Academia Journal of Environmental Science 6(6): 136-139, June 2018
DOI: 10.15413/ajes.2018.0120
ISSN: ISSN 2315-778X

Academia Publishing

Research Paper

A case study on effect of flood spreading on soil quality in Addapuseela village, Vizianagaram District, Andhra Pradesh, India

Accepted 29th June, 2018

B.V.R Murthy, N. Rajesh, P. Muralikrishna, R. Karunasree and D. Saikrishna

Department of Civil Engineering, Baba Institute of Technology and Sciences Affiliated to JNT University, Kakinada, Visakhapatnam, Andhrapradesh, India.

*Corresponding author. E-mail: vrmurthyb@gmail.com

ABSTRACT

Soil quality is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. It is important managing soils so they are sustainable for future generations. This study focuses on the post effect of flooding on soil quality parameters in farmlands of Addapuseela village which is nearer to Thotapalli reservoir in Vizianagaram District, Andhrapradesh. The objective of this work is to evaluate the soil parameters which are useful for crop growth in the flood affected and unaffected lands. The standards were taken from Zonal Research and Extension Advisory Council (ZREAC). The soil samples were collected from both flood affected and unaffected farmlands for laboratory tests. The indicators like pH, electrical conductivity, organic carbon, nitrogen, phosphorous, potassium, sulphur, zinc, iron, manganese and copper plays major roles for assessing the soil quality. It was observed that the pH, electrical conductivity, phosphorous, iron, manganese and copper were in considerable range in all selected farmlands. After flood, the organic carbon and zinc decreased and at the same time sulphur was increased. The soil was not much affected in the farmlands after comparing the results of before and after flood.

Key words: Soil quality, flood, pH, electrical conductivity.

Abbreviations: ACL: Above critical limit, **AL:** Aluminum, **BCL:** Below critical level, **Cu:** Copper, **D:** Decreased, **EC:** Electrical conductivity, **Fe:** Iron, **I:** Increased, **K:** Potassium, **L_1:** The land which is nearer to the reservoir, **L_2:** The land which is 0.25 km away from L_1, **L_3:** The land which is not affected by flood, **L_1S:** Average test value of soil samples collected from L_1, **L_2S:** Average test value of soil samples collected from L_2, **L_3S:** Average test value of soil samples collected from L_3, L_1S_1: Soil sample1 taken from L_1. **L_1S_2:** Soil sample 2 taken from L_1, L_2S_1: Soil sample 1 taken from L_2, **L_2S_2:** Soil sample 2 taken from L_2, **L_2S_3:** Soil sample 3 taken from L_2, **L_3S_1:** Soil sample 1 taken from L_3, **L_3S_2:** Soil sample 2 taken from L_3, **L_3S_3:** Soil sample 3 taken from L_3, **Mg:** Magnesium, **Mn:** Manganese, **N:** Nitrogen, **OC:** Organic carbon, **P:** Phosphorus, **ppm:** Parts per million, **S:** Sulphur and **Zn:** Zinc.

INTRODUCTION

The earth is bounded with natural resources like air, water and soil. Soil is one of the important natural resource related to its double role as a reserve of nutritional elements and water and support for vegetation, leading to the creation of forests and protected areas. The function of soil is based on classification and its quality.

Soil quality is the capability of a soil to perform functions that are essential to people and the environment. Generally, the soil quality is affected by floods, contamination and liquefaction. The quality of soil is adversely affected by floods when compared to contamination and liquefaction. Flooded soils are quickly depleted of oxygen, and most crops require oxygen for their growth and flooding frequently results in higher levels of plant diseases that

Table 1: Soil Report of farmlands (after flood effect).

Soil sample	After flood												
	Chemical indicators												
	pH	EC	OC	N	P	K	S	Zn	Fe	Mn	Cu	B	Moisture (%)
L_1S_1	6.84	0.35	7.5	58	17	173	47	1.98	4.13	7.65	4.13	-	28.52
L_1S_2	7.23	0.92	7.5	95	17	130	34	2.06	26.34	0.57	4.52	-	16.3
L_1S_3	6.71	0.9	81	26	139	-	-	-	-	-	-	-	21.2
L_2S_1	7.07	0.47	7.5	85	35	119	78	1.56	17.47	7.46	3.72	-	20.2
L_2S_2	7.01	0.55	7.5	83	91	139	17	1.98	29.65	6.1	5.16	-	29.9
L_2S_3	6.73	0.57	0.5	87	30	133	34	1.93	27.54	2.9	3.84	-	5.82
L_3S_1	6.52	0.05	7.5	76	26	105	39	-	-	-	-	-	15.5
L_3S_2	6.55	0.72	7.5	55	26	150	28	1.78	31.8	10.07	3.72	-	19.9
L_3S_3	6.5	0.6	7.5	66	47	79	48	-	-	-	-	-	6.3
L_3S_4	6.85	0.98	7.5	77	22	298	34	2.45	31.8	8.01	6.25	-	8.1

Table 2: Soil report of farmlands (before flood effect).

Soil sample	Before flood												
	Chemical indicators												
	pH	EC	OC	N	P	K	S	Zn	Fe	Mn	Cu	B	Moisture (%)
L_1S_1	7.02	0.13	0.28	71	16.7	214	20	0.468	13.38	14.33	1.50	-	Not available
L_1S_2	7.23	0.16	0.34	102	13.91	108	81	0.585	12.95	12.88	0.924	-	
L_1S_3	6.78	0.1	0.45	112	13.91	110	135	0.486	16.91	14.93	0.796	-	
L_2S_1	6.73	0.17	0.48	106	13.91	426	41	0.368	14.66	12.58	1.024	-	
L_2S_2	6.8	0.11	0.57	96	11.13	89	41	0.504	15.41	13.26	0.56	-	
L_2S_3	7.15	0.13	0.31	102	19.48	125	135	0.532	11.52	13.73	0.898	-	
L_3S_1	7.61	0.21	0.35	105	14.81	116	137	0.671	16.31	14.71	0.741	-	
L_3S_2	7.54	0.11	6.31	86	13.91	128	149	0.596	16.37	15.81	7.41	-	
L_3S_3	7.34	0.29	0.13	56	13.9	98	108	0.492	9.74	15.34	0.434	-	
L_3S_4	6.67	0.15	0.63	106	8.35	175	40	-	-	-	-	-	

reduce stands and yields.

Objective

The objective of this study is to evaluate the soil quality parameters in the farmlands after flood effect.

Study area

The study area, Addapuseela village is located in Parvathipuram mandal of Vizianagaram district in Andhra Pradesh, India. Parvathipuram is located at 18°46'N and 83°25'E. It has an average elevation of 120 m (393.7 feet). Addapuseela is situated 7 km away from sub-district headquarter Parvatipuram and 89 km away from district headquarter Vizianagaram. The Addapuseela village population has 3411 as per population census 2011. The total geographical area of Addapuseela village is 715 ha having latitude 18°76´37.49¨ N and longitude 83°45´43.51¨ E. In the present case study, the soil quality was evaluated in the farmlands of Addapuseela village nearer to Thotapalli reservoir which was affected by the flood in January, 2016.

METHODOLOGY

The preliminary data was collected from the Agricultural office which is located in Parvathipuram mandal. After that the soil samples were collected from three different farmlands which were nearer to Thotapalli reservoir, 0.25 km away from the reservoir and the land which was not affected by flood. Reports were obtained after conducting laboratory tests on the collected samples.

RESULTS AND DISCUSSION

Tables 1 and 2 show the laboratory test results. Tables 3 and 4 show that soil pH is a major factor influencing the availability of elements in the soil for plant uptake. The pH

Table 3: Average test results of chemical indicators before and after flood effect.

Indicators	Collecting samples	Before	After	Before	After	Remarks
		Soil reports (average values)		As per ZREAC standards		
pH	L_1S	6.92	7.01	Neutral	Neutral	a) Average pH values were increased in L_1, L_3 and decreased in L_2. B) As per standards of pH values L1, L2 and L3 were in neutral before and after flood.
	L_2S	6.93	6.81	Neutral	Neutral	
	L_3S	6.60	7.29	Neutral	Neutral	
EC	L_3S	0.73	0.13	Normal	Normal	Drastic change occurred in E.C values of L_1, L_2 and L_3 and the values were decreased when compared to before flood reports but as per standards the E.C values of L_1, L_2 and L_3 are normal.
	L_1S	0.53	0.14	Normal	Normal	
	L_3S	0.58	0.18	Normal	Normal	
OC	L_1S	5.16	0.35	High	Low	After flood effect OC values of L_1, L_2 and L_3 were decreased and these value became less than 0.5%. As per standards these values in low range.
	L_2S	5.16	0.45	High	Low	
	L_3S	7.5	0.35	High	Low	
N	L_1S	78	95	Low	Low	After flood, N values of L_1, L_2 and L_3 were increased but both the values of before and after flood in low range as per the standards.
	L_2S	85	101.3	Low	Low	
	L_3S	68.5	88.25	Low	Low	
P	L_1S	20	14.84	Medium	Medium	After flood, P values were same in L_1 and L_2 and decreased in L_3 but these values in medium range when compared to before flooding.
	L_2S	52	14.84	High	Medium	
	L_3S	30.25	11.99	High	Medium	
K	L_1S	147.3	144	High	High	a) The drastic change happened in the results of L_2. b) In L_2 and L_3, K values varies from medium to high and high to medium before and after flood effect respectively.
	L_2S	130	213.3	Medium	High	
	L_3S	157.25	129.25	High	Medium	
S	L_1S	40	78.67	High	High	a) After flood effect S content was increased more in L_3. b) The L_1, L_2 and L_3 values were in high range before and after flood as per the standards.
	L_2S	42	73.33	High	High	
	L_3S	37.25	108.5	High	High	
Zn	L_1S	1.34	0.513	ACL	BCL	From L_1, L_2 and L_3 the Zn values were decreased after flood effect but as per standards the values are in BCL.
	L_2S	1.82	0.428	ACL	BCL	
	L_3S	1.057	0.44	ACL	BCL	
Fe	L_1S	18.23	14.41	ACL	ACL	After flood, the Fe values were decreased but as per standards these values are ACL in both the cases.
	L_2S	24.88	13.86	ACL	ACL	
	L_3S	15.9	10.6	ACL	ACL	
Mn	L_1S	2.57	14.04	ACL	ACL	The Mn content was increased in L_1, L_2 and L_3 but as per standards these are considered as ACL in both the cases.
	L_2S	5.49	13.19	ACL	ACL	
	L_3S	4.52	11.22	ACL	ACL	
Cu	L_1S	2.88	1.07	ACL	ACL	After flood, the Cu values were decreased but these are considered as ACL in both the cases.
	L_2S	4.24	0.826	ACL	ACL	
	L_3S	2.49	2.15	ACL	ACL	

values of soil in L_1 and L_2 which are affected by flood was found to be 7.01 and 6.81, but before flood the pH values were 6.92 and 6.93. In L_3 the pH value is 7.29 but before flood it is 6.6. The pH value is increased by 1.3 and 10.5% in

Table 4: Report on after comparing the results of before and after flood.

Land	Chemical indicators										
	pH	EC	OC	N	P	K	S	Zn	Fe	Mn	Cu
L_1	I	D	D	I	D	D	I	D	D	I	D
L_2	D	D	D	I	D	I	I	D	D	I	D
L_3	I	D	D	I	D	D	I	D	D	I	D

L_1 and L_3, respectively but decreased by 1.7% in L_2. From the standards the pH values are neutral range in L_1, L_2 and L_3 before and after flood effect.

The result also showed that electrical conductivity is a measure of ionic concentration in the soils and is therefore related to dissolve solutes such as ions and salts. It is a measure of salinity. The resultant flood on the affected soils drastically decreased their electrical conductivity of 82% in L_1, 73.5% in L_2 and 70% in L_3. If electrical conductivity has low range, it becomes hazardous to plant growth. If it is in high range, it can damage crops and soil structure, but the EC values are normal in L_1, L_2 and L_3 before and after flood effect (Tables 3 and 4).

Organic carbon in L_1, L_2 and L_3 were 0.35, 0.45 and 0.35 but before flooding the OC values were 5.16, 5.16 and 7.5 in the same lands respectively. The resulting flood on soils drastically decreased their organic carbon as 93.21 and 91% in L_1 and L_2 and 95% in L_3. The OC results are in low range and are essential in maintaining the soil fertility.

Nitrate percentage increased 21% in L_1, 19.2% in L_2 and 29% in L_3. The obtained results are in low range as per standard ranges. Nitrate is an important soil parameter that enhances soil quality, fertility and productivity.

The values of sulphur and phosphorous are in acceptable limit but the values of P decreased by 25% in L_1, 71% in L_2 and 60% in L_3. S is increased 97% in L_1, 74.5% in L_2 and 66% in L_3.

Potassium and manganese are major nutrients for soil productivity. If these nutrients are below standard levels it is not a healthy development and it shows a negative impact on soil quality. Potassium is a micro nutrient for proper microbial functioning and less availability of micronutrients like Zn, Fe Cu is not good for agricultural soils. After flood effect, Zn was found to be below the critical limit but before flood it is in above critical limit. Fe and Cu are above critical limit in both before and after flood effect. So these are in safe limits and useful for healthy crop.

Conclusion

From the comparison of results of before and after flood the quality of soil in the selected farmlands was not much affected

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Cite this article as:

Murthy BVR, Rajesh N, Muralikrishna P, Karunasree R, Saikrishna D (2018). A case study on effect of flood spreading on soil quality in Addapuseela village, Vizianagaram District, Andhra Pradesh, India.. Acad. J. Environ. Sci. 6(6): 136-139.

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