EFFECT OF SOIL AMENDMENTS ON THE SOIL ORGANIC CARBON CONTENT AND YIELD OF RED ONION GROWN IN SANDY REGOSOL.

Premanandarajah.P[1], Prapakar.K[1], Sivapriya.V[1] and Vimal Jothy.I[2]

ABSTRACT

A pot experiment was carried out at the agronomy farm Faculty of Agriculture, Eastern University, vantharumoolai, Chenkalady located in Batticaloa district to develop a nutrient management technology by integrating organic manures with chemical fertilizer on red onion in sandy regosols. Four organic sources integrated with different rates of recommended chemical fertilizer were evaluated with sole recommended chemical fertilizer. There were twelve treatments including integrated organic manures with chemical fertilizers at different rates, sole organic manure treatment and no fertilizer as control. The treatments were arranged in a Completely Randomized Design with 3 replicates. Analysis for soil organic carbon content was carried out at planting, just before top dressing and at the time of harvest. Red onion yield was recorded at harvest.

Tank silt had the greatest influence on soil organic carbon content. In tank silt and poultry manures treated soils organic carbon content was increased from initial stage to harvesting stage. There was no significant influence of partially burned paddy husk on soil organic carbon content. But it was higher at harvest.

The results indicated that the integrated use of organic manure with recommended level of chemical fertilizers increased the yield of red onion remarkably. Among organic manures tank silt with recommended level of fertilizers showed better response in relation to yield than others.

Key words : Partially burned paddy husk, Poultry manure, Soil organic matter content, Tank silt, Yield.

INTRODUCTION

Organic manures are natural resources of plant nutrients and microbial energy. They serve as chelating agents and cation exchange materials when applied to soil. Organic manures promote plant growth, regulate the flow of water and improve soil tilth. They act as storehouse for nutrients, increase the cation exchange capacity and reduce the effects of compaction. Organic manures play a vital role in maintenance of physical, chemical and biological conditions of soil and supply macro- and micronutrients to crops. Physical and physiochemical function of organic manure is that, it promotes good soil structure, thereby improving tilth, aeration and retention of moisture and increasing buffering and exchange capacity of soils (Donahue *et al.,* 1983).

The amount of organic manure in soil varies greatly between different soils. Alluvial soils often have high levels of manures and sandy soils, low levels. Sandy regosol soil predominating the coastal belt of Batticaloa district is very low in plant nutrients and poor in other soil fertility components due to its poor retention capacity. Brady (1990) stated that sandy soils have lower cation exchange capacity than clay soils because the coarse textured soils are low in both clay and humus content. Addition of organic manures improves soil biological and physico–chemical properties as well as the major and minor nutrient status of soils (Dwivedi *et al*., 1990). Manures are by nature, organic. It supplies some organic matter to the soil, much of which is lost to the atmosphere as CO_2 and some of which is changed to humus (a black or brown organic substances) which persists in the soil and improve its physical properties (Simpson, 1986).

The combination of organic and inorganic fertilizer seems to be more practical than the use of organic fertilizer alone. The importance of integrated plant nutrient management system (IPNMS) is recognized mainly because of the growing consumption of inorganic fertilizers and the unavailability of nutrients at low cost. Another reason is that, many researches revealed that neither inorganic fertilizer nor organic sources alone

[1] Department of Agric Chemistry, Eastern University, Sri Lanka.
[2] Tamil Nadu Agricultural University, Coimbatore, India.

could achieve a sustainable productivity of soils as well as crops under highly intensive cropping systems (Singh *et al.,* 1994). The draw backs associated with either mineral or organic sources of plant nutrients are often overcome when they are used in judicious combination. Parasuraman and Mani (2003) concluded that under the integrated nutrient system the crop enjoyed a better nutritional environment that was reflected in the yield. The organic C, and available N, P and K contents of soil significantly improved with the use of 100 per cent recommended fertilizer + 7.5 t FYM ha^{-1} in groundnut, finger millet cropping system (Varalakshmi *et al.,* 2005).

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 seasons and are referred as tank silt. Farmers in Kalutha vala 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 effect. It is well known that poultry manures are another source of nutrients and are highly available in Batticaloa district. Poultrymanures containabout 1.67% nitrogen (Limtong and Pachaya, 1996).

Against this considerations, the present investigation was contemplated to asses the use of locally available amendments with following objectives

Objectives

- To evaluate the impact of locally available amendments on yield of red onion grown in sandy regosol.
- To study the influence of amendments on soil organic carbon content.

MATERIALS AND METHODOLOGY

Location

A pot culture experiment was carried out at the agronomy farm of Faculty of Agriculture Eastern University, vantharumoolai, Chenkalady located in Batticaloa district by integrating locally available organic manures with chemical fertilizer. Three organic sources (partially burnt paddy husk, tank silt and poultry manure) integrated with different rates of recommended chemical fertilizer and were evaluated with sole recommended chemical fertilizer. There were twelve treatments including integrated organic manures with chemical fertilizers at different rates, sole organic manure treatment and no fertilizer control. The treatments were arranged in a Completely Randomized Design with 3 replicates. Red onion was grown in each pot. Soil analysis for soil organic matter content was carried out at planting, just before top dressing and at the time of harvest. Red onion yield was recorded at harvest.

Pot experiment

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 10 cm from the top of the pot. Treatments were arranged in a Complete Randomized Design with three replicates. Organic amendments used in the research work were mixed (@ 10t /ha) thoroughly with the soil two weeks prior to planting to allow decomposition. Chemical fertilizers were applied to each pot according to the treatment. One day before planting urea, triple super phosphate and muriate of potash were applied at therate of 100kg/ha, 100kg.haand 50kg/harespectively as basal. Three weeks after planting urea and muriate of potash were top dressed at the rate of 100kg/ha and 25kg/ha respectively as top dressing.

Observations

After 70 days of planting, when 80% of upper portion levels become yellow, dry bulbs were harvested and fresh weight of bulbs were recorded.

Soil sampling and analysis

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. Organic matter content was determined (Walkey and Black, 1934). Chemical analysis was carried out for three replicate of each treatment.

RESULTS AND DISCUSSION

Effect of treatments on organic matter content of soil

The results revealed that the organic manure significantly influenced the soil organic carbon content (Fig 1).

The results indicated that the treatment received tank silt significantly increased the organic carbon content than others. This may be due to the decomposed form

of tank silt. Soil treated with partially burnt paddy husk showed low level of organic carbon content, which was on par with control. This might be due to slow decomposition of paddy husk. The rate of decomposition in this case was mainly affected by the composition of organic amendments. Mulvey (1999), confirmed this that in general the greater the carbon/ nitrogen ratio slower the breakdown .

due to easily decomposable form of organic manure. The increase in organic carbon content might be due to the addition of organic manures which stimulated the growth and activity of microorganisms, and also due to better root growth. These observations are in line with the findings of Varalakshmi *et al.* (2005) in groundnut – finger millet cropping sequence. When organic materials added to the soil, the heterotrophic

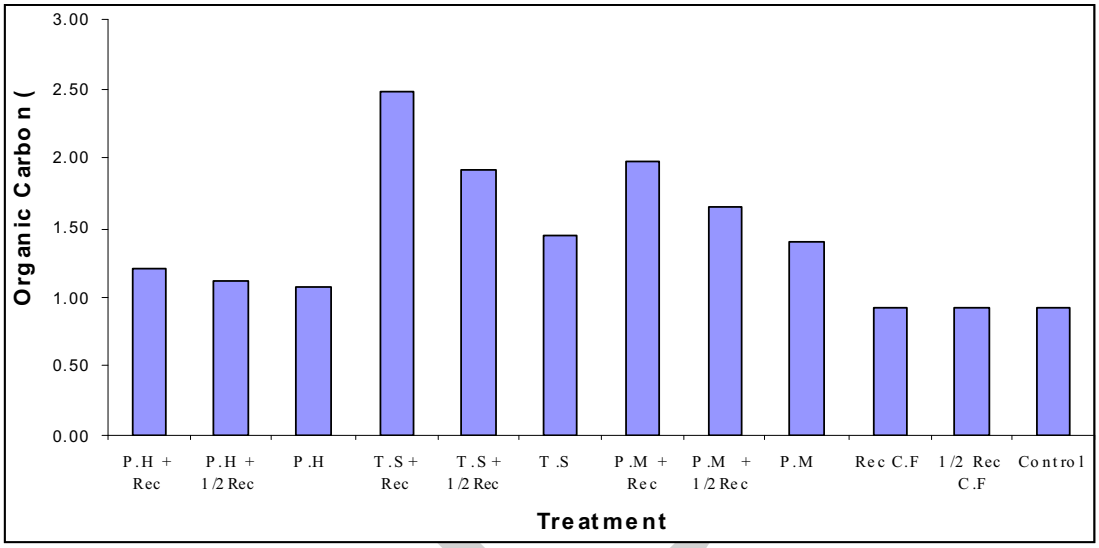

Figure 1: Effect of treatments on soil organic carbon content (%).

Changes in organic carbon content.

Statistical analysis of soil organic carbon content showed that different organic manures significantly influenced the soil organic carbon content.

flora would have become active and multiplied rapidly, yielding in CO_2 large quantities. Higher production of biomass might have increased the organic carbon content (Babhulkar *et al.,* 2000). During decomposition much of the organic carbon content is lost from the

Table 1: Effect of treatments on nutrient availability

Treatment	Organic C (%)	Available Nitrogen (%)	C:N ratio
P.H + Rec	1.21	0.066	1.83
P.H + ½ Rec	1.12	0.048	2.34
P.H	1.08	0.046	2.34
T.S + Rec	2.48	0.088	2.81
T.S + ½ Rec	1.93	0.065	2.98
T.S	1.43	0.046	3.11
P.M + Rec	1.98	0.249	0.79
P.M + ½ Rec	1.65	0.208	0.79
P.M	1.40	0.159	0.88
Rec C.F	0.93	0.016	5.76
½Rec C.F	0.93	0.014	6.49
Control	0.92	0.013	7.09

Tank silt and poultry manures treatments significantly increased soil organic carbon content. This may be

soil (Simpson, 1986). In control, there was very low level or absence of organic residues in the soil.

Yieldof onion

Yield is a good indicator to analyze the effect of different organic manures and chemical fertilizers. The results showed that the addition of organic matter significantly influenced the yield of groundnut. This result was supported by Vitosh *et al*. (1997) that the yield of corn grains increased with the increase in organic matter addition. He also concluded that commercial fertilizers when applied at appropriate rates could be just as effective as manure for grain product.

A statistical analysis of the data showed that the treatment received tank silt with recommended level of fertilizers gave significantly higher yield than others. This result indicated that the performance of tank silt is much better than other organic amendments in relation to yield. This might be due to high nutrient retention capacity and high organic carbon release from the tank silt since it was in partially decomposed form. It was supported by Titus and Pereira, (2004) that the application of tank silt act as an excellent soil conditioner and aids in the better uptake of nutrients and better root aeration. This indicated the significance of tank silt on the fertility and nutrient retention status. Mixing locally available amendments, tank silt enables the soil to hold water and nutrients n the upper layers, which is then available to crops (Wassan, 2002)

Among the treatment combinations integrated use of organic matter with recommended level of chemical fertilizers favored the yield significantly. This was followed by the treatment combining organic matter with half level of chemical fertilizers. In sole organic manure treatment the yield was lower than integrated use of organic manure and chemical fertilizers. The increased yield may be due to the effect of integrated use of organic manures and chemical fertilizers on fertilizer use efficiency. It was supported by Sanjay Arora (2000) that integrated use of plant nutrients increased nutrient supply and balanced fertilization. In addition integrated use of different sources of plant nutrient helps to increase their efficiencies and also crop productivity. The increase in yield might also be attributed to the beneficial effects of combined use of manure with fertilizers as nutrient availability increased through enhanced microbial activity, conversion from unavailable to available forms and also due to improved physical, chemical and bio-chemical conditions. These results are in conformity with the findings of Babhulkar *et al.* (2000) in soybean.

The findings of Wijayatilleke (2001) also supported the result that the combined use of organic manures and chemical fertilizers increased the yield in cabbage, tomato and beans. The fertilizer and soil additives, from both mineral and organic sources, must be applied periodically to maintain or build up productive capacity (FAO, 1994).

The results indicated that the yield was significantly lower in sole partially burnt paddy husk. Partially burnt paddy husk takes long time for its decomposition. This may be due to the slow decomposition rate, low nutrient status and wider C : N ratio of paddy husk than other organic manures. Due to the temporary immobilization of partially burnt husk at initial stage there may be starvation by plants for nutrients. Therefore yield may be low in partially burnt paddy husk treated plants.

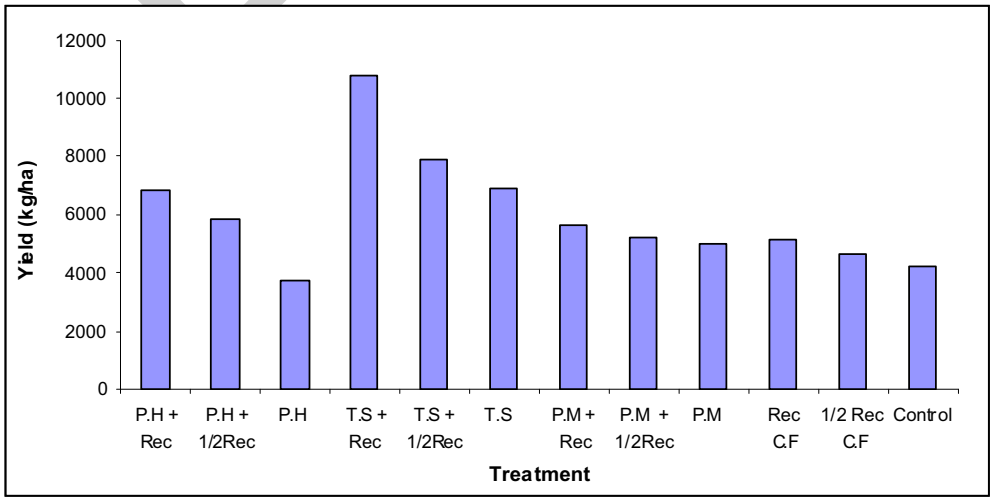

Figure 2: Effect of treatments on onion yield (kgha^{-1})

CONCLUSION

The organic carbon content of soil was increased with the addition of organic amendments and was higher in tank silt treatment. Integrated use of organic manure with chemical fertilizer increased onion yield. Among organic manures used tank silt performed well.

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