SUMMARY

Management of water and soil fertility have been very important to increase productivity in rice. The global crisis in energy has forced the farmers to economize the use of fertilizers. In order to find out a rational method of fertilizer utilization, rice cv. Cjatii, a semidwarf high yielding, weakly photo sensitive variety was grown in medium irrigated land containing fine sandy loam laterite soil in four consecutive cropping seasons, 1982 wet, 1983 dry, 1983 wet and 1984 dry. The plants were grown at five levels of fertilizers ($F_0$=no fertilizer, $F_1$=30:15:15, $F_2$ = 60:30:30, $F_3$=90:45:45 and $F_4$=120:60:60 Kg ha$^{-1}$ N:P$_2$O$_5$ :K$_2$O respectively) and three different irrigation schedules ($I_1$ = continuous submergence of 5-2 cm, $I_2$= submergence of 5-2 cm of water at the time of tillering and reproductive stages - and soil saturated condition during the rest of the period and $I_3$ = soil saturated condition with life saving irrigation) in a randomized block design with three replicates. The treatments of higher doses of fertilizers and more favourable irrigation in the order of $I_1$> $I_2$> $I_3$, increased the yield of grains and straw significantly. The effects of the two types of treatments (water regimes and fertility) were found to be independent of one another and no statistical interaction was found in between them. The enhancement in the yield of grains was primarily by increase in the number of grains through the survival of more numbers of tillers and
spikelets in the panicles. The grain weight also increased to contribute to the yield of grains. The utilization efficiency of water was found to be high under the condition of high fertilizer input. But the efficiency of fertilizer decreased with increase in level of fertility. However, high fertilizer treatment was recommended to the farmers because of the high remuneration obtained in the form of yield of grains. The response of the plants to the treatments was poor in the wet season due to the cloudy condition of the sky which might have interrupted leaf photosynthesis.

Fertilizer treatment and soil submergence increased the availability of the essential nutrients in the growing medium and uptake of nitrogen, phosphorus and potassium was found to increase significantly in different parts of the plant. The treatments increased the primary productivity of the plant significantly by increasing the shoot and root weight, leaf and tiller number leaf area, height of the plant, root volume and spread. But the length of the roots was negatively influenced by the treatments. The increase in the vegetative characters of the plant was positively-correlated with the yield of grains. Taking into consideration the positive effects on the biological and economical yield from the plant, it was believed that the treatments effectively increased leaf photosynthesis and translocated more assimilate to support higher growth of the panicle.

Increase in water regime and soil fertility increased the
concentration of chlorophylls, soluble carbohydrates and free amino acid in the third leaf and the panicle. These treatments also increased the number of spikelets and grains, dry mass and the concentration of soluble carbohydrates and amino acids of the primary branches at different positions of the panicle. These observations supported the view that the treatments enhanced leaf photosynthesis and distribution of assimilates to the panicle and consequently the yield of grains increased.

However, the increase in the concentration of assimilates in the branches, did not alter the pattern of yield contribution of the branches located at different parts of the panicle. Considerable variation was found in spikelet number, grain number, grain yield and dry mass of the primary branches of the panicle in all treatments. The branches at the middle part contributed maximum and minimum contribution was obtained from the proximal part. Analysis of the soluble carbohydrate and amino acids of the individual primary branches, indicated better supply in favour of the branches in the middle in comparison to the other parts. However, the disparity in assimilate concentration did not match the variation in growth and yield between the branches properly. The assimilate concentration of the low yielding proximal branches often remained equal or higher than that in the distal branches. These observations indicated a resistance to assimilate consumption in the proximal branches, which should be investigated. The treatments of fertilizers and shallow
Submergence are believed to have improved yield by increasing assimilate supply to the inflorescence from the other parts, within the sink limitations. But for higher yield, the sink capacity is to be modified by the manipulation of other physiological characters, which presently remain obscure. Before such attempts are made, it is desirable that the resistance to assimilate supply in the proximal branches is investigated anatomically.