*Short Communication*

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# GROWTH AND NUTRIENT CONTENT OF RICE PLANT UNDER FLOODED AND UNFLOODED CONDITIONS

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A glass house pot experiment was conducted with three watering treatments consisting of continuous flooding, alternate flooding-draining and non-flooded conditions with rice. At harvest plant height, number of tillers, straw and grain weight and N, P, K, Fe and Mn contents were highest under flooded condition, but were markedly reduced under alternate flooding and non-flooded conditions.

Standing water provides an ideal environment for rice production under most soil and climatic conditions. Not only are the yield and plant nutrients use efficiency usually better under continuous submergence, but such conditions also provide an excellent means of weed control [1-4]. In many rice growing countries, however, continuous flooding is not maintained either due to the shortage of water or for crop management purposes and the field becomes desaturated. Rice growing under rainfed lowland conditions in the tropics and subtropics may experience one or more cycle of alternate flooding (anaerobic condition) and draining (aerobic condition) due to irregular rainfall distribution and non-uniform field flooding [5]. On flooding the soil, the contents of Fe, Mn, Cu and P in soil solution have been reported to increase [6]. The present work reports the effect of continuous, alternate flooding-draining, and non-flooded conditions on the growth and the content of N, P, K, Fe and Mn of rice.

The soil sample collected from a rice field was clay loam in texture containing 0.092 % total N, 1.49 % organic matter, 0.0024 % $P_2O_5$ with pH of 7.5. It was air-dried, powdered and passed through a 2mm sieve and 4 kg lots were weighed into pots. The basal dressings of 60 mg N and 30 mg P/kg soil from $(NH_4)_2SO_4$ and $KH_2PO_4$ were added to the pots and mixed thoroughly. Thereafter the pots were flooded with water and planted with four seedlings (var. IR-8) per pot. The water management schedules were. (a) continuous submergence for the entire growth period, referred to as flooded (b) alternate flooding and drying (drying till appearance of hair cracks) and (c) field capacity (15 % moisture).

The plants were grown up to maturity before they were

Table 1. Growth, grain yield and nutrient content of rice as influenced by water regimes.

| Water treatments | Plant height (cm) | Number of tillers/pot | Straw yield (g/pot) | Grain yield (g/pot) | Nutrient content in rice grain | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | N | P | K | Fe | Mn |
| | | | | | % | | | ppm | |
| Continuous submergence | 105 a | 22 a | 36 a | 9.5 a | 1.07 a | 0,44a | 0,26 a | 129 a | 50 a |
| Alternate flooding drying | 86 b | 16 b | 23 b | 4.8 b | 0,93 ab | 0,32 b | 0,22 ab | 91 b | 35 ab |
| Upland condition | 64 c | 11 b | 14 c | 3.2 b | 0,77 b | 0,28 b | 0,14 b | 80 b | 25 b |
| LSD at 1 % level | 12 | 5 | 4 | 2 | 0,18 | 0,10 | 0,08 | 18 | 17 |

harvested. Straw and grain were separated and weighed. The grain samples were analyzed for N, P, K, Fe and Mn after wet-ashing in a triacid mixture. Phosphorus was determined colorimetrically with the vanadate method, K by flame photometry and N by the micro-Kjeldahl method [7]. Iron and Mn were estimated using phenanthroline and periodate reagents [7].

Data in Table 1 show that continuous soil submergence increased rice growth and nutrient contents. Straw and grain yields under flooding condition were 55 and 46 % higher than under non-flooded condition. Plant height and tillering under flooding condition were significantly higher than that obtained under non-flooded condition. Results reported in the literature [6,8] show that the dry mass yield obtained were consistently higher when rice was grown under flooded conditions than when it was grown under alternate flooding and non-flooded conditions. Continuous flooding provides an ideal condition for rice growth by minimizing N loss, increasing P, Fe and Mn availabilities and by providing a more favourable ecological environment [2,9].

N, P, K, Fe, and Mn contents in grain increased under flooding conditions compared with non-flooded. The percentage increases for these nutrients under flooding condition were 22, 35, 33, 30 and 45 % for N, P, K, Fe and Mn respectively. The content of these nutrients in the grain appeared to be less when grown under non-flooded condition as the lower soil moisture reduced the supply of most of the nutrients to the roots. These results indicate that continuous flooding of soil is beneficial to growth of rice.

*Key words:* Rice, Moisture regimes, Nutrient uptake.

## REFERENCES

1. A.J. Obermueller and D.S. Mikkelsen, Agron. J., **66**, 627 (1974).
2. W.H. Patrick, Jr. and R. Wyatt, Soil Sci. Soc. Am. Proc., 28, 647 (1964).
3. B.N. Sahu and B.J.M. Rao, Oryza, **11**, 59 (1974).
4. G.L. Terman and S.E. Allen, Soil Sci. Soc. Am. Proc. **38**, 780 (1974).
5. R.N. Sah and D.S. Mikkelsen, Plant and Soil, **75**, 221 (1983).
6. S.M. Alam, Pakistan J. Sci. Ind. Res., **24**, 192 (1981).
7. M.L. Jackson, *Soil Chemical Analysis,* (Prentice-Hall, Englewood Inc. Cliffs., N.J., USA, 1958).
8. S.K. De. Datta, *Principles and Practices of Rice Production* (John Wiley & Sons, New York, 1981).
9. S.T. Seneweratne and D.S. Mikkelsen, Plant and Soil, **4**, 127 (1961).