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Characterization of tank silts of Hassan Taluk and their effect on soil and maize crop

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Abstract
Three tank silts were collected during the month of July 2009 from the tanks of Santhigrama, Karekere and Addihalli of Hassan district and analyzed for their physic-chemical property. Highest pH value was observed in Shanthigrama tank silts and lowest was found in Addihalli tank silt. The EC was lowest in Shanthigrama tank silt and high in Addihalli tank silt. The highest clay content was found in Shantigrama tank silt (50%), sand content was in Karekere and addihalli tank silt. OM content was highest was found in Kareker tank silt and lowest in Addihalli tank silt. Available nitrogen content was low, phosphorus content was high and available potassium content was found to be low. Exchangeable calcium content was highest in Addihalli tank silt and lowest in Karekere tank silt and magnesium content was found higher in Karekere tank silt. A pot culture experiment was carried out at Agricultural Farm Section, College of Agriculture Hassan during *Kharif* 2009 in order to know the effect of application of different tank silt on soil fertility status as well as on crop growth. Addition of tank silts to soil influenced the physic-chemical properties. Available nutrients like N, P, K and exchangeable nutrients like Ca and Mg were increased with application of tank silt but texture of the soil was not altered. Addition or incorporating of tank silts with soil significantly increased the plant growth parameters and soil fertility. Texture of the soil was not affected and it may be affected with periods of time.

Keywords: tank silt, maize and soil fertility

Introduction
Crop production broadly depends on the fertility of the soil where a crop is raised. The kind and quality of seed, climate of the region, soil moisture regime and plant protection measures adopted by a farmer are some other factors which affect the volume of production. But even if all factors of crop production are in the optimum, the fertility of a soil largely determines ultimate yield. The differenced in crop production resulting from the manipulation of soil fertility.

During the early period of our civilization when population was scares and land was plentiful, people settled along riverside where annual flooding enriched the soil. At other places, shifting cultivation was adopted to give rest to the land region soil fertility. When settled agriculture come to be practiced and farmers learnt the advantages of adding animal and vegetable manures, their use gradually picked up. In course of time, the value of green manure crops and particularly legumes was recognized. The period from the middle of nineteenth century to the beginning of twentieth century marks an era during which much progress was made in the evaluating with the addition of manures and fertilizers.

Every field contains a maximum of one or more and minimum of one or more nutrients with this minimum, be it lime, potash, nitrogen, phosphoric acid, magnesia or any other nutrient, the yields stand in direct relation. It is a factor that governs and controls the yield. With this minimum, the yield will remain the same and not increase even through amounts of nutrients is increased a hundred fold.

In developing countries like India, where the land-person ratio is rapidly declining, the only means of meeting the needs of agricultural produce is through increased productivity without determent to environment and sustainability. The per capita land availability in the country has decreased from 0.48 ha in 1951 to 0.17 ha in 1985 and is projected to be reduced to 0.10 ha by the year 2025. Not only the land available for cultivation is decreasing, the quality of land available for cropping is also declining due to urbanization, industrialization *etc*. This has led to the cultivation of marginal land and destruction of forests, resulting in improvement of soil quality and making the land more prone of floods and erosion. Consequently, the country'sproductive resource base id being affected adversely. This calls for the management of soil resources base in terms of both quantity and quality. Integrated nutrient management envisages the use of chemical fertilizers in conjunction with organic manures, legumes in cropping system, biofertilizers and other locally available nutrient sources for sustaining

soil health and productivity. The combined application of organic manures and chemical fertilizers generally produces higher crop yield than when each is applied alone. This increase in crop productivity may be due to combined effect of nutrient supply, synergism and improvement in soil physical and biological properties farmyard manure (FYM) constitutes an important component of integrated nutrient management for maintaining soil fertility and yield stability.

The green manures area valuable potential sources of N and organic matter. Sesbania, sunhemp and cowpea incorporated before transplanting rice partially meet the nutrient requirement of the crop. In upland crops the most efficient time of intercropping of green manure crops has been found to be 15 days before seedling. Besides being a source of P, K, S and micro-nutrients, green manure influences availability of the nutrient through its favorable impact on oxidation reduction regime, pH and increased chelating capacity. In permeable coarse-textured soils, green manuring helps in correcting the iron chlorosis in rice. The green manuring plays an important role in reclamation of salt-affected soils and improvement in physical and biological properties of soil.

Growing legumes in rotation and incorporation of legume residues after picking of pod also significantly improves the yield of cereal crop in rotation. The efficiency of incorporation of azolla in increasing grain yield and nitrogen uptake of rice depends on the temperatures of a region. Also, several problems like very high or very low temperature, grazing by invertebrates, pesticides irrigation and drainage limit the wide scale use of azolla besides it being labours intensive.

Instead of using the organic matter it also possible to use the tank silt to improve the soil fertility. The tank silts are containing high amount of clay, sand, silt and organic matter. Quality of tank silts also varies from region to region. Tank silt formed by the action of erosion the detached materials from the top soil profile was transported to a pond or a tank or other structures. However, applying of tank silt to farm field is also practiced in some areas. The tank silts was defined as "it is sediment from catchment area and settled in tank".

In order to know the effect of tank silt on soil fertility, the experiment was conducted entitled "characterization of tank silts of Hassan taluk and their effect on soil and crop" with objectives to characterize of tank silts of different villages, to study the effect of application of different tank silts on soil fertility and to study the effect of application of different tank silts on growth parameters of crop.

Material and Methods

Three tank silts were collected during the month of July 2009 from the tanks of Santhigrama, Karekere and Addihalli of Hassan district. These tanks silts were analyzed for physic-chemical properties such as pH, electrical conductivity (EC), and sand (%), silt (%), clay (%), organic matter (%), and available nutrient such as N, P, K, Ca and Mg content of soil. Soil sample collected for grow the maize crop and analyzed for physic-chemical properties in order to know the initial soil fertility status of soil sample. Pot culture experiment was conducted in order to know the effect of application of different tank silt on soil fertility status as wellas on crop growth; a pot culture experiment was carried out at agricultural farm section, college of agriculture Hassan during *Kharif* 2009. The experiment was laid out in completely randomized design (CRD) with 10 treatments (T_1: Soil; T_2: Soil+ Shanthigrama tank silt @ 7.5 t ha^{-1};T_3:Soil+ Shanthigrama tank silt @ 10 t ha^{-1}; T_4:Soil+ Shanthigrama tank silt @ 12.5 t ha^{-1}; T_5: Soil+ Karekere tank silt @ 7.5 t ha^{-1};T_6:Soil+ Karekere tank silt @ 10 t ha^{-1}; T_7:Soil+ Karekere tank silt @ 12.5 t ha^{-1};T_8:Soil+ Addihalli tank silt @ 7.5 t ha^{-1},T_9: Soil+ Addihalli tank silt @ 10 t ha^{-1};T_{10}:Soil+ Addihalli tank silt @ 12.5 t ha^{-1}) and three replications using maize crop as a test crop variety used was NAC 6004.

Totally thirty number of cement pots having cspacity of 50 kg were collected and filled with 20 kg of soil to each pot calculated amount of tank silt were weighed as per the treatment and mixed thourogly with soil and filled in respective pots to each pot three number of maize seeds were dibbeld on 10th august 2009. Later equal amount of watering was done to all pots to bring soil mostering. After germination only two seedlings was maintained per plot and pots were maintained by irrigating periodically. The fertilizer DAP (0.1%) was sprayed uniformly to all the pots at 30 days after sowing. Plants were uprooted at 70 days after sowing and different growth parameters such as number of leaves $plant^{-1}$ and dry matter weight were recorded. After harvest of maize crop soil sample from each pot were collected and analyzed for physic-chemical properties and available nutrient status by following standard procedure.

Results and Discussion

Initial properties of tank silts and soils

Properties of tank silts: The pH value of tank silts were found to be normal to silty alkaline in range (7.4 to 7.7). This is may be due to accumulation of salts. The highest pH value was observed in Shanthigrama tank silts and lowest was found in Addihalli tank silt. Electrical conductivity of tank sits was found to be 1.19 to 1.62 d Sm^{-1}. The lowest was found in Shanthigrama tank silt and high in Addihalli tank silt. Texture of tank silts was found to be sandy loam to clayey. The highest clay content were found in Shantigrama tank silt (50%), sand content of Karekere and addihalli tank silt were found to be high in both tank silt were found to be high in both tank silt (50%). Clay content of Karekere and Addihalli tank silt were found in same range (20%). Percentage of silt content were found to be high in Shanthigrama tank silt (30%) and low in Addihalli and Kareker tank silt (10%). Organic matter content was found to be high and it ranges from 2.07 to 2.99 per cent. Highest was found in Kareker tank silt and lowest in Addihalli tank silt. Available nitrogen content was low and it ranges from 90 to 250 ppm, phosphorus content was high and it ranges from 0.7 to 2.65 per cent. Available potassium content was found to be low and it ranges from 15 to 35 ppm. Exchangeable calcium content ranges from 3 to 4.25 meq $100g^{-1}$. Highest was in Addihalli tank silt and lowest in Karekere tank silt and magnesium content was found in Karekere tank silt (5 meq $100g^{-1}$).

Properties of soil: The result showed that soil pH or soil reaction was normal (7.2), EC was 0.5 dS m^{-1}. The texture of soil was clay loam, sand percentage was high (70%), silt content was 6 per cent and clay content was high (12%). The soil organic matter was high (1.96%) and available nutrient content like nitrogen was low (15.6 to 13.44 kg ha^{-1}), phosphorus content was medium (50.12 kg ha^{-1}) and potassium content found to be 13.44 kg ha^{-1}. The exchangeable calcium and magnesium were medium in range (4 and 5.75 meq $100g^{-1}$ respectively).

Growth parameters of maize crop

There was significant difference was found in maize crop on number of leaves, plant height and dry matter accumulation. The vegetative growth of plant was significantly affected. The

results were given in the table 2. The number of leaves plant^{-1} ranges from 5 to 7.5. The more number of leaves were found in T_7 may be due to presence of high organic matter and available nitrogen content in Karekere tank silts. The lowest was found in T_2 and T_6 may be due to less organic matter and nitrogen content. The height of the plant was significantly affected and it ranges 60.5 to 85.61 cm. The highest plant height was observed in the T_7 may be due to the high percentage of organic matter and available nitrogen content may enhanced uptake of nitrogen content may enhanced vegetative growth of maize crop. Data on dry matter weight of plant were significantly affected. The weight of each plant ranges 16.16 to 20.53 g and higher was found in the T_7 and less was found in T_2.

Table 1: Initial physic-chemical properties of different tanksilts and soil

Properties	Shanthigrama tank silt (S1)	Karekere tank silt (S2)	Addihalli tank silt (S3)	Soil (For pot culture)
pH	7.7	7.5	7.4	7.2
EC (dSm^{-1})	1.19	1.6	1.62	0.5
Clay (%)	50	20	20	12.0
Silt (%)	30	10	10	6.0
Sand (%)	30	50	50	70
Texture	Clay	Sandy loam	Sandy loam	Sandy clay loam
Organic matter (%)	2.5	2.99	2.07	1.96
Available nitrogen (ppm)	106	250	90	156 kg ha^{-1}
Available phosphorus (%)	2.65	0.72	2.33	50.12 kg ha^{-1}
Available potassium (ppm)	7.5	15.0	35	13.44 kg ha^{-1}
Exch, Ca (meq 100g^{-1})	4.0	3.0	4.25	4.0
Exch Mg (meq 100g^{-1})	6.25	5.0	6.5	5.75

Table 2: Effect of application of tank silt on growth of maize.

Treatments	Number of leaves plant^{-1}	Plant height (cm)	Dry weight (g plant^{-1})
T_1: Soil	5.6	71.20	18.25
T_2: Soil+ Shanthigrama tank silt @ 7.5 t ha^{-1}	5.0	63.20	16.16
T_3: Soil+ Shanthigrama tank silt @ 10 t ha^{-1}	5.3	69.18	17.55
T_4: Soil+ Shanthigrama tank silt @ 12.5 t ha^{-1}	6.8	82.77	20.02
T_5: Soil+ Karekere tank silt @ 7.5 t ha^{-1}	6.3	77.60	19.50
T_6: Soil+ Karekere tank silt @ 10 t ha^{-1}	5.0	60.50	16.50
T_7: Soil+ Karekere tank silt @ 12.5 t ha^{-1}	7.5	85.61	20.53
T_8: Soil+ Addihalli tank silt @ 7.5 t ha^{-1}	6.8	82.00	19.73
T_9: Soil+ Addihalli tank silt @ 10 t ha^{-1}	6.0	70.20	17.30
T_{10}: Soil+ Addihalli tank silt @ 12.5 t ha^{-1}	6.1	73.67	18.48
CD	1.23	10.01	1.69
C.V	5.75	6.4	4.4

Table 3: Effect of application of different tank silt on physic-chemical properties of soil.

Treatments	pH	EC (dSm^{-1})	Clay (%)	Silt (%)	Sand (%)	Organic matter (%)
T_1: Soil	7.20	0.21	12.00	6.00	1.99	1.99
T_2: Soil+ Shanthigrama tank silt @ 7.5 t ha^{-1}	7.65	1.20	12.50	5.50	2.46	2.46
T_3: Soil+ Shanthigrama tank silt @ 10 t ha^{-1}	7.80	1.20	12.75	5.45	2.60	2.60
T_4: Soil+ Shanthigrama tank silt @ 12.5 t ha^{-1}	8.10	1.08	13.00	5.50	2.66	2.66
T_5: Soil+ Karekere tank silt @ 7.5 t ha^{-1}	7.90	1.20	12.00	5.50	2.44	2.44
T_6: Soil+ Karekere tank silt @ 10 t ha^{-1}	8.10	1.80	12.00	5.50	2.56	2.56
T_7: Soil+ Karekere tank silt @ 12.5 t ha^{-1}	8.10	0.81	12.50	5.00	2.76	2.76
T_8: Soil+ Addihalli tank silt @ 7.5 t ha^{-1}	7.80	1.82	11.75	6.75	2.33	2.33
T_9: Soil+ Addihalli tank silt @ 10 t ha^{-1}	8.01	0.80	11.88	6.62	2.51	2.51
T_{10}: Soil+ Addihalli tank silt @ 12.5 t ha^{-1}	8.00	0.70	12.00	7.00	2.59	2.59
CD	NS	0.24	NS	1.68	0.20	0.20
C.V	5.19	8.02	3.7	10.68	2.9	2.90

Ost harvest physico-chemical properties of soil

Post-harvest soil sample from each pot were collected and analyzed for physic-chemical property, available nutrient status. The results showed that pH content showed non-significant results and it ranges from 7.2 to 8.1. The lowest pH value was found in T_1 and highest was recorded in the T_7. The pH value was in all the treatment except T_1 may be due to affected by tank silt application. The EC was significantly differing in all the treatment. The EC value ranges from 0.21 to 1.8 d Sm^{-1}. The highest value was found in T_8 and lowest in T_1. The increased EC value may be due to high initial EC of tank silt.

The texture was observed to be sandy- clay loam. Per centage of clay content were ranges from 11.75 to 13 per cent. High clay percentage was found to be in T_z (13%). The percentage of silt was ranges from 5 to 7. The highest percentage was observed in T_{10} and lowest was recorded in T_7. The significant difference found in T_7, T_8, T_{10} and remaining treatment was on par with each other. The sand content was ranges from 69.86 to 71.6 per cent, respectively. Highest was found in T and lowest was found in the T_4. There was significant difference was found in T_2, T_8, T_9 and other treatments were on par with each other. The organic matter content was ranges from 1.99 to 2.76 per cent, respectively. Highest was recorded

in T_7 and lowest was recorded in T_1. There was significant difference found in all treatments except T_6, T_9 and T_{10} may be due to the high initial sand percentage in Shanthigrama and Addihalli tank silt. This difference may be due to high initial organic matter percentage in all tank silts, organic matter increased because of addition of tank silt.

Available nitrogen were significantly affected in all the treatments, it ranges from 150.7 kg ha^{-1} to 237.18 kg ha^{-1}. The highest N content were observed T_7 and lowest in the T_1. The available P were significantly differed in all treatments and it ranges from 50.9 to 119.4 kg ha^{-1} and lowest was recorded in T_1 and highest was recorded in T_3. This may be due to the high initial P content present in Shanthigrama tank silt. The potassium content ranges from 4.46 to 9.91. The lowest K content found in T_1 and highest was recorded in T_{10}. The K content was significantly affected in all treatment except T_2 and T_3. The highest K content present in T_{10} may be due to the high initial K content in Addihalli tank silt. The exchangeable Ca content was ranges from 3.97 to 5.4 meq $100g^{-1}$. Most of the treatments were on par with each other except T_2, T_3 and T_{10}. The higher Ca content was recorded in T for and lower recorded T_1. This was mainly due to application of tank silt in difference dosage. The exchangeable Mg was differs on significantly the Mg content ranges from 5.4 to 6.2 meq $100g^{-1}$. The highest value observed in T_9 due to high initial Mg content in Addihalli tank silt.

Conclusion

Addition of tank silts to soil influenced the physic-chemical properties. Available nutrients like N, P, K and exchangeable nutrients like Ca and Mg were increased but texture of the soil was not altered. If further more the tank silts added periodically texture may alter. By addition of different quantity of tank silts to the soil invariably influences the growth parameters of crop. The data on experiment shows, addition or incorporating of tank silts with soil significantly increased the plant growth parameters and soil fertility and quality of tank silts also depends on different regions, climatic condition and use efficiency. Texture of the soil was not affected and it may be affected with periods of time. Addition of tank silt also influenced soil structure, infiltration rate and physic-chemical properties.

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