Economic evaluation of sediments as a source of plant nutrients

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Sediment deposition as a result of soil erosion is a significant problem in the village water tanks. In order to increase the rainwater storage capacity, removal of sediments from water tanks was taken up under the State Government Water Conservation Programme in Medak District, Andhra Pradesh, India. The feasibility of desilting operations and returning such huge amounts of sediments to agricultural fields was assessed by determining the sediment quality in terms of nutrients, organic carbon (C), biological properties and their economic value as a source of plant nutrients. Analysis of sediment samples showed an average of 720 mg nitrogen (N), 320 mg phosphorus (P), 310 mg potassium (K) and 9.1 g of organic C per kg of sediment. Higher microbial populations were found in the sediments that recorded high nutrient and organic C contents. The microbial biomass C in the sediments recorded an average value of 308 mg kg^{-1} sediment and the average proportion of microbial biomass C to organic C was 3.8%. Application of 48,777 t of sediment from 21 tanks returned 34 t of N, 15 t of P, 15 t of K and 433 t of organic C to agricultural lands. The benefit–cost ratio of desilting operation and application of sediments to agricultural lands in 21 tanks varied from 0.65 to 5.38, with an average ratio of 1.88. Further, extrapolation of the results for the N, P, K and organic C nutrient values to 78 water tanks in Medak district indicated that 177 t of N, 82 t of P, 76 t of K and 2016 t of organic C could be returned to the agricultural fields. The study suggests economic feasibility for the application of tank sediments to the agricultural fields for crop production, in addition to increased water storage capacity, groundwater recharge and availability of more irrigation water and environmental benefits.

Keywords: Desilted tank sediments, microbial activity, nutrients, organic carbon, water tanks.

THE movement of sediments and associated agricultural pollutants such as fertilizers, amendments and pesticides in water tanks is the result of soil erosion from adjacent farmlands. Sediment deposition is a significant problem in water tanks that have been traditionally the water storage structures for storing rainwater and run-off water during storm events. It is more so in the semi-arid tropical (SAT) regions where soil erosion is a common problem either due to heavy and erratic rainfall patterns or due to erosion by wind in the dry periods[1,2]. For rainfed-farming systems in Medak District, Andhra Pradesh, India, having SAT climate characterized by low rainfall (< 750 mm) and long dry spells, water tanks are the main source for storing rainwater (for supplemental irrigation) and also help recharge the groundwater. However, deposition of sediments in tanks reduces the water storage capacity[3,4]. This causes interference with drainage, land use, irrigation and adversely impacts the water quality (both surface and groundwater). There is a need to capture significant amount of rainwater in the dry regions, which is generally lost as run-off and deep drainage, so that the stored water can be used for increasing crop productivity. Hence, sediment removal from water tanks is an important natural resource management practice that needs to be implemented to reduce the negative environmental (sediment-associated nutrients and contaminants in terms of both their accumulation and storage) outcomes of agricultural practices and increase water availability and quality[5].

As the sediments in the water tanks are the result of soil erosion from adjacent farmlands, the prospect of efficiently returning sediments to agricultural production while also controlling erosion is an intriguing challenge to agronomists and agricultural engineers[6]. Also, as these sediments are derived from clean uplands, they should be perhaps more appropriately viewed as a resource out of place than as a disposal problem[7].

Earlier research showed that land application of sediments is an attractive option, and demonstrated that they are potentially capable of supporting agronomic crops due to their higher natural fertility and water-holding capacity. As bulk of the sediments deposited in the water bodies is generally fine silt and clay[8], their application to the soil makes good use of the sediment content of clay and silt, nutrients and organic matter, and brings them back to the soil[9]. Some relevant examples suggest beneficial uses of sediments on land application. Appropriate rates of sediment application to the agricultural soils improved the properties of sandy soils of the area and increased the yield of lettuce[9,10].

Understanding the nutrient value of sediments, their application to agricultural fields is encouraged for soil health maintenance and sustainable productivity. Based on the soil and water conservation practices and envi-

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ronmental considerations, it was hypothesized that application of sediments to agricultural fields would be economically viable. However, quantification of nutrients in the sediments and economic valuation based on fertilizer value although important, are not available.

The objective of the present study therefore, was to make an economic evaluation of nutrients in sediments collected from a large number of tanks in Medak District.

Materials and methods

Site description

The research study locations were 21 village water tanks spread out in 11 mandals situated in Medak District at long. 78.25°E, lat. 17.75°N, and 500 m msl (Figure 1). The soils adjacent to the water tanks were mostly sandy and gravely shallow-type of red soils (Alfisols), while black soils (Vertisols and associated soils) were found in small patches in a few depression areas of the district. Dominant soil types consisted of sandy loam (SL) and clay loam (CL) in the study area (Table 1). The normal annual precipitation of the district was 873 mm and rainfall in the district varied spatially and temporally, and often occurred as torrential downpours.

Sampling and analysis of sediments

In these water tanks, massive desilting operations were undertaken during the dry season (March–May) of 2001 and 2002 to restore their storage capacity under the State Government Water Conservation Programme. Across each water tank, ten different sampling points were selected randomly to define spatial variability and depth of sediments. At each water tank site, depending on the depth of sediment deposited, sediment sampling was done at depth intervals of 0–15, 15–30, 30–45, 45–60 and 60–90 cm. For a few water tanks (tank nos 7–9), the sampling depth was up to 45 cm; in tank nos 2 and 21 the sediment deposits were found up to 60 cm, while in other tanks sampling depth extended up to 90 cm. At each depth interval, the sediments sampled at ten random spots were mixed to yield a homogenous representative sediment sample of the water tank site. The samples were air-dried, processed and analysed for physico-chemical and biological properties following the standard methods (Table 2). Microbial population sizes were estimated by analysing three replicate sub-samples of each sediment sample drawn from 0–15 and 15–30 cm sediment sampling depth. Sediment samples were also assessed for microbial biomass carbon (C), which is as an important component of the soil organic matter that regulates nutrient transformation and its cycling.

Nutrient usage

The information provided by the agriculture department of Medak District revealed that the chemical fertilizers commonly used by the farmers were urea, diammonium phosphate (DAP) and muriate of potash (KCl) for supplying nitrogen (N), phosphorus (P) and potassium (K) nutrients for growing crops. On an average, for agricultural crops, the farmers applied 50 kg N, 60 kg P_2O_5 ha^{-1} and rarely 60 kg K_2O ha^{-1}. Depending on the availability, farmyard manure (FYM) was applied at a rate of 10–12 t ha^{-1}, biannually. When FYM was available, the amount of chemical fertilizer application was accordingly reduced and additional amount of N was applied through urea.

Computation of nutrient value of sediment

The computation of nutrient value of sediments was based on the commonly used sources of nutrients (chemical fertilizers and organic sources, e.g. manure). The composition of the sediments in terms of N, P, K and organic C was obtained from analytical results. Economic valuation of N, P and K in sediment samples was calculated based on the existing chemical fertilizer costs. The valuation of N in the sediments was based on the cost of urea fertilizer, the fertilizer equivalent value of P was based on the fractional cost of phosphorus through DAP fertilizer, and the valuation of K in the sediments was based on the cost of muriate of potash at the existing rates.

Apparent benefit–cost ratio

The benefit–cost (B/C) ratio of desilting operation and application of sediments to agricultural lands was computed by comparing the benefits accrued to costs incurred during the activity. The amount of sediments removed from the water tanks was calculated based on the volume of sediments, density values and moisture correction factor. For each tank site, the nutrient content of N, P and K of the sediments multiplied by the amount of sediments returned to agricultural fields was taken as the benefit and the expenditure incurred for desilting activity as the cost. The B/C ratio calculated is the apparent value and indicates only cost of desilting operation and value of sediments as source of N, P and K nutrients.

Results and discussion

The results of physico-chemical and biological parameters determined following standard methods (Table 2) and computation of B/C ratio to assess the economic feasibility of desilting a large amount of sediments from water tanks of Medak District are discussed below.

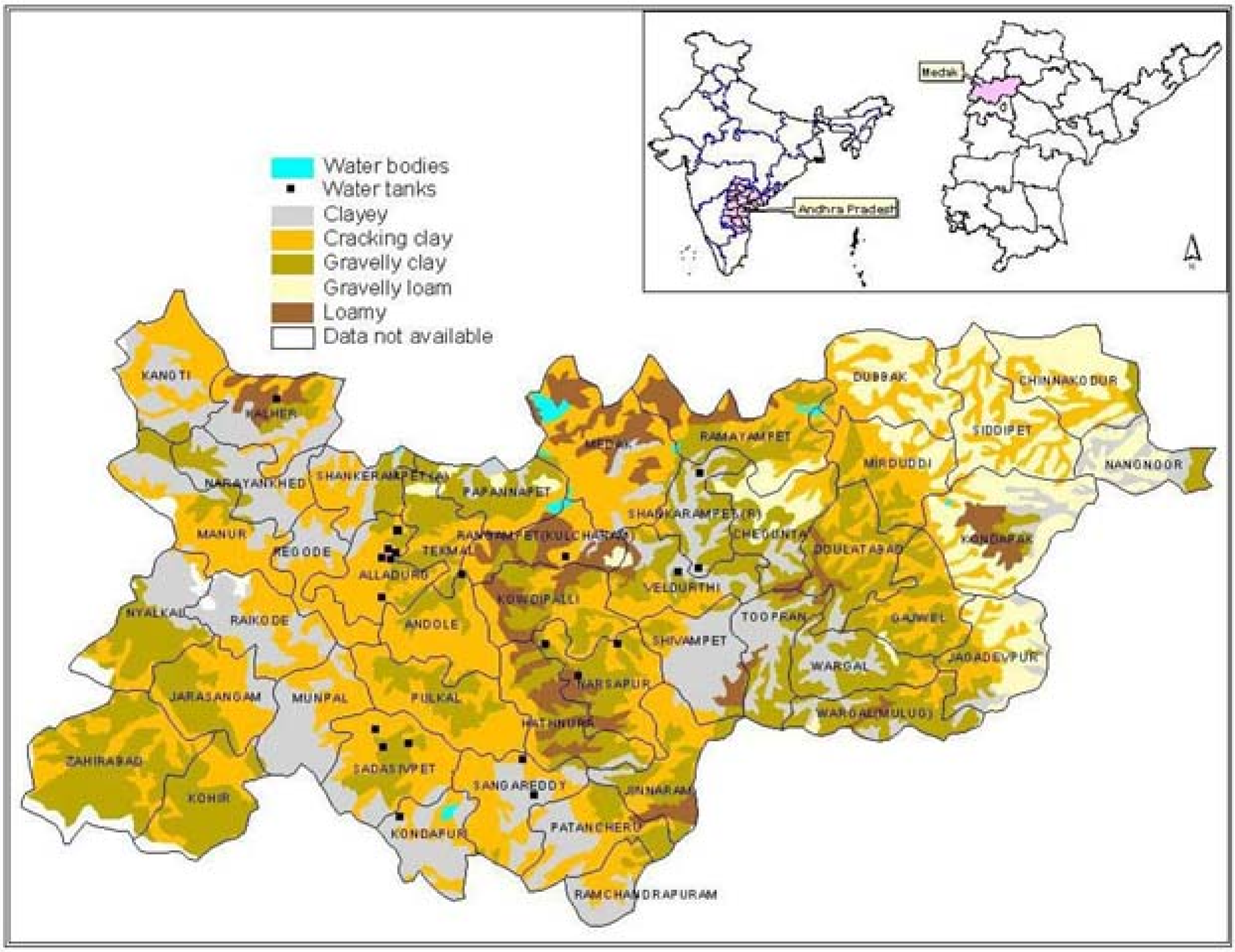

Figure 1. Location of various water tanks studied in 11 mandals of Medak District, Andhra Pradesh, India.

Texture of the sediments

Texture analysis of the sediments deposited in the tanks revealed that their composition varied widely within the district reflecting on the soil type, topography, rainfall intensity, crop cover and organic matter content of the soils in the catchment area of the water tanks. The sediment deposits in these water tanks that moved along the flow of water during run-off came from SL and fine-grained soils as CL and heavy textured soils (Table 1). The fine sand in the samples ranged between 12 and 53%, while silt and clay amounts ranged between 30 and 71%. High clay content was found in tank nos 3, 5, 11 and 21. The fine texture of the sediments reflects the sediment source[7] and rate of erosion[2].

pH of the sediments

The mean pH of the sediments in 21 water tank sites ranged between 6.2 and 7.6, with an average value of 6.8 (Table 3). The sediment pH values are moderated by relatively high organic matter content in the sediments that would have helped adjust the pH value to neutral range through soil reduction and associated biochemical changes[11].

Nitrogen, phosphorus and potassium in the sediments

The mean total N content in the tank sediment samples varied from 340 to 1760 mg kg^{-1} sediment, with an average N content of 719 mg kg^{-1}, that is two times higher than the normal soil N content of the cultivated fields in the region. The sediments also indicate the loss of nutrient-rich fertile topsoil from the surrounding areas. Highest N content was recorded in sediment samples from tank no. 3 (Table 4). Sediment samples from tank nos 2, 3, 11, 13 and 19 recorded total N values greater than 1000 mg N kg^{-1} of sediment, indicating the usage of fertilizers by the farmers and greater economic feasibility in replacing the sediments back to the agricultural fields.

The total P content in the 21 tank sediment samples ranged between 127 and 1120 mg P kg^{-1} of sediment, with an average of 321 mg of total P kg^{-1} sediment (Table 4).

Table 1. Location of water tanks, distribution of soil types and details of desilting in Medak District, Andhra Pradesh, India

Tank no.	Mandal	Village	Tank	Soil texture	Amount of sediment removed (t)	Cost incurred (US$)*
1	Sangareddy	Goudicherla	Kudi Cheruvu	SL	2460	660
2	Sangareddy	Yeranoor	Edula Kunta	SL	745	200
3	Kondapur	Merepally	Kotha Kunta	CL	1974	529
4	Sadasivapet	Atmakur	Rahul Cheruvu	CL	4276	1147
5	Sadasivapet	Veltoor	Pedda Cheruvu	CL	5220	1400
6	Sadasivapet	Enekepally	Kotha Cheruvu	CL	729	196
7	Alladurg	Muslapur	Nadayani Kunta	CL	1445	388
8	Alladurg	Marvelly	Regode Cheruvu	CL	1146	307
9	Alladurg	Chilver	Komantlavani Kunta	CL	2970	797
10	Alladurg	G.Peddapur	Gollai Kunta	CL	2785	747
11	Andole	Masaipally	Govram Cheruvu	SL	5583	1498
12	Kalher	Krishnapur	Krishnapur Cheruvu	SL	2270	609
13	Kulcharam	Pothereddypally	Chandra Kunta	SL	2165	581
14	Kulcharam	Yenigandla	Damara Cheruvu	SL	1928	517
15	Narsapur	Lingapur	Komati Kunta	SL	3001	805
16	Narsapur	Chipal thruthy	Pathi Kunta	SL	2662	714
17	Narsapur	Thirmalapur	Damara Cheruvu	SL	3016	809
18	Yeldurthy	Edulapally	Pedda Cheruvu	SL	1218	327
19	Shankarampet	Dharpally	Bathkamma Cheruvu	SL	1298	348
20	Shankarampet	Kaslapur	Chintala Cheruvu	SL	468	126
21	Alladurg	G.Peddapur	Thimmana Cheruvu	CL	1411	379
	Total value				48777	13081

*1 US$ = Indian rupees 43.5.

Table 2. Methods used for sediment analysis

Property	Method
Particle size analysis	Hydrometer method[18]
pH	Glass electrode[19]
Total N	Modified Kjeldahl digestion[20]
Total P	Perchloric acid digestion[21]
Exchangeable K	Ammonium acetate saturation[22]
Organic C	Combustion method
	Primacs[sc] TOC Analyzer, Skalar[23]
Microbial biomass C	Chloroform-fumigation[24–26]
Microbial population	Serial dilution and spread plate
	Bacteria-nutrient agar[27]
	Fungi–potato dextrose agar[28]
	Actinomycetes–nutrient agar[29]

It was observed that 50% of the tank sediment samples had total P values higher than the mean value (321 mg kg^{-1} sediment). The available (extractable) K content in the tank sediment samples varied from 69 to 510 mg kg^{-1} sediment, with an average K content of 310 mg kg^{-1}. Highest K content was recorded in sediment samples from tank no. 8.

Results show that nutrient (N, P and K) losses from the agricultural land were higher as reflected in the sediment N, P and K composition. High nutrient accumulation in the sediments is attributable to fertilizer application in agricultural fields, part of which gets deposited in the water bodies through run-off. Similar results were reported in the Xiangahi wetlands of China[12], where sediment analysis showed high nutrient amounts of organic C (1.8%), N (981 mg kg^{-1}) and P (212 mg kg^{-1}). Among the plant nutrients, N being intensively used to grow crops[5] is reflected in the results, where high amount of N was found in the sediments and is in accordance with the findings of sediments studies in lakes[13,14]. The ranges of nutrient concentrations associated with sediments reflect the intensity of agricultural activity apart from point-source inputs.

Organic carbon

The mean organic C values in the sediments of 21 water tanks ranged from 4 to 22.3 g C kg^{-1} sediment (Table 3). Highest organic C values were obtained at 0–15 cm depth interval in most of the sediments except for tank nos 1, 4, 7 and 8, where 15–30 cm sediment depth intervals recorded slightly higher values over the 0–15 cm sediment depth. In general, the concentration of organic C in the sediments decreased with increasing depth in the tanks. Highest organic C value of 27.2 g C kg^{-1} sediment was recorded in tank no. 3 (Kothakunta Tank, Merepally village, Kondapur mandal). Tank nos 5, 7, 16 and 17 recorded organic C values lower than 6.5 g C kg^{-1} sediment. Lowest organic carbon value of 4 g C kg^{-1} sediment was recorded in tank no. 7 (Nadayani Kunta Tank, Aldurg mandal). The overall mean organic C value for the 21 tank sediment samples studied was 9.1 g C kg^{-1} sediment. Similar results have been found by other researchers[10,12].

Table 3. Values of mean and range of sediment pH, organic carbon (OC) and microbial biomass carbon (MBC) of sediment samples collected from Medak District

Tank no.	pH	OC ($g\ kg^{-1}$ sediment)	Amount of C in sediment (t)	MBC ($mg\ kg^{-1}$ sediment)
1	7.0 (6.3–7.6)	8.9 (6.8–10.9)	21.9	272 (249–323)
2	6.9 (6.3–7.5)	11.2 (4.8–18.8)	8.4	358 (315–394)
3	6.7 (6.6–6.8)	22.3 (6.9–34.1)	44.0	387 (319–399)
4	7.0 (6.5–7.5)	8.4 (7.1–9.7)	35.8	323 (280–386)
5	6.7 (6.7–7.0)	6.0 (5.7–6.4)	31.1	204 (172–239)
6	7.5 (7.4–7.6)	7.8 (7.2–8.2)	5.7	344 (301–403)
7	6.2 (6.1–6.4)	4.0 (3.6–4.5)	5.8	216 (186–256)
8	7.4 (7.3–7.4)	8.0 (7.8–8.3)	9.2	305 (281–354)
9	6.9 (6.8–7.1)	9.9 (8.3–12.7)	29.5	326 (273–353)
10	6.4 (6.1–6.6)	7.4 (6.5–8.4)	20.7	241 (233–313)
11	7.4 (7.2–7.6)	10.5 (8.7–12.3)	58.7	346 (329–392)
12	6.3 (6.0–6.8)	6.5 (5.5–7.6)	14.6	333 (315–438)
13	6.7 (6.1–7.4)	8.0 (1.8–20.6)	17.2	296 (240–329)
14	6.6 (6.5–6.7)	6.6 (5.3–8.6)	12.7	339 (264–358)
15	6.4 (6.0–7.1)	13.6 (10.9–16.3)	40.8	333 (313–357)
16	7.3 (6.9–7.7)	5.2 (3.5–6.7)	13.9	310 (285–341)
17	7.6 (6.9–8.0)	5.1 (3.8–5.9)	15.5	290 (243–305)
18	6.6 (6.3–7.0)	11.7 (6.1–24.3)	14.2	331 (240–358)
19	6.3 (6.1–6.5)	13.9 (11.3–17.6)	18.0	317 (277–374)
20	6.2 (6.0–6.3)	6.6 (4.6–9.7)	3.1	311 (297–365)
21	7.5 (7.5–7.6)	8.5 (7.2–10.0)	11.9	293 (271–313)
Total/average	6.8**	9.1**	432.9*	308**

*Total value; **Average value. Values in parenthesis show the range.

The results clearly indicate that soil erosion removes significant amounts of organic C along with sediments[2].

Microbial population

Quantification of viable microorganisms (fungi, bacteria and actinomycetes population) in tank sediment samples recorded a higher and diversified population of the microflora, indicating qualitative and quantitative differences in the sediments. The upper layer of sediments showed high microbial abundance, indicating the richness in terms of organic C and nutrients. A perusal of the results of microbial population recorded as colony forming units (CFU) revealed that among the microflora, bacteria were

Table 4. Values of mean and range of nutrients in tank sediments, their economic terms of plant nutrients and benefit–cost analysis of desilting operations

Tank no.	N (mg kg^{-1})	P (mg kg^{-1})	K (mg kg^{-1})	Fertilizer equivalent (US $) N	Fertilizer equivalent (US $) P	Fertilizer equivalent (US $) K	B/C ratio
1	549 (347–632)	250 (177–383)	326 (188–506)	338.1	492.8	172.6	1.52
2	998 (305–1898)	312 (161–435)	344 (118–570)	186.2	185.1	55.2	2.13
3	1761 (572–2738)	1122 (509–1433)	489 (412–551)	868.1	1771.8	208	5.38
4	770 (527–1088)	421 (375–558)	407 (375–437)	694.6	1336.7	375.3	2.10
5	368 (347–384)	291 (278–299)	405 (391–420)	495.7	1255	455.2	1.58
6	512 (494–546)	267 (252–281)	387 (380–392)	94.8	158.4	60.8	1.61
7	440 (428–452)	132 (129–134)	69 (65–73)	158.9	150.6	21.4	0.85
8	630 (530–729)	348 (180–516)	509 (476–543)	180.4	321.5	125.8	2.04
9	593 (405–833)	182 (171–204)	281 (226–346)	616.0	476.0	179.5	1.60
10	549 (459–638)	344 (192–495)	161 (129–193)	382.8	758.8	96.5	1.66
11	813 (474–1152)	244 (225–263)	262 (251–272)	1604.5	1176.8	314.6	2.07
12	416 (381–488)	190 (173–204)	243 (221–265)	238.3	345.7	118.6	1.15
13	883 (255–2715)	161 (99–308)	225 (97–348)	584.5	295.1	105.0	1.70
14	637 (426–908)	280 (285–323)	374 (361–404)	356.5	463.6	155.4	1.89
15	701 (642–782)	447 (347–533)	344 (325–357)	547.5	1058.3	222.4	2.27
16	463 (384–519)	243 (216–264)	197 (173–506)	286.1	512.1	112.9	1.28
17	339 (303–359)	127 (80–188)	114 (86–163)	256.3	193.4	74.2	0.65
18	838 (531–1309)	396 (354–449)	366 (298–418)	207.1	371.1	96.0	2.06
19	1128 (902–1425)	533 (468–624)	419 (398–433)	356.9	530.7	117.2	2.89
20	555 (293–831)	285 (189–341)	281 (143–374)	75.2	120.0	28.3	1.78
21	473 (437–495)	189 (168–203)	268 (219–294)	166.8	214.9	81.3	1.22
Average	719	321	308				1.88

Values in parenthesis show range.

in highest number, followed by actinomycetes and fungi which were lowest in population (Figure 2). The actinomycetes and fungi populations ($< 5 \times 10^4$ CFU g^{-1} sediment) were similar in all the 21 tank samples. However, the bacterial population in sediments recorded a wide range ($1–81 \times 10^4$ CFU g^{-1} sediment). The bacterial population on an average varied between 20×10^4 and 30×10^4 CFU g^{-1} of tank sediment and sediments from tank nos 3, 6, 14, 16, 18 and 21 recorded bacterial populations above the average range. Comparatively low population counts were found in sediment samples from tank nos 7, 10, 11, 12 and 17. High microbial population counts were

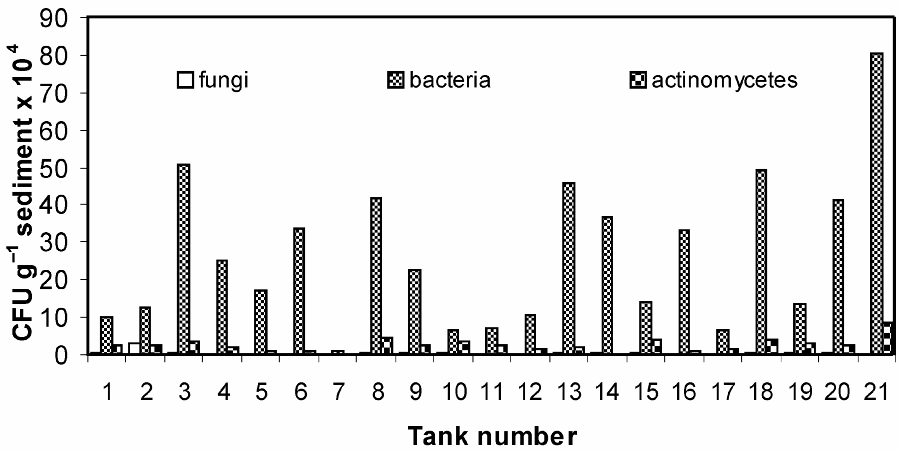

Figure 2. Microbial population counts in the 21 tanks sediments in Medak District.

recorded in sediment samples from tank no. 21 that was surrounded by clayey soil. In general, higher microbial counts were recorded from the sediments collected from tanks surrounded by soils with clay texture. Since sediments are deposited due to erosion from the agricultural catchments, the characteristics of soils in the adjacent fields such as pH, temperature, texture, organic C levels, nutrients and crops influence the distribution and density of the microbial population.

The microbial activity and population being regulated by the availability of nutrients, the results showed that a higher number of viable microbial bacteria and actinomycetes was found in tank sediments that recorded high nutrient and organic C values and microbial biomass C (tank nos 3, 19 and 21). This wide variability in the microbial population could be attributed to the nutrient status of the tank sediments, farm cropping, soil and fertilization history, which have a direct influence on sediment quality.

Microbial biomass

The microbial biomass C, which is an important component of the organic matter that regulates transformation and storage of nutrients[15] and represents a readily available source of nutrients, varied widely in the sediment samples. The microbial biomass C values in the sediments ranged between 204 and 387 mg C kg^{-1} of sediment (Table 3), with an average of 308 mg of biomass C kg^{-1} of sediment. The microbial biomass C values in the sediments decreased with depth in all the 21 water tank locations. This decrease is attributed to lower availability of C to support microbial activity[16]. Samples from tank no. 3 recorded the highest microbial biomass C (387 mg C kg^{-1} of sediment). Among the 21 tank samples, 33% recorded less than the mean value (308 mg kg^{-1} of sediment). The influence of cropping systems, nutrient availability, soil reaction and other physico-chemical parameters on microbial activity is reflected in the microbial biomass values. The biomass C as a proportion of organic C varied in tank sediment samples between 1.7 and 5.9%, and decreased with sediment depth (data not shown). On an average, the proportion of microbial biomass C to organic C was recorded to be 3.8% and is in accordance with Smith and Paul[17], where soil microbial biomass C, the labile component of the soil organic fraction, comprised 1–3% of total soil C. The higher proportion values suggest greater and faster release of nutrients from the particular sediment samples. Overall, from the results it was found that sediment samples that recorded high nutrient concentrations (N, P, K and organic C) also had higher microbial population and microbial biomass C values (Table 3).

Economics of removal of sediments from the tanks

Benefit–cost ratio: The quantity of sediments removed from desilting activity in the 21 water tanks varied between 470 and 5580 t. The total quantity of sediments from all the 21 tanks amounted to 48,777 t. In Govram Cheruvu (tank no. 11), Andole mandal, that received 816 mm of rainfall in 2001 (highest in the district), 5580 t of sediment was obtained, which was the highest amongst the 21 water tanks. The total cost incurred in the removal of sediments from the tanks amounted to US$ 13,081 (Table 1). From nutrient valuation, it was found that in total 48,777 t of sediment contained 34 t of total N, 15 t of P, 15 t of K and 432 t of organic C. The B/C ratio ranged between 0.65 and 5.38; and in the case of 70% of tank desilting operations, the B/C ratio was greater than 1.6. The mean B/C ratio of desilting operation was 1.88; that is, for every dollar of cost invested in desilting, 1.88 dollars of benefit was realized (Table 4).

Average B/C ratio of 1.88 suggests that desilting operations are not only economically viable but also have additional benefits like environmental protection, carbon sequestration, increased soil microbial biodiversity, improved soil quality and increased water storage. If indirect additional environmental benefits are also estimated in the benefit component, then there would be compounded benefit. Application of sediment back to the agricultural fields forms an improved agricultural management system that enhances and protects the soil quality, resulting in improved production capacity of the soil and reversing the process of land degradation. Additionally, the process of sediment application to farmlands rich in organic C would result in C conservation.

Extrapolation of results to Medak District

The enormous task of desilting 78 water tanks in the district, deposited with huge amounts of sediment, was assessed for economic feasibility through B/C analysis. For this, the results obtained from the 21 tanks were extrapolated to the entire district in which a total of 78 tanks were desilted. The approach used for extrapolation utilized the nearest available tank sediment composition, values of N, P, K and organic C determined for the 21 water tanks. Average values of sediment analysis from 2 to 3 nearest tanks were used to compute for rest of the tanks in the district. The extrapolation of results showed that the overall mean N, P and K concentration in the sediments from 78 tanks was 716, 341 and 315 mg kg^{-1} sediment respectively. Average organic C value was 9.3 g C kg^{-1} sediment. In the district, a total of 246,831 t of sediment from 78 tanks was desilted. Addition of these sediments back to the farms returned 177 t of N, 82 t of P, 76 t of K and 2016 t of organic C. On an average, the B/C ratio for desilting the water tanks and returning sediments to agricultural fields in the district was calculated to be 1.93, which reflects a positive benefit for the cost incurred in the desilting programme.

Conclusion

The results indicate that the sediments deposited in the water tanks of Medak District provided significant amount of nutrients (N, P and K), were richer in organic C and microbial activity, and thus can act as fertilizer substitutes for crop production. Because loss of microbial diversity through erosion from fields is one of the important factors for land degradation, returning tank sediments rich in nutrients, organic C, microbial biomass C and microbial population would help in improving the microbial diversity and biological activity in farm soils, thereby improving soil quality and crop production. Owing to the large amount of organic C (2016 t) in tank sediments, application to agricultural fields would increase soil C.

From the cost-effectiveness of the desilting activity as shown by the B/C ratio (1.88), the study strongly suggests that after understanding the composition of the sediments, returning the sediments to agricultural fields is a viable option. Sediments rich in nutrients when desilted and returned to agricultural lands, not only increase the reservoir capacity and but also provide environmental benefits; and more importantly, return the nutrients back to the soil.

Depending on the availability of tank sediments and their nutrient content, a case is made for their proper utilization through application to farmlands for increasing productivity and improving soil quality. Though the potential for likely contaminants is low in the sediments, there is a need for further studies on sediment quality and agronomic aspects of sediments added to soils.

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