching losses, Partial balance.

Management of soil P and K in intensive irrigated rice has rather received less attention than increasing cropping intensity and new cultivars, irrigation and fertilizer N (Dobermann *et al*.,1998). Removal of nutrients such as P and K has markedly increased with the higher yields of new systems involving improved germplasm and intensive fertilization; particularly under high N application. In the early years of green revolution, crop responses to fertilizer P and K were marginal (De Datta and Mikkelsen,1985). With continuous intensive cropping, P became first deficient nutrient as revealed in long-term experiments whereas, it usually took longer until significant responses to K application were found (Shiga,1982).

Relationships between nutrient supply, nutrient uptake, tissue concentration and its use efficiency in rice have been well documented by Dobermann *et al*. (1998); mostly on the basis of long term experiments conducted at IRRI. As revealed from surveys world wide, intensification of agriculture always meant intensive use of inorganic fertilizers, mainly of N, while P and K back seated. This led to imbalanced nutrition and became a hurdle in obtaining significant response to added nutrients. Nutritional imbalances may also prevent new cultivars from expressing their full yield potential. Interaction among nutrients is also considered as a key factor in deciding the agronomic efficiency of added nutrients in irrigated rice. Both N response ratio and agronomic efficiency of N decreased drastically due to imbalanced nutrition of P as manifested by decreased uptake of P (De Datta *et al*., 1988).

A preliminary survey, prior to this investigation was conducted in the Tungabhadra Project (TBP) area to know the existing agronomic and fertilizer practices followed in rice by random sampling across farmers' and locations. The mean fertilizer NPK consumption was in the range of 230:90:110 kg / ha of NPK per season. This application far exceeded the recommended dose of 150:75:75 kg / ha of NPK per season for rice in this area. It is evident from the above that there is both qualitative and quantitative imbalance in nutrient management which is a major constraint in further increasing rice production. This has resulted in increased fertilizer application rates due to decreased use efficiencies over years; yield levels remaining almost static. Reduced nutrient use efficiencies result in loss of precious highly paid nutrients apart from polluting the soil-water environment. To improve use efficiencies, application of nutrients in right quantities, combinations and time is most necessary. Under these circumstances, the present investigation was undertaken to study the effect of levels, splits and timing of NPK application on losses and partial balance of P and K.

MATERIALS AND METHODS

The experiment was conducted at Agricultural Research Station, Gangavathi of University of Agricultural Sciences, Dharwad Karnataka of India. The soil of the experimental site was medium deep black clay belonging to order vertisol. The soil has a pH of 8.3, available N of 247 kg ha^{-1} (Subbaiah and Asija, 1956), available P (Olsen *et al*.,1954) of 23.5 kg ha^{-1} and exchangeable K (Knudsen *et al*.,1982) of 378 kg ha^{-1} in the surface 20 cm