EFFECT OF LOCALLY AVAILABLE ORGANIC AMENDMENTS ON NITROGEN RECOVERY OF RED ONION GROWN IN SANDY REGOSOLS.

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INTRODUCTION

Soils are irreplaceable and valuable source for mankind, to act as a tool for the decomposition of organic manures and recycling of nutrients from soils back to plants. Sandy regosol soil predominating the coastal belt of Batticaloa district is very low in plant nutrients e-specially nitrogen and poor in other soil fertility components due to its poor retention capacity. Nitrogen is one of the essential nutrients for plants and its practical management as the major element in intensive agriculture for plant production is an important aspect. The nitrogen status can be achieved by the addition of locally available organic compounds, which favours plant growth mainly by improving the retention capacity ofregosol soils.

In Batticaloa district along the riverbed the salvenia and other water loving plants are deposited, decomposed and formed into a black colour organic compound like compost. These components are locally available along the riverbeds as dry mud during dry season and are referred as tank silt. Farmers in Kaluthavala area mostly use tank silt as organic manure.Burnt paddy husk is another highly available amendment in Batticaloa district, which improves nutrient level of sandy regosol effectively without any side effects. It is well known that poultry manures are another source of nutrients and are highly available in Batticaloa district.

Understanding the recovery of fertilizer nitrogen under particular soil and environmental condition and the process of potential nitrogen losses is important to adopt protection measures to enhance the nitrogen recovery of crops and to reduce the potential nitrogen losses and ground water pollution.

OBJECTIVE OF THE STUDY

- To study the nitrogen content of soils with the locally available amendment.
- The study is to estimate the effectiveness of locally available organic compounds on nitrogen recovery in crop (red onion) on sandy regosol

METHODOLOGY

A pot experiment was carried out during the period of August to October 2004; at the Agronomy farm of Faculty of Agriculture, Eastern University, Vanthorumoolai, Chenkalady located in Batticaloa district.

Disturbed, surface soil samples (Sandy regosols) were collected up to a depth of 20cm from Agronomy farm, Eastern University. Soil was filled into plastic pots leaving 10cm from the top of the pot.

The treatments Tl - TI2 were arranged in a Complete Randomized Design with 3 replicates. Organic amendments used in the research work (tank silt, poultry manures and partially burnt paddy husk) were mixed thoroughly with the soil 2 weeks prior to planting to allow decomposition.

By using three locally available organic materials and chemical fertilizers the following treatments were prepared.

Table: 1 Description of treatments

Treatments	Abbreviations	
T_1	P.H + Rec	Partially burnt paddy husk & Recommended amount of chemical fertilizers
T_2	P.H + ½Rec	Partially burnt paddy husk & ½ Recommended amount of chemical fertilizers
T_3	P.H	Partially burnt paddy husk only
T_4	T.S + Rec	Tank silt & Recommended amount of chemical fertilizers
T_5	T.S + ½Rec	Tank silt & ½ Recommended amount of chemical fertilizers
T_6	T.S	Tank silt only
T_7	P.M + Rec	Poultry manures & Recommended amount of chemical fertilizers
T_8	P.M + ½Rec	Poultry manures & ½ Recommended amount of chemical fertilizers
T_9	P.M	Poultry manures only
T_{10}	Rec C.F	Recommended amount of chemical fertilizers
T_{11}	½ Rec C.F	½ Recommended amount of chemical fertilizers
T_{12}	Control	Without any organic manures or chemical fertilizers

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All other agronomic practices were carried out according to the Department of Agriculture's recommendation.

After 70 days of planting, when 80% of upper portion leaves become yellow and dry, bulbs were harvested.

Soil samples were collected at 3 stages from each pot at the time of planting, just before top dressing and at the time of harvest. All soil samples were allowed to air dry before estimation. Total nitrogen content of each and every sample was determined at three different stages. Nitrogen content of the plants was estimated by kjeldhal method. Nitrogen recovery of plant is calculated from the equation (Rees and Castle, 2002).

$$NRC = \frac{TNP - TNC}{ANT}$$

NRC - Nitrogen recovery co efficient
TNP - Total N uptake by plant from fertilized treatments
TNC - Total N taken from control
ANT - Amount ofN contained in treatment

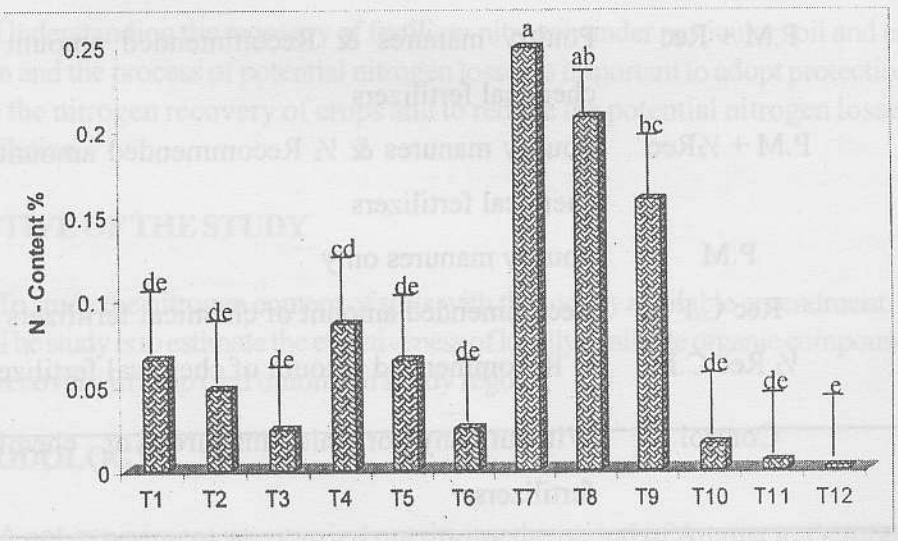
All the results given in the following chapter were analyzed statistically such as Analysis of Yariance (ANOVA), pair comparison among treatments were tested by Duncan Multiple Range (DMRT) by using SAS application statistical package.

RESULTS AND DISCUSSION

Nitrogen content of soil

Effect of nitrogen content in soil with differnt treatments.

The mean nitrogen content of soil treated with different organic amendments is illustrated in Figure:1



Mean followed by the same letters in each set of treatment are not significantly different at $p<0.05$ according to DMRT

Figure: 1 The mean percentage of nitrogen content of soil with different organic matters.

There is significant difference in soil nitrogen content among 12 treatments ($p<O.O5$). Here nitrogen content of soil was analyzed for all treatments as it is affected by chemical fertilizers also.

Figure: 1 show that N - content of soil is remarkably high in soil treated with poultry manure. Addition of manures increases the nitrogen status of soil. A similar result was found by Vitosh etal. (1997). The lower the C: N ratio, the more N will be released into the soil for immediate crop use (Sullivan, 2003). It is also strengthened the results.

Among the treatments nitrogen content of soil is much higher in soil treated with organic matter with recommended level of fertilizer (T1, T4, T7). N content of soil in organic matter with half the rate (T2, Ts, Tg) and singular use of organic matter (T3, T6, T9) ranked second and third respectively. This may be due to the effect of chemical fertilizers and increased decomposition of organic matters by adding nitrogen containing chemical fertilizers.

When comparing the soils treated with recommended chemical fertilizers (T 1, T 4, T 7 and T10), results presents that the addition of organic materials increased the nitrogen status of soil. N content of soil is higher in T1, T4 and T7 than T10. It might be due to organic manures helps to reduce the leaching loss of nitrogen from soil and act as a binding agent for nutrients. And also nitrogen is contributed from organic manures.

The progressive release of the nutrient elements by mineralization of organic matter is essential for plant nutrition in traditional system of cropping where little or no inorganic fertilizers are used, the fact that the release from organic matter mineralization is progressive is very important as it reduces losses by leaching. Losses of soluble forms by leaching depend mainly on the rate of decomposition of organic matter (Charreau, 1978).

Blondel (1971) experienced that the levels of mineral nitrogen are low in organic matters, but mineralization of N appears to have been induced by the plants themselves and addition of organic matter significantly increased mineralization by 36% for the soil from Nioro and Bambey. The fraction of humus seems to have special importance for mineralization of nitrogen and nitrogen nutrition of crops in the sandy to coarse loamy soils of the dry tropical zone.

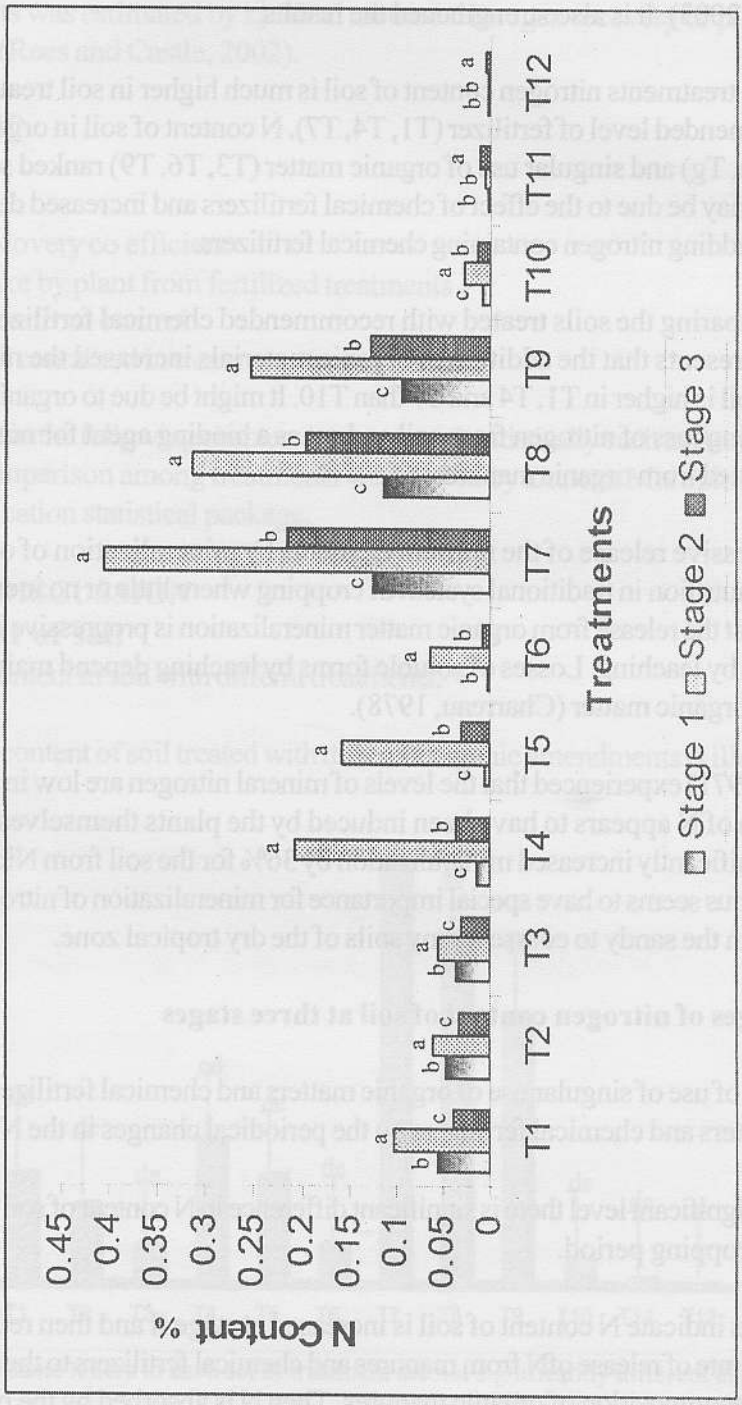
Periodical changes of nitrogen content of soil at three stages

The effect of use of singular use of organic matters and chemical fertilizers and integrated use of organic matters and chemical fertilizers on the periodical changes in the N content given in the figure: 2.

At 5% of significant level there is significant difference in N content of soil from initial stage to the end of the cropping period.

The results indicate N content of soil is increased at stage II and then reduced there after. It is indicating that rate of release ofN from manures and chemical fertilizers to the soil are very high at stage II due to decomposition of organic manures. Then N is absorbed by the plant and reduced the level of N status in soil. The onion crop normally absorbs more nutrients during bulbing stage, which may be the reason for reducing nitrogen level of soil from stage II to stage III.

It is support by Sullivan et al. (2001) pioneered that the amount of nutrient uptake by an onion crop is very small from germination to bulb initiation and the period of rapid nutrient uptake starts at bulb initiation and continues through bulb growth. Heavy rainfall during this period may also lead to loss of nitrogen as nitrate leaching.



Mean followed by the same letters in each set of treatment are not significantly different at $p<0.05$

Figure: 2 The soil nitrogen content of different treatments at different stages

NITROGEN RECOVERY CO - EFFICIENT

Works to analyze recovery of nitrogen benefited to reduce the losses of fertilizers and providing the potential for greater economic efficiency. The mean values of Nitrogen Recovery Coefficient (NRC) are presented in the table: 2. NRC is an indicator to estimate the efficiency of fertilizers recovery.

Table: 2 The mean value of NRC of different treatments

Treatments	Mean value of NRC	%
T_1 - P.H+Rec	0.391000 ^{b}	39 %
T_2 - P.H + ½Rec	0.517000 ^{a}	51%
T_3 - P.H	0.361667 ^{c}	36%
T_4 - T.S+ Rec	0.314667 ^{d}	31%
T_5 - T.S + ½Rec	0.350333 ^{c}	35%
T_6 - T.S	0.269333 ^{e}	26%
T_7 - P.M+Rec	0.114667 ^{h}	11%
T_8 - P.M + ½Rec	0.136667 ^{g}	13%
T_9 - P.M	0.110333 ^{h}	11%
T_{10} - Rec C.F	0.138667 $^{g f}$	13%
T_{11} - ½Rec C.F	0.150333 ^{f}	15%
T_{12} - Control	0.00000 ^{i}	0

Mean followed by the same letters are not significantly different at $p<0.05$ according to DMRT. At 5% probability level, there is significant difference in nitrogen recovery coefficient among different treatments. The nitrogen recovery is the uptake efficiency per unit nitrogen applied. Results indicate that the nitrogen recovery of T2 is significantly higher (51 %) than other treatments. Among three different organic amendments nitrogen recovery is much higher in partially burnt paddy husk than tank silt and poultry manures treated pots. This may be due to low nitrogen content of partially burnt paddy husk than others. The nitrogen requirement of onion is higher so the onion crop may absorb most of the available nitrogen from partially burnt paddy husk treatment. Residual N at the end of the cropping period is very low in soil treated with partially burnt paddy husk (Figure: 1).

Addition of partially burnt paddy husk results in microbial immobilization of soil nutrients particularly nitrogen. Microorganism may use the soil nitrogen for the decomposition. So, available nitrogen for plant uptake may much lower in the soil. Allen Barker (2003) proposed that the material with a C: N ratio wider than 35:1 will cause microbial immobilization of available nitrogen (nitrate and ammonium) in the soil. Residues with C: N ratios between 25:1 to 35:1 tend to have little short-term effect on the level of nitrate aJ;ld ammonia in the soil although in the initial stages of decomposition they may cause a tie-up of the mineral nitrogen. C: N ratios above 25:1 can result in nitrogen being "tied up" by soil microbes in the breakdown of carbon-rich crop residues, thus pulling nitrogen away from crop plants(Sullivan, 2003).

Nitrogen recovery of plants grown in soil treated with poultry manures is significantly very low. This might be due to more retention capacity and high nitrogen content of poultry manures. So, the part of the nitrogen may remain in the soil for next cropping in soil treated with poultry manures. Residual N at the end of the cropping period is very high in soil treated with poultry manures (Figure: 2).

There is a general rule of thumb for nitrogen that organic nitrogen released during second and third cropping seasons after.. initial application will be 50% and 25% respectively of that mineralized during the first cropping season (Carl Rosen, 2001).This result supported the low nitrogen recovery % of poultry manures than others.

And also worms effect was observed in the soil treated with poultry manure. This may be the reason for the poor performance of crops to recover the nitrogen from soil. Among the treatments, organic material with half recommended level of chemical fertilizers (T2, T5 & T8) shows significantly higher nitrogen recovery than organic material with recommended level of chemical fertilizers (T1, T4, T7). This may be due to high available nitrogen than plant requirement in soil treated with recommended level of chemical fertilizers. Part of the nitrogen in soil treated with fully recommended fertilizers may remain for next cropping or it may be leached down from the soil.

Treatments with singular use of organic matter (T3, T6 & T9) shows low level recovered nitrogen than those of combined use of organic manures and chemical fertilizers. When comparing nitrogen containing chemical fertilizers, nitrogen content is low in organic materials. Addition of chemical fertilizers helps to improve the decomposition of organic matters and increase the available nitrogen in soil. This may be the reason for the higher nitrogen recovery coefficient in integrated use of organic matter and chemical fertilizers.

This is strengthened by Sullivan (2003). He stated that adding some nitrogen fertilizer aid the decomposition process. Mulvey (1999) also supported that nitrogen should be added as an ammonium salt, and it is the preferred nitrogen source for microbial activity for nitrogen mineralization.

CONCLUSION

In this experiment partially burnt paddy husk treated plants utilized more nitrogen and poultry manure treated plants utilized very low level of nitrogen.

The results indicated that organic matter with 1/2 recommended levels of chemical fertilizers treated plants recovered more nitrogen than organic matter with recommended level of chemical fertilizers treated plants.

Organic matter enhanced the soil nitrogen level. The increase was greater for poultry manured soils than tank silt and partially burnt paddy husk treated soils.

The results showed that N content of soil is increased at stage II and then reduced there after. It is indicating that the rate of release of N from manures and chemical fertilizers to the soil is very high at stage II due to decomposition of organic manures.

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