ABSTRACT

The present investigation was undertaken with an objective to study the effects of varying doses of fertilizers and irrigation levels on winter/summer crops and to assess the direct and residual effectsof organic and inorganic fertilizers on the performance of succeeding autumn rice in the rice based cropping system. Three crops, viz. mustard, maize and groundnut were grown preceding transplanted rice crop during 1992 to 1994. A pot experiment was conducted during autumn 1994 to obtain more information on the decomposition of various organic matters and nutrient release pattern under submerged condition.

It could be seen that application of inorganic fertilizer singly or in combination with organic source considerably improved the yield of mustard, maize and groundnut crops, depending on the level of fertilizers applied. The improvement in yield was due to enhanced uptake of N, P, and K. Irrigation was helpful to increase in uptake of nutrients as well as grain yield. The water-use-efficiency was maximum for mustard and groundnut at 0.6 IW/CPE ratio whereas for maize it was at 0.75 IW/CPE ratio.

Direct application of crop residues as well as green manure to rice significantly increased the grain yield which ranged from 9 to 16 per cent. The recovery of N from different crop residues varied from 17 to 44 per cent. When these crop residues or green manure were combined with inorganic fertilizer to supply nutrients at a level of $N_{100}P_{60}K_{40}$, the grain yield of rice increased by 79 to 84 per cent depending on the treatment.

The mineralization of these organic materials showed that NH_4^+-N content in soil reached at its peak between 50 and 60 days after transplantation and thereafter reduced sharply. Inorganic fertilizer showed faster mineralization of N which is evident from NO_3^--N content, attained its peak at 30 days after transplanting and thereafter it declined sharply. On the other hand, the organic materials showed gradual decrease in NO_3^--N content in soil. The status of NH_4^+-N and NO_3^--N in soil was always higher under combined application of organic and inorganic fertilizer than inorganic fertilizer alone.

After harvest of mustard, maize and groundnut, when rice crop was grown under residual fertility, the effect was more pronounced and the grain yield was higher under inorganic + FYM as compared to only inorganic fertilizer treatment. Moreover, higher dose of fertilizer showed greater effect of residual fertility than that of lower dose.

In the experimental soil, there was gradual build-up of organic carbon (OC) content which was as high as 0.68 per cent in groundnut-rice cropping sequence when combined organic and inorganic fertilizers were applied. Application of inorganic fertilizer has not added any residual OC which is almost alike with native OC of the soil (0.38 per cent). There was also increase in available N, P and K content of soil due to residual fertility. In acid lateritic soil of high rainfall region, groundnut-rice cropping sequence proved to be a better choice than maize-rice and mustard-rice sequence in terms of higher total productivity, net return and benefit : cost ratio.

Key Words : Rice based cropping system, Direct and residual effect, Crop residues, Green manure, Fertilizers and irrigation levels, IW/CPE ratio, Water-use-efficiency, Mineralization, Nutrient release pattern, Nutrient uptake, Residual fertility, Total productivity, Net return, Benefit : Cost ratio.