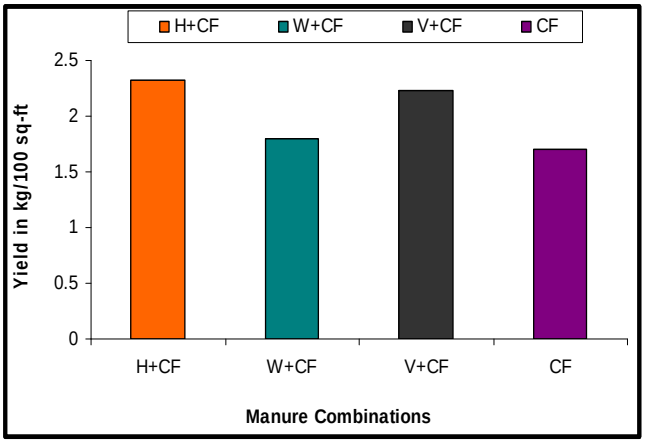

Figure 3.22: Observed Yield of the crop

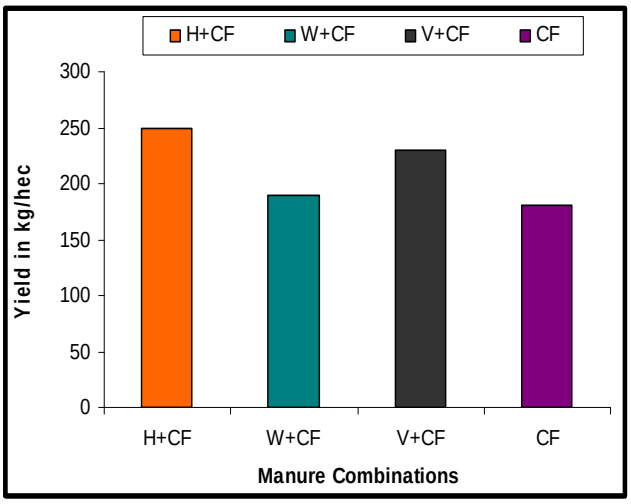

Figure 3.23: Estimated yield of the crop.

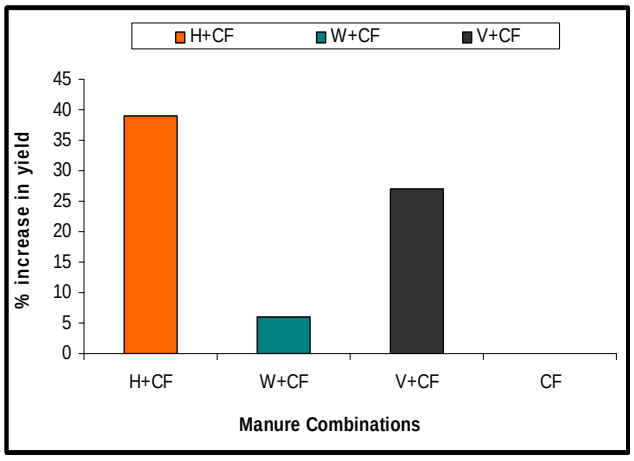

Figure 3.24: Percent Increase in the crop yield

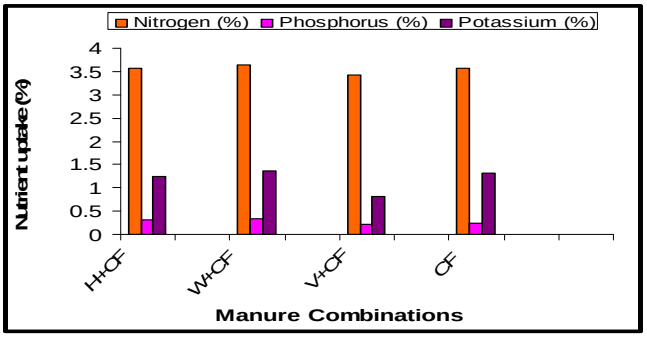

Figure 3.25: Nutrient uptakes in the crop

The initial investment of chemical fertilizer is relatively less compared to organic and chemical fertilizer combinations, but the benefit (profit) seems to be lesser in comparison with H+CF, V+CF and W+CF respectively (3.26).

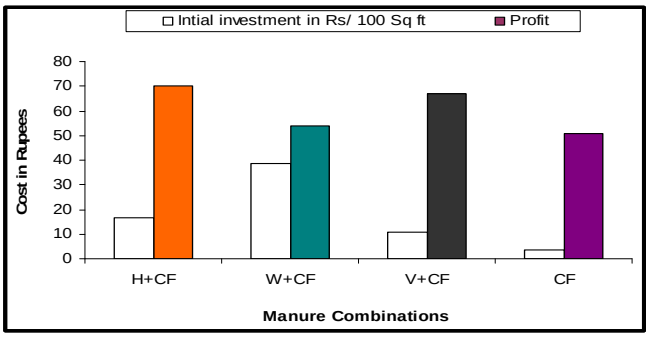

Figure 3.26: Cost Benefit analyses

3.7 Column Studies

3.7.1 Column Studies for Nitrate and Phosphate

It is evident that (fig. 3.27) the nitrate's concentration decreased up to 5th day later increased steadily up to first 10 days and subsequently showed a declining trend with time. The increasing trend has been attributed to the cumulative accumulation of the nitrates in the soil pores and decreasing trend has been ascribed to the transformation processes implicated in the soil system.

At 300mm depth of column H+CF and W+CF combination showed higher values of nitrates. These indicate that the leached concentration must have reached such a depth over a period of time.

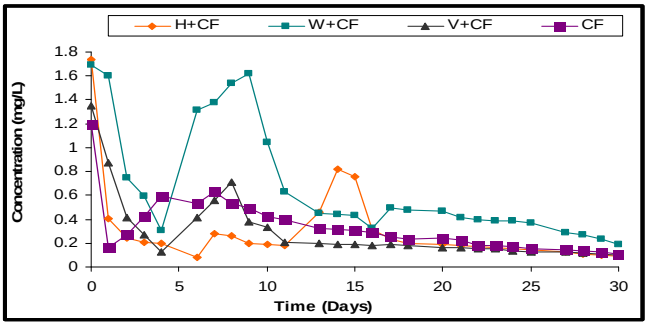

Figure 3.27 Nitrate concentrations at 0-150mm depth

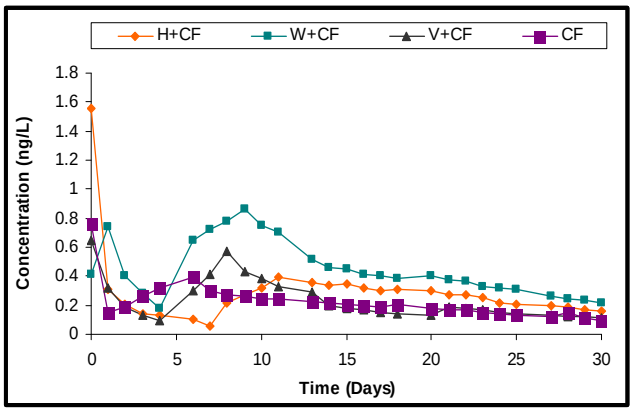

Figure 3.28: Nitrate concentrations at 150-300mm depth

At 450mm depth, at 30th day the nitrate content was found to be low in CF combination. This is due to the use of DAP and Ammonium sulfate containing lower concentrations of nitrates (fig 3.29).

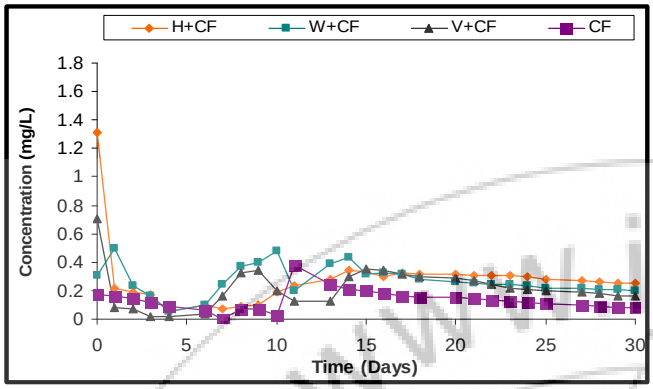

Figure 3.29: Nitrate concentrations at 300-450mm depth

It is observed very much varying during first 10 days in every treatment combination as there was fixation and release during the initial steps. After 14th day all combinations have shown a declining trend (fig 3.30). (Fig 3.31) The Phosphate content was maximum between 10th and 15th day at 150-300 mm depth indicating the release of phosphate during this period. At 300-450 mm depth of soil, the phosphate content was very less in all the treatments. This shows that leaching of phosphate is much slower compared to nitrate leaching (fig3.32).

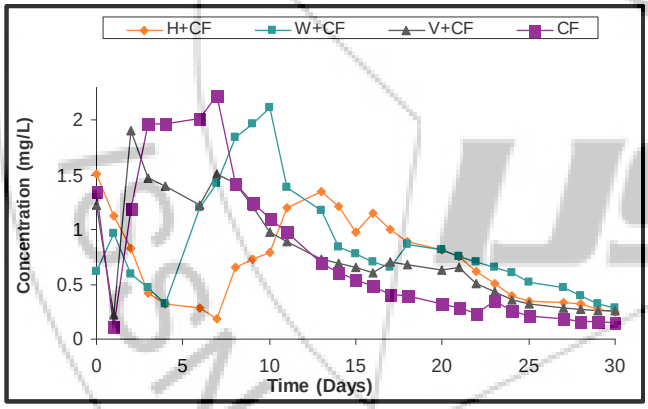

Figure 3.30 Phosphate concentrations at 0-150mm depth

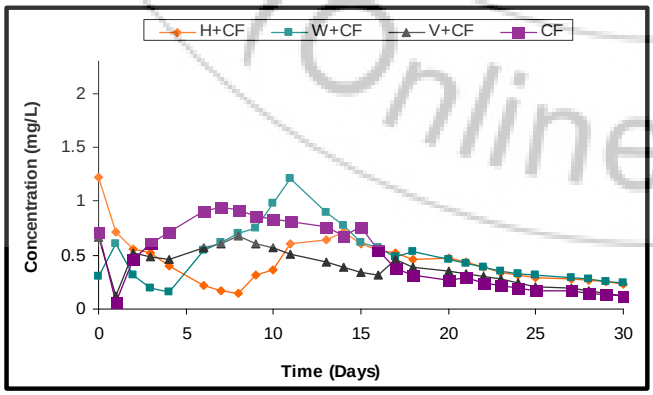

Figure 3.31: Phosphate concentrations at 150-300mm depth

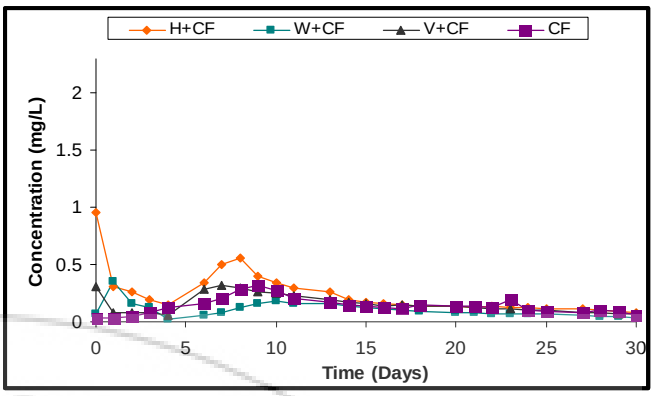

Figure 3.32: Phosphate concentrations at 450mm depth

4. Conclusions

Based on the extensive analytical and laboratory studies, the following conclusions could be drawn.

1. The NPK values, Organic carbon, Organic matter at different depth of soil after harvesting the crop were quite high on plots where W+CF combination was applied, hence increasing the nutrient values and fertility of the soil. The observed trend is W+CF > V+CF > H+CF.
2. H+CF combination has given higher percentage yield when compared to other manure combinations, though the physical growth of the plant is good and equal in case of V+CF and CF alone.
3. Water holding capacity of the soil has shown overall improvement in the plots of V+CF and H+CF combinations ensuring good retention of water for plant growth.
4. Humanure in combination of chemical fertilizer (75:25 ratios) can serves as an alternative to the commercially available inorganic fertilizers, the application of Humanure will reduce the waste disposal consequences on the environment.
5. The Residual nutrient (%) content in plant samples of W+CF applied plot is slightly higher compared to other manure combinations.
6. The results of cost benefit analysis have shown maximum benefits for the combinations of H+CF and V+CF indicating the efficiency and effectiveness of higher percentage of organic manure in combination with chemical fertilizer.
7. The column studies have shown the vertical transport of nutrients from top layer to 450 mm depth.
8. The chemical fertilizer applied column has recorded higher rate of percolation of nutrient when compared to other manure combinations. This concludes that the combination of organic manures with chemical fertilizer retain nutrients in the upper layers of soil thus maintaining soil fertility.

5. Future Scope

1) Various other organic sources like Farm yard manure, Cattle manure, Poultry manures, green manuring etc. may be evaluated to assess the effect of the manure on the physical, chemical and Biological properties of the soil along with different combinations ratios.

2) To estimate the microbial dynamics in terms of population of various micro-organisms and their biomass after application of organic manure in soil system.

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References

[1] Abdullah, A. A. (2008), "Effect of Vermicompost and Vermiwash on the Productivity of Spinach (Spinaciaoleracea), Onion (Allium cepa) and Potato (Solanumtuberosum)", World Journal of Agricultiral Sciences, Vol. 4(5), PP- 554-557.
[2] Aveyard, Jim. (1988), "Land degradation: Changing attitudes - why? Journal of Soil Conservation". New South Wales, PP- 46–51.
[3] Bhiday, M.R. (1994), "Earthworms in Agriculture". Indian Farming, PP-31–34.
[4] Daniel, J., Sucharita, D., and Desai J. (2005), "Improving Livelihoods through Vermicomposting".
[5] Davison, J. (1988), "Plant Beneficial Bacteria". Biotechnology, 6 March, 1988, PP-282-286.
[6] Donahue, R., Miller, R., and Shickluna, J (1981), "Soils: An Introduction to Soils and Plant Growth", Agricultural, Ecosystem and Environment, Vol (31), PP-301-312.
[7] Duxbury, Peverly, (1978), and Miller, (1979), "Fate and Transport of Nutrients".
[8] Goodland, J.A., Watson, C., Ledec, G. (1984), "Environmental Management in Tropical Agriculture". Boulder, Colorado: Westview Press.
[9] Gupta, P. K. (1999), Text book of "Soil, Plant, Water and Fertilizer Analysis". Published by Agro Botanica, Vyas Nagar, and Bikaner.
[10] Guzha, E., and Gotosa (2005), J. "The Effects of Humanure and Ecofert (urine) on Soil Fertility and Physical Properties". Physics of Earth Journal, PP- 1-8.
[11] Guzha, E., and Muduma (2005), S. "An Assessment of Community Attitude on Human Excreta use and Products Produced from Human Excreta Plots". Physics of Earth Journal, PP- 1-6.
[12] IS: 2720, Part IV, (1965), "Grain Size Analysis", Indian Standards Institution, PP-1-37.
[13] Kannan, P., Saravanan, A., Krishnakumar, S., and Natarajan, S.K., (2005), "Biological Properties of Soil as Influenced by Different Organic Manures", Journal of Agricultural and Biological Sciences, Vol- 1(2), PP-181-183.
[14] Kumaraswamy, K. (2002), "Organic Farming – Relevance and Prospects".Newsletter No.12, Indian Society of SoilScience, IARI, New Delhi, PP-4.
[15] Lehmann, J and Schroth, G (2003), "Nutrient Leaching", PP-(151-161).
[16] Maheswarappa, H.P., Nanjappa, H.V., and Hegde, M.R. (1999), "Influence of Organic Manures on Yield of Arrowroot, Soil Physico-Chemical and Biological Properties when Grown as Intercrop in Coconut Garden". Annals of Agricultural Research, Vol- 20(3): PP-318–323.
[17] Mashauri, D. A., and Senzia, M.A (In press). "Reuse of Nutrients from Ecological Sanitation Toilets as a Source of Fertilizers". Water Resources Engineering, Tanzania.
[18] Marinari, S., Masciandaro, G., Ceccanti, B., and Grego, S. (2000), "Influence of Organic and Mineral Fertilisers on Soil Biological and Physical Properties". Bioresource Technology, PP-9–17.
[19] Mitchell, A., and Edwards, C.A. (1997), "The Production of Vermicompost using EiseniaFetidafrom Cattle Manure". Soil Biology and Biochemistry, PP-3–4.
[20] Padhi, S. B., and Swain, P. K. "Effective Role of Microorganism and Seaweeds as Biofertilizers in Organic Farming for a Sustainable Environment". Algal Research Laboratory, Department of Botany, Berhampur University.
[21] Pavithra, (2005), "Modeling of Pollutant Migration in the Subsurface Environment" M.Tech Thesis, PP-1-54.
[22] Poincelot, (2004), "Maintaining Soil Fertility under an Organic Management System", West Virginia University.
[23] Preetha, D., Sushama, P.K., and Marykutty, K.C. (2005), "Vermicompost+inorganic fertilizers promote yield and nutrient uptake of amaranth (Amaranthus tricolor L.)", Journal of Tropical Agricultural, Vol 43(1-2), PP- 87-89.
[24] Punmia, B., C. (1991),"Soil Mechanics and Foundations", lakshmi publications, New delhi.
[25] Ramesh Naik., Halepyati, A.S., and Pujari, B.T. (2007), "Effect of Organic Manures and Fertilizer Levels on Growth, Yield Components and Yield of Safflower (CarthamustinctoriusL.)", Karnataka Journal of Agricultural Sciences, Vol 20(4), PP-835-836.
[26] Rasool, A., Mousa, T., G., and Rahim, D., T. (2008), "Influence of Vermicompost on Soil Chemical and Physical Properties in Tomato (Lycopersicumesculentum) field", African Journal of Biotechology, Vol 4 (5), PP-2397-2401.
[27] Saxena, M.M. (1990), "Environmental Analysis – Water, Air and Soil", Lakshmi Publications, New Delhi.
[28] Steven C. Hodges. "Soil Fertility Basics", Soil Science Extension North Carolina State University
[29] Sultan, A.I. (1997), "Vermicology – The Biology of Earthworms". Orient Longman Ltd, New Delhi, PP-92.
[30] Wani, S.P. (2002), "Improving the livelihoods: New partnerships for win-win solutions for natural resource management". Paper submitted in the 2nd International

Agronomy Congress held at New Delhi, India during November 2002, PP-26-30.
[31] Wani, S.P., and Lee, K.K. (1992), "Biofertilizers Role in Upland Crops Production. InFertilizers, Organic Manures, Recyclable Wastes and Biofertilisers (Tandon HLS, ed.)", PP- 91.
[32] Wani, S.P., Rupela, O.P., and Lee, K.K. (1995), "Sustainable Agriculture in the Semi-arid Tropics through Biological Nitrogen Fixation in Grain Legumes. Plant and Soil", PP-29–49.

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