EFFECT OF DIFFERENT SALINITY LEVELS OF A SOIL ON NUTRIENT AVAILABILITY OF MANURE AMENDED SOIL

K.Prapagar[1], S.Dasina[2] and W.Shanika[1]

[1]Department of Agricultural Chemistry
[2]Department of Agricultural Engineering,
Faculty of Agriculture, Eastern University, Sri Lanka
ckomathy14@yahoo.com, dasin27@gmail.com

ABSTRACT

Sri Lanka has been identified as one of the tropical country where scattered dry zone is now under Agricultural benefits. In order to that, salinization is recognized as the major factor contributes in land degradation, which ultimately influence on crop yield. Saline soil which is characterized with salt comprises the high concentration of soluble salts and very low amount of organic matter as well as nitrogen content. For that, present study was designed to assess the plant nutrient availability of manure treated soil at different soil salinity levels. A laboratory study was conducted to evaluate the effect of different soil salinity levels on nutrient availability. Cow dung and paddy straw were chosen as organic amendments and applied at the rate of 10 tons/ ha. Manure decomposition and nutrient availability studied at three different salinity levels named as 1500 ppm, 2000 ppm and 2500 ppm. The study was arranged in a completely randomized design (CRD) with seven (7) treatments and three replicates. As the result, incubated treatments (25^{o} C for 42 days) were undergone for further analysis on nutrient availability. With increasing salt concentration, nutrient availability was significantly decreased in manure amended soil. Among the treatments control had lowest nitrogen (N), Phosphorus (P) and Potassium (K) content. Highest N (0.223%) and P (110.14ppm) content was observed at 1500 ppm salt solution treated cow dung amended soil and highest K (158.33ppm) was observed in1500ppm salt solution treated paddy straw amended soil. Moreover, the availability of N and P nutrients was reduced with the increasing salt concentration due to the highest immobilization of ions to the soil. It would be succeeded with the suitable amendments application to overcome those immobilization complexes in soils.

Keywords: Cow dung, mineralization, organic matter, paddy straw, salinity

INTRODUCTION

Organic matter plays a vital role in maintaining structural stability (Le Guillou *et al*., 2011) including improvement of soil aggregate stability and porosity which in turn promotes water infiltration, enhances salt leaching, soil microbiological activities and also, decreases the exchangeable sodium percentage and electrical conductivity in most of the agricultural soils. Further, it facilitates easy tillage via incorporated moisture holding capacity and decreased bulk density which leads to the success in forming water-stable aggregates and contributes to soil Cation Exchange Capacity in Agricultural lands.

Decomposition of organic matter in soil is the most important prerequisite to make these nutrients available and contribute often through the microbial biomass which is one part of organic matter produced by soil microorganism (Jedidi *et al*., 2004). In an addition, release of inorganic forms of Nitrogen (N), Phosphorous (P) and other organically-bound nutrients in soil is functionally associated with carbon mineralization (Mafongoya *et al.,* 2000) which is significantly affected by the salinity stress that inhibits the mineralization of organic materials in soil.

As it is believed that soil salinity can alter the organic manure decomposition and nutrient availability, the present study was designed to assess the plant nutrient availability of manure treated soil at different soil salinity levels.

MATERIALS AND METHODS

Soil (Sandy regosols) which is used for this present study was collected from an agricultural field and cow dung and paddy straw were chosen as organic amendments. 100g of sieved (2mm sieve) air dried sandy regosol soil samples were thoroughly mixed with 473mg (at the rate of 10 tons/ha) of organic manure and placed in the gas-tight glass bottles. 35 ml of 1500ppm, 2000ppm and 2500ppm concentrations salt solution were applied to the manure amended soil at 30% water-filled pore space (WFPS). The treated soil samples along with the control were incubated in the dark room at 25±1^{o}C temperature for 42 days and maintained with Constant moisture content of the soil.

Treatments

The study was arranged in a completely randomized design (CRD) using 7 treatments and replicated three times. The treatments were; T1- Control (no organic matter and salt), T2-1500ppm salt solution+ cow dung, T3-2000ppm salt solution + cow dung, T4-2500ppm salt solution+ cow dung, T5-1500ppm salt solution+ paddy straw, T6-2000ppm salt solution+ paddy straw, T7-2500ppm salt solution+ paddy straw.

Soil analysis

Soil analysis was carried out at the end of the experiment for the parameters of total nitrogen, available phosphorous and exchangeable potassium. Soil available phosphorous was extracted by Borax solution (pH 1.5) and Phosphorus, Nitrogen and exchangeable Potassium were determined by vanadomolybdate blue method (Beater, 1949), Kjeldahl method (Bremner 1965) and Flame photometry (Toth and Prince, 1949), respectively. The data generated were subjected to analysis of variance (ANOVA) using the SAS software (SAS Institute, 1988). The mean separation was performed using the least significant difference (LSD) at P<0.05.

RESULTS AND DISCUSSION

The variation in total nitrogen, available phosphorus and exchangeable potassium content after the 42 days of incubation period with respect to different organic amendments and different salt concentration presented in the table 01

Table 2: Nutrient content of content of soil after the incubation period

Treatment	N %	P (ppm)	K (ppm)
T1- Control (no organic matter and salt)	0.128 ^{d}	73.9 ^{e}	91.67 ^{d}
T2- 1500ppm salt solution + cow dung	0.223 ^{a}	110.14 ^{a}	141.67 ^{b}
T3- 2000ppm salt solution + cow dung	0.209 ^{ab}	99.17 ^{b}	141.67 ^{b}
T4- 2500ppm salt solution + cow dung	0.186 ^{bc}	97.77 ^{b}	108.33 ^{c}
T5- 1500ppm salt solution+ paddy straw	0.186 ^{bc}	81.014 ^{c}	158.33 ^{a}
T6- 2000ppm salt solution+ paddy straw	0.156 ^{cd}	79.611 ^{cd}	149.89 ^{ab}
T7- 2500ppm salt solution+ paddy straw	0.141 ^{d}	77.597 ^{d}	137.50 ^{b}

Mean followed by the same letters are not significantly different according to the Duncan Multiple Range test at 5% level.

Total Nitrogen

In the present study, total nitrogen content of the initial soil mass was 0.18% which significantly (P< 0.05) increased with addition of organic manure to a level of 0.223% (Table 1) at the level of 1500ppm salt concentration. Similar trend was observed in paddy straw treated soil where the N content was 0.186%.This may due to the immobilization of inorganic N in paddy straw due to its high C: N ratio and its slow degradation due to the presence of lignin bound cellulose (Mandal, K.G *et al*., 2004). However, the application of cow dung and paddy straw resulted in significant decrease

in available N value afterwards. This was agreed with Pathak and Rao (1998) that N mineralization was stimulated at low salinity and had a decreasing trend with increasing salinity

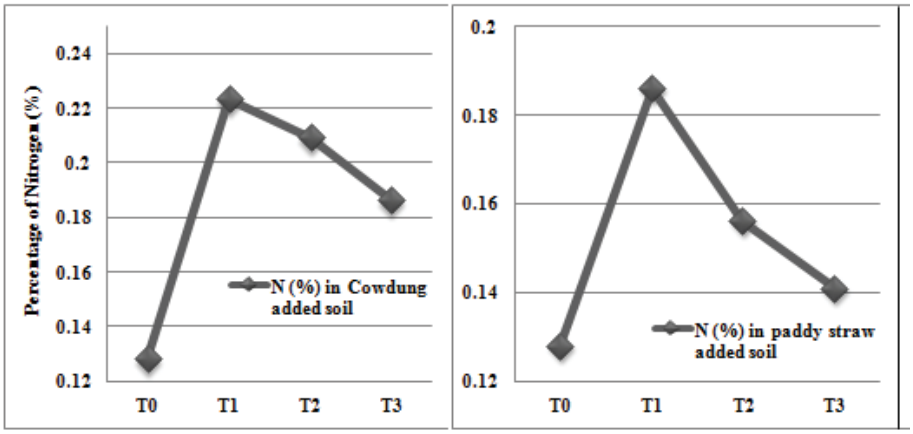

Figure 1. Nitrogen content after the incubation period

Available Phosphorous

Initial available phosphorous was found as 74.6ppm in soil which increased significantly ($P<0.05$). Available phosphorus in soil increased in all the treatments at the end of the incubation (Table 1), and the increasing trend was more with cow dung amended soil at all salt concentration level than paddy straw treated soil. A slight decrease in available phosphorus was observed with the increase in salt concentration which might be due to fixation of available phosphorus at higher salinities (Gupta *et al*., 2001).

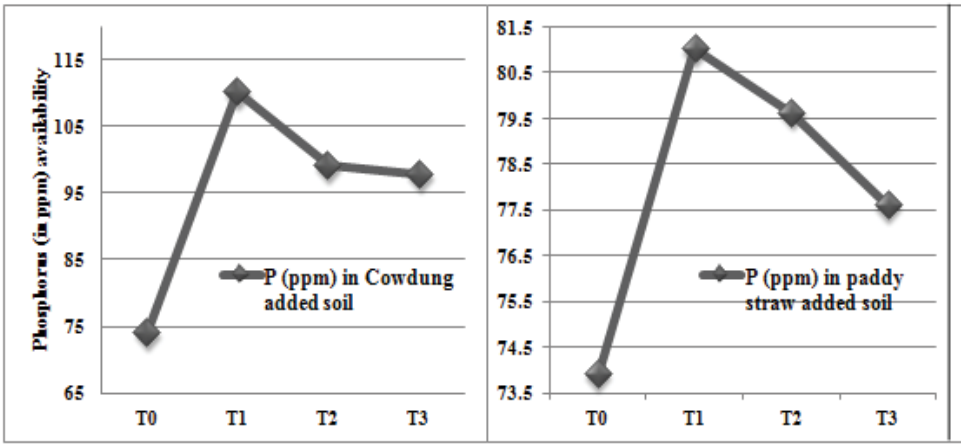

Figure 2. Phosphorus content after the incubation period

Exchangeable Potassium

Analyzed data showed that the initial potassium content of the soil was 91.7ppm and it increased with an addition of organic manure to a level of 158.33ppm (Table 1). A significant ($P< 0.05$) difference was found among two different organic manures. Among the organic manure amended soil, paddy straw amended salt soil had higher potassium value (158.33ppm) than cow dung amended soil (141.67ppm) at the end of the incubation. The result indicates with increasing salt concentration decreases K availability due to this at higher salt concentration low K value recorded in soil. Saqib *et al*., (2000) reported an increased concentration of Na^+ and Cl^-, decreased the concentration K^+.

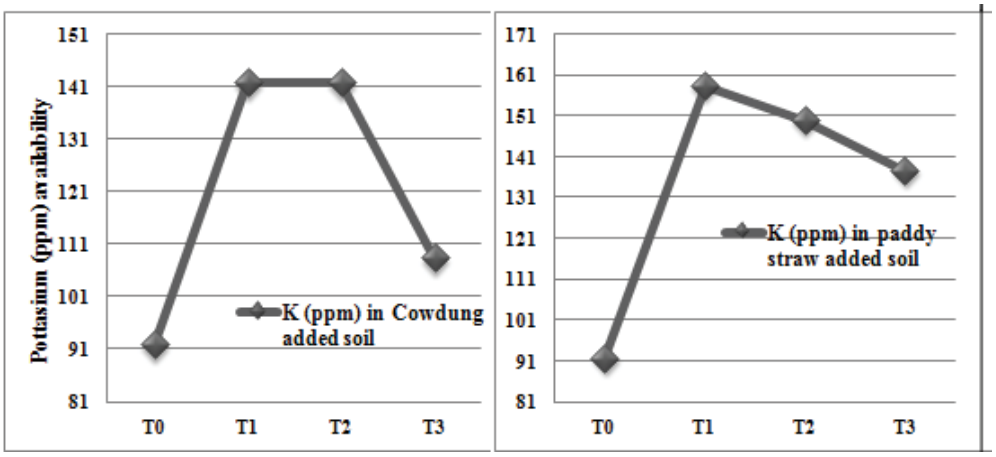

Figure 1. Potassium content after the incubation period

CONCLUSION

With increasing salt concentration, nutrient availability was significantly decreased in manure amended soil. Among the treatments, control had lowest nitrogen (N), Phosphorus (P) and Potassium (K) content. Highest N and P content was observed at 1500 ppm salt solution treated cow dung amended soil and the highest K was observed at1500 ppm salt solution treated paddy straw amended soil. Results could be concluded that the response pattern of decomposition of organic manure incorporated to the soil and nutrient changes depended on salinity stress.

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