B-30: Decomposition and N release from green leaf materials and urea applied to soils differing in carbon

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In alley cropping systems application of green manures alone will not be sufficient to increase the crop production while maintaining the productivity of the system. Therefore, the use of both organic materials and fertilizers is essential.

The availability of N in these materials depends on their chemical composition and the physical, chemical and biological properties of soil to which they are applied. In order to find out the rate of application of these materials the amount of nutrients released from them during decomposition must be known.

Therefore, inclubation experiments were carried out with soils from Anuradhapura (Alfisol) and Matara (Ultisol). The N-release from fertilizers (urea) and 7 green manure species was studied.

An Ultisol from Matara and Alfisol from A'pura were taken. The green manures used were *Tithonia diversifolia, Gliricidia sepium, Cassia siamea, Crotalaria juncea, Flemingia macrophyla, Erythrina lithosperma* and *Acacia auriculiformis*. In one treatment urea was added in 2 split applications (50 and 100 kg/ha).

Experiment was carried out in a completely randomized design under greenhouse conditions.

One hundred and fifty grams of soils were put in 450 ml bottles. A micro-nutrient solution (MPCL medium) and water was added to keep the soil at 50% of the water holding capacity. Bottles were pre-incubated for a period of 2 weeks to avoid the flush in N-mineralization at the beginning.

Oven dried (68°C) and ground green manures were applied at a rate of 20 t/ha. A control with soil was also included. The bottles were covered with lids and incubated at room temperature (26°C for 70 days).

Samples were taken at 0, 1, 2, 3, 7, 14, 28, 42, 56 and 70 days. CO_2 evolution was measured titrimetrically after trapping in 5 ml 1N NaOH. N-mineralization was measured colorimetrically after extracting the soil with 2N KCl.

The CO_2 production, as a measure of soil microbial activity, differed significantly among the treatments in A'pura soil. In Matara soil, significant differences were found only at the end. The control with A'pura soil gave the lowest microbial activity. Application of urea did not increase the nutrient release through microbial activity. In both soils the highest microbial activity was obtained with the application of *Crotalaria juncea*.

In A'pura soil, N mineralized throughout the incubation period was different among the treatments according to the magnitude of *Acacia* < *Tithonia* < *Gliricidia* < *Cassia* < *Erythrina* < *Flemingia* < Urea < *Crotalaria*. *Crotalaria, Cassia and Flemingia* showed more or less similar pattern of N availability in the soil as urea does.

The plants grown at 28/23° had higher relative growth rates (RGR) than plants grown at 23/18°C. Irrespective of temperature, high N and P supply also positively affected the relative growth rates of plants. The changes in net assimilation rates (NAR) showed a similar pattern.

The plants grown at 28/23°C showed significantly higher dry matter accumulation than plants grown at 23/18°C. The plants receiving high N and P levels (N_2P_2) had highest dry matter yields at both air temperatures as compared with N_1P_2, N_2P_1 and N_1P_1 plants. Irrespective of nitrogen level and temperature, plants grown with high P levels had the highest nodule dry matter at all harvests, but when compared with each other the values were not significant.

The N concentrations in plant tissues were higher for all the treatments at 23/18°C as compared with 28/23°C. Irrespective of temp, plant tissue nitrogen concentration was lowest in plants receiving low N and P levels and highest in plants receiving high N and low P levels. The highest percentage N derived from atmosphere (%NDFA) was observed in plants receiving low N and high P levels (N_1P_2) at both temperature regimes. When considering the amount of N fixed (mg/plant) the N_1P_2 plants were superior than that of N_2P_2, N_2P_1 and N_1P_1 plants.

The highest RGR of plants receiving high N and P were due to increase in NAR. High air temperature also favourably affected the above parameters. Dry matter accumulation of *C.macrocarpum* was significantly increased under high temperature conditions and also by high N and P supply.

Phosphorus showed a specific effect on modulation of *C.macrocarpum*. Under low mineral nitrogen supply, the percentage of N derived from the atmosphere was more. This was also favoured through the specific effect of phosphorous on stimulating growth and nodule development. Therefore, it is concluded that inspite of higher growth rate the symbiotic nitrogen fixation of *C.macrocarpum* did not increase.