Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 2880-2883

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Characterization of tank silt of natural reservoirs in Western Melghat region of Dharni

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Abstract
The present Investigation was carried out for Characterization of tank silt of natural reservoirs in Western Melghat region of Dharni and its physical properties. The tank silt samples were collected based on GPS from eleven reservoirs in Western Melhgat region of Dharni.
The particle size analysis of various tank silt content ranged from sand 3.50 to 19.50 %, silt 55.70 to 66.40% and clay 20.20 to 31.00% with textural classes silt loam to silt clay loam. It was further observed that bulk density ranged from 1.15 to 1.50 Mg m^{-3}, particle density from 2.46 to 2.59 Mg m^{-3} and hydraulic conductivity from 0.86 to 1.06 cm hr^{-1}.The pH of different tank silt was found in the ranged of 6.21 to 7.43 which was slightly acidic to neutral in reaction, electrical conductivity ranged from 0.17 to 0.74 and organic carbon was noted between 5.6 to 9.7 g kg^{-1}. From this study it can be concluded that, tank silt from all the natural reservoirs of Western Melghat region are beneficial for improvement of physical and chemical properties of agricultural soil in the region.

Keywords: Western melghat region, Tank Silt, Natural Reservoirs

1. Introduction
Tank silt is the deposited and suspended matter or eroded soil in tank, which comes along with surface runoff caused due to intensive rainfall. Addition of tank sediments to cultivated fields improves physical and chemical properties of soil, which results in good crop growth and yield. The practice also minimizes cost on the other external inputs such as manures, fertilizers, etc.
The sediments washed through runoff from catchment area gets deposited in tank beds and generally referred as tank silt. The tanks not only act as the reservoirs for surface water but also recharge the ground water. It is intriguing to note that sediments deposition has become a chronic problem in water bodies due to soil erosion. It is more in semi - arid tropical region where rainfall pattern is erratic and intensity is high.
Tank sediments can be used preferably in the fields of respective catchment to build up their productivity. Addition of tank sediments to cultivated fields improves the physico-chemical properties of the soil which results in good crop growth and higher yields. Tanks silt is a rich mine containing all the needed macro and micro nutrients essential for plant growth and also a good source of organic matter. Tank sediments can be used preferably in the fields of respective catchment to build up their productivity. Tank silt containing high organic matter possesses high porosity show lower value of bulk density because aggregate formation increase micro organism like earthworm, rodents, insects. Increase macro pores in the soil.
Application of tank silt increased the water holding capacity, clay content and nutrient availability in the soil. It also enhanced the soil moisture content. Addition of 100 t ha^{-1} of tank silt over 2 or 3 years was found to improve light soils in Andhra Pradesh (Wassan, 2002). Annadurai *et al.* (2005) reported that, the mixture of tank silt and press mud when amended to soils improved the physical condition of soil by increasing the hydraulic conductivity, organic matter content and water holding capacity and reducing pH and bulk density of soils. There is a growing need and feedback from the large number of farmers in the area and State Agricultural Department that the study should be undertaken to generate information on the contents of tank silt and its advantages and drawbacks, if any. It is thus essential to characterize the tank silt and study the soil properties as influenced by the tank silt.
Melghat is situated in the southern offshoot of Satpuda ranges and north eastern Maharashtra in Amravati district. It is constituted by incorporating two Tehsils of Amravati district namely Dharni and Chikhaldara. It covers a geographical area about 4,426 sq. kms. of this, 3,630 sq. kms is in Chikhaldara. This tehsil retains its dense forest covers because of its comparatively low population about 76,000 people in 197 villages. The 796 sq. kms of Dharni tehsil have fewer forests due to pressure of 1.13 lakh people living in 153 village

The formation of Melghat region is the Deccan trap, with lava flows found in a horizontal position. The underlying rock is basalt. The soil although fertile is generally stony as it is derived from the weathering and disintegration of underlying rock. Its depth and drainage vary considerably, greater depth on lower slopes and valleys to very shallow on the steep upper slopes. There are three major soil types found in the region; Boulders soil', which is most common throughout the reserve, is shallow and found on slopes, and is excessively drained resulting in loss of moisture during dry season 'Clay soil' which is very fertile, is found in low lying areas. The altitude in the sanctuary ranges from 305 m to 1045 m above MSL, with the highest point at Belkandha peak, near Rorighat. The entire area is criss crossed by perennial and annual streams and rivers. It also forms the catchment of the Narmada river, with tributaries like Malini, Koti, Bori, Sonbhadra and Tawa. Soils are deep along the rivers, fairly deep and well drained on lower slopes and shallow on higher steep slopes (Padhye 1961).

Melghat is the green treasure of Maharashtra. Here, a variety of flora and fauna are available. As per the record of 1998-99, the percentage of forest area in the Dharni and Chikhaldara were 12 percent and 87 percent respectively. Day by day, the forests are reducing due to uncontrolled cutting of trees. The nature of forests over the major area of Melghat is of dry deciduous type. Teak (Sagwan) is the most common and dominant tree throughout this area. The other kind of trees are also available in this forest e.g. Moin. Aola. Ghoti. Tiwas. Amaltas, Tendu, Sajad, Haldu, Gum and Dudhi etc. Botany's researchers have identified more than 150 plant species. Some of them are rare medicinal plants, and the uses as well as information regarding such plants are known only to the local tribal residents of the region.

2. Material and methods

The present investigation entitled “Characterization of tank silt of natural reservoirs in western Melghat region of Dharni” has been carried out by collecting tank silt samples of respective tanks. The study was conducted in the vicinity of eleven reservoirs in Melghat region of Dharni.

The present study was carried out in the eleven natural reservoirs located in Dharni area.The tank silt samples from all eleven natural reservoirs were collected by using Global Position System (GPS). The size of that natural reservoirs is differents. Among the eleven natural reservoirs four natural reservoirs are of below ten hectares size were as seven reservoirs having the size ten and more than ten hectares area.

The silt samples from all these natural reservoirs were collected separately and analyzed for physical and chemical properties by using standard procedure.

3. Results and Discussion

The silt samples from eleven natural reservoirs from melghat area were analyzed for following physical properties. The results perceived are presented separately along with discussion.

3.1 Particle size analysis of tank silt of natural reservoirs.

The result received in respect of particle size analysis of tank silt of various natural reservoirs is presented in Table 1.

3.1.1 Mandwa reservoir

The particle size analysis of tank silt in Mandwa reservoir was found as sand 5.30 %, silt 66.40 %, and 28.30 % clay with silt clay loam class. The higher silt percentage that is 66.40 % and lower sand percent that is 5.30 % might be due to barren hills deforestation in the catchment area and more erosion.

3. 1.2 Jutpani reservoir

The textural analysis of tank silt in Jutpani reservoir was noted as 17.00 % sand, 59.50 % silt and 23.50 % clay which was categories as silt loam class. Accumulation of more silt than clay and sand may be due to deforestation and more area under agriculture.

3. 1.3 Baru reservoir

The sand, silt and clay per cent from the tank silt of Baru reservoir were noted as 3.50 % sand, 65.50 % silt and 31.00 % clay with silt clay loam texture class. Higher quantity of silt deposition and lower percentage of sand might be due to the more slope as Baru reservoirs is situated in the valley type basin.

3. 1.4 Gambhri reservoir

The particle size analysis from the tank silt of Gambhri reservoir found as 14.50 % sand, 57.90 % silt and 27.60 % clay with textural class as silt clay loam. This might be due to more deforestation and undulating topography resulting in more erosion.

3. 1.5 Gawandho reservoir

The textural analysis of the sediments deposited in the Gawandho tank was reported as 15.40 % sand, 55.70 % silt and 28.90 % clay with silt clay loam textural class. May be due to more erosion from the forest area as the catchment area is completely forest

3. 1.6 Sadarabadi reservoir

The textural analysis of tank silt in Sadarabadi reservoir was noted as 16.40 % sand, 62.40 % silt and 21.20 % clay which was categories as silt loam class. Accumulation of more silt than clay and sand may be due to deforestation and area under agriculture.

3. 1.7 Khari reservoir

The particle size analysis of tank silt in Khari reservoir was found as sand 19.50 %, silt 58.20 %, and 22.30 % clay with silt loam class. Higher quantity of silt deposition and lower percentage of sand might be due to the more slope as Khari reservoir is situated in the valley type basin.

3. 1.8 Bobdo reservoir

The sand, silt and clay per cent from the tank silt of Bobdo reservoir were noted as 17.80 % sand, 62.00 % silt and 20.20 % clay with silt loam texture class. The higher silt percentage that is 62.00 % and lower sand percent that is 17.80 % might be due to barren hills deforestation in the catchment area and more erosion.

3. 1.9 Titamba reservoir

The textural analysis of the sediments deposited in the Titamba tank was reported as 11.80 % sand, 64.20% silt and 24.00 % clay with silt loam textural class. May be due to more erosion from the forest area as the catchment area is completely forest

3. 1.10 Dhodra reservoir

The particle size analysis from the tank silt of Dhodra reservoir found as 11.20 % sand, 61.90 % silt and 26.90 % clay with textural class as silt loam. Accumulation of more

silt than clay and sand may be due to deforestation and more area under agriculture.

3. 1.11 Lavada reservoir

The textural analysis of the sediments deposited in the Lavada tank was reported as 16.00 % sand, 62.60 % silt and 21.40 % clay with silt loam textural class. This might be due to more deforestation and undulating topography resulting in more erosion.

The textural analysis of above eleven reservoirs revealed that the composition of the sediments deposited in the tanks varied widely and reflecting the varied percentage of sand, silt and clay with two different textural classes

Particle size analysis of various tank silt range from 3.50 % to 19.50 % sand, 55.70 % to 66.40 % silt and 20.20 % to 31.00 % clay with mean value that is 13.49 % sand, 61.48 % silt and 25.03 % clay respectively. The textural classes of the tank silt from the various reservoirs was classified silt loam to silt clay loam with ± 1.54 sand, with ± 1.01 silt and with ± 1.10 clay.

The percent silt content was estimated higher than sand and clay percent in all the tank sediments. There was no much more deviation in the deposition of silt in all the tanks. However the sand percentage in Baru and Mandwa reservoirs were reported lower as compared to other reservoirs. There was no much more variation in the deposition of clay percentage however more the deforestation and slope reflected on the deposition of sediments in the repetition. Krishanappa *at al*. (1998) reported in the particle size analysis and observed in Kolar Tahasil of Karnataka. The more silt content is beneficial in improving available water contain of the cultivable soil if added. The similar finding was drawn by Bhanavase *et al.* (2011).

Table 1: Particle size analysis of tank silt of natural reservoirs

Sr. No.	Name of Location	Tank silt			Textural class
		Sand (%)	Silt (%)	Clay (%)	
1	Mandwa	5.30	66.40	28.30	Silt clay loam
2	Jutpani	17.00	59.50	23.50	Silt loam
3	Baru	3.50	65.50	31.00	Silt clay loam
4	Gambhri	14.50	57.90	27.60	Silt clay loam
5	Gawandho	15.40	55.70	28.90	Silt clay loam
6	Sadarabadi	16.40	62.40	21.20	Silt loam
7	Khari	19.50	58.20	22.30	Silt loam
8	Bobdo	17.80	62.00	20.20	Silt loam
9	Titamba	11.80	64.20	24.00	Silt loam
10	Dhodra	11.20	61.90	26.90	Silt loam
11	Lavada	16.00	62.60	21.40	Silt loam
	Maximum	19.50	66.40	31.00	
	Minimum	3.50	55.70	20.20	
	Average	13.49	61.48	25.03	
	S. E. (m) ±	1.54	1.01	1.10	
	C. V. (%)	37.90	5.42	14.60	

3.2 Bulk density and Particle density of tank silt of natural reservoirs

The finding obtains from the present investigation regarding bulk density and particle densities from the tank silt on eleven natural reservoirs have been presented in Table 2.

3. 2.1 Mandwa reservoir

The values of bulk density and particle density in Mandwa tank silt sample were found as 1.23 Mg m^{-3} and 2.51 Mg m^{-3} respectively.

3. 2.2 Jutpani reservoir

The values of bulk density and particle density in Jutpani reservoir of tank silt sample was reported as 1.21 Mg m^{-3} and 2.55 Mg m^{-3} respectively.

3. 2.3 Baru reservoir

The bulk density and particle density from the tank silt sample of Baru reservoir were noted as 1.33 Mg m^{-3} and 2.55 Mg m^{-3} respectively.

3. 2.4 Gambhri reservoir

The bulk density and particle density from the tank silt sample of Gambhri reservoir were recorded as 1.16 Mg m^{-3} and 2.49 Mg m^{-3} respectively.

3. 2.5 Gawandho reservoir

The tank silt values of bulk density and particle density of Gawandho reservoir were found as 1.15 Mg m^{-3} and 2.52 Mg m^{-3} respectively.

3. 2.6 Sadarabadi reservoir

The bulk density and particle density from the tank silt sample of Sadarabadi reservoir were observed as 1.25 Mg m^{-3} and 2.56 Mg m^{-3} respectively.

3. 2.7 Khari reservoir

The values of bulk density and particle density in Khari reservoirs of tank silt sample were reported as 1.19 Mg m^{-3} and 2.54 Mg m^{-3} respectively.

3. 2.8 Bobdo reservoir

The bulk density and particle density from the tank silt sample of Bobdo reservoir were noted as 1.20 Mg m^{-3} and 2.57 Mg m^{-3} respectively.

3. 2.9 Titamba reservoir

The bulk density and particle density from the tank silt sample of Titamba reservoir were recorded as 1.42 Mg m^{-3} and 2.59 Mg m^{-3} respectively.

3. 2.10 Dhodra reservoir

The tank silt values of bulk density and particle density of Dhodra reservoir were found as 1.47 Mg m^{-3} and 2.53 Mg m^{-3} respectively.

3. 2.11 Lavada reservoir

The values of bulk density and particle density in Lavada reservoir of tank silt sample was reported as 1.47 Mg m^{-3} and 2.48 Mg m^{-3} respectively.

The bulk density and particle density from the tank silt samples of eleven natural reservoirs were ranged from 1.15 to 1.50 Mg m^{-3} for bulk density and particle density were ranged from 2.46 to 2.59 Mg m^{-3} with the mean value as 1.25 Mg m^{-3} and 2.53 Mg m^{-3} with ± 0.03 bulk density and ± 0.01 particle density respectively. This might be due to the more silt percentage and less clay size fraction in the various tank silt

The lowest bulk density into 1.15 Mg m^{-3} was noted from the tank silt sample of Gawandho natural reservoir. However, the highest bulk density was seen 1.50 Mg m^{-3} in the tank silt sample collected from Lavada natural reservoir. However, in general variation in bulk density might be due to the content of silt particle.

The higher particle density 2.59 Mg m^{-3} was viewed in the tank silt of Titamba natural reservoir. The value of lowest particle density 2.46 Mg m^{-3} recorded in the sample from Jutpani reservoirs. The similar value was perceived in bulk density and particle density of tank silt in poochikadu village of Tamilnadu was reported by Jeyamangalam *et al.* (2012).

3. 3. Hydraulic conductivity of tank silt of natural reservoirs

The data regarding hydraulic conductivity of tank silt sample collected from eleven natural reservoirs of Dharni area is depicted in Table 2.

The variation was noted in the hydraulic conductivity of the tank silt of all the eleven tank silt samples

3. 3.1 Mandwa reservoir

The saturated hydraulic conductivity of tank silt sample from Mandwa reservoir was noted 0.90 cm hr^{-1}.

3. 3.2 Jutpani reservoir

The hydraulic conductivity for Jutpani reservoir of tank silt was recorded as 0.86 cm hr^{-1}.

3. 3.3 Baru reservoir

The hydraulic conductivity for Baru reservoir of tank silt was found as 0.91 cm hr^{-1}.

3. 3.4 Gambhri reservoir

The values of hydraulic conductivity of tank silt in Gambhri reservoir was observed as 0.97 cm hr^{-1}.

3. 3.5 Gawandho reservoir

The saturated hydraulic conductivity of tank silt sample from Gawandho reservoir was noted 1.03 cm hr^{-1}.

Table 2: Bulk density, Particle density and Hydraulic conductivity of tank silt of natural reservoirs

Sr. No.	Name of Location	B.D. (Mg m^{-3})	P.D. (Mg m^{-3})	H.C. (cm hr^{-1})
1	Mandwa	1.23	2.51	0.90
2	Jutpani	1.21	2.46	0.86
3	Baru	1.33	2.55	0.91
4	Gambhri	1.16	2.49	0.97
5	Gawandho	1.15	2.52	1.03
6	Sadarabadi	1.25	2.56	1.06
7	Khari	1.19	2.54	0.96
8	Bobdo	1.20	2.57	0.87
9	Titamba	1.42	2.59	1.05
10	Dhodra	1.47	2.53	0.94
11	Lavada	1.50	2.48	0.98
	Maximum	1.50	2.59	1.06
	Minimum	1.15	2.46	0.86
	Average	1.25	2.53	0.96
	S. E. (m) ±	0.03	0.01	0.02
	C. V. (%)	9.08	1.58	7.24

3. 3. 6 Sadarbadi reservoir

The hydraulic conductivity for Sadarabadi reservoir of tank silt was recorded as 1.06 cm hr^{-1}.

3. 3.7 Khari reservoir

The values of hydraulic conductivity of tank silt in Khari reservoir was observed as 0.96 cm hr^{-1}.

3. 3.8 Bobdo reservoir

The saturated hydraulic conductivity of tank silt sample from Bobdo reservoir was noted 0.87 cm hr^{-1}.

3. 3.9 Titamba reservoir

The hydraulic conductivity for Titamba reservoir of tank silt was recorded as 1.05 cm hr^{-1}.

3. 3.10 Dhodra reservoir

The values of hydraulic conductivity of tank silt in Dhodra reservoir was observed as 0.94 cm hr^{-1}.

3. 3.11 Lavada reservoir

The hydraulic conductivity for Lavada reservoir of tank silt was found as 0.98 cm hr^{-1}.

The hydraulic conductivity from the tank silt samles of natural reservoirs in melghat ranged from 0.86 to 1.06 cm hr^{-1} with mean value that is 0.96 cm hr^{-1} with ± 0.02.

The lowest hydraulic conductivity reported in the sample of Jutpani reservoir 0.86 cm hr^{-1} however highest hydraulic conductivity was found 1.06 cm hr^{-1} Sadarabadi reservoir of tank silt. The increase in clay and silt content of soil due to tank silt application has been reported by Krishanappa *et al.* (1998) in Kolar district of Karnataka.

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