ABSTRACT

Urea-N transformations in the River Estate Series *(Fluventic Eutropepts)* and its efficiency in dasheen (*Colocasia esculenta* L. Schott) cropping systems

Gregory Anthony Gouveia

In Trinidad, dasheen (*Colocasia esculenta* L. Schott) is grown mainly in low lying areas where lands are inundated for most, if not all, of the year. The corms are consumed abundantly and local supply is usually much lower than the demand, which has to be met by imports from other islands. Any expansion in local supply, however, is more likely to come from upland cultivation of the crop, since additional lowlands are either unavailable or are being earmarked for rice production. In the Caribbean and Pacific regions, high corm yields from upland dasheen systems have been realised for quite a long time; however, the reports have been quite inconsistent with respect to N fertilizer management practices. It was therefore necessary to investigate the effects of N fertilization in upland dasheen in a very comprehensive manner.

Three field experiments were conducted between July 1988 and March 1991 to determine the fate of applied $CO(NH_2)_2$ in the River Estate Series *(Fluventic Eutropepts)* and its effect on growth, development and N efficiency in dasheen. In two of these experiments, the effects of N rate and method of dasheen production were assessed. The rates of N were 0, 150, 300 and 600 kg/ha and 150, 300 and 450 kg/ha for the first and second field experiments respectively. In the first experiment, three methods of dasheen production were investigated i.e. monocrop dasheen grown for corms only (MC system), monocrop dasheen grown for leaves and corms (MLC system), and intercrop dasheen (I system). However, in the second field experiment, only the MC and the I systems were compared, and in this, N-15 $CO(NH_2)_2$ was used. In the third field experiment, four sequential cropping practices were investigated primarily to determine their effects on the $CO(NH_2)_2$-^{15}N behaviour and use in dasheen. Finally, a greenhouse experiment was established in early 1991 to assess the effects of crop residue incorporation on the fate of applied ^{15}N on the River Estate Series.

Hydrolysis of $CO(NH_2)_2$ was generally complete within three days, but was prolonged where it was banded at a rate of 450 kg N/ha. The pH at the soil surface above the band increased to 9.0 indicating that volatilization was probably significant at the zone of

application, despite incorporation to a depth of five cm below the surface. Although the pH only increased just above neutrality for broadcast $CO(NH_2)_2$, volatilization was probably also an important mechanism of N loss since the fertilizer was applied over a large surface area of soil. Nitrification proceeded at a slower rate than $CO(NH_2)_2$ hydrolysis and exchangeable NH_4^+-N levels in the soil were generally slightly higher than NO_3^--N.

Application of $CO(NH_2)_2$-N increased the rate of photosynthesis of the crop which resulted in a doubling of total fresh corm yields from an average of 10.2 to 19.6 t/ha. The greatest yields were achieved with the application of 300 kg N/ha with values of 26.1 t/ha for the MC system, 23.3 t/ha for the I system and 15.6 t/ha for the MLC system. However, the optimum N rate was in the order I < MC < MLC ranging between 250 and 375 kg/ha. Leaf cutting reduced corm yields by an average of 39 % while there was only a 14% reduction due to intercropping. However, leaf yields were increased by more than 160% with N application and the productivity of the intercropping system was superior to that of the monocrop. There was also great consistency in corm yields and the productivity of the intercrop from one experiment to the next despite a much less consistent rainfall pattern.

There was no significant effect of N rate or cropping system on $CO(NH_2)_2$-N efficiency in dasheen which averaged 17.4% and 16.9% for band and broadcast applications respectively. Generally, the efficiencies were similar for early (two weeks after planting) and late (18 weeks after planting) applications of $CO(NH_2)_2$. Although incorporation of residue from a preceding pigeon pea crop resulted in a significantly greater (40%) total corm yield compared to cropping systems in which no residue was incorporated, neither the efficiency of $CO(NH_2)_2$-N nor the total N uptake was improved. The greenhouse study showed that the rate of decomposition of pigeon pea residue was slightly slower than that of rice and maize straws and confirmed that crop residue incorporation can lead to a better conservation of added N through biological immobilization, which can subsequently be remineralized during crop growth, thus improving N uptake efficiency through the development of a slow release system.

The results of the experiments therefore show that dasheen can successfully be cultivated on an upland soil even in areas with an annual rainfall less than 2000 mm. Furrow cultivation in land prepared in a system of ridges and furrows affords this possibility; however, much more careful management of the applied $CO(NH_2)_2$ must be practiced so as to reduce losses mainly through volatilization, dentrification and leaching. Frequent applications close to the crop and/or crop residue (organic matter) incorporations can aid in improving the overall recovery in the soil/plant system.