Quantification of suitability of soils for the cultivation of rice sugarcane using Heber Soil Quality Index (HSQI)

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Abstract

Soil is viewed as a significant source and upkeep of its fitness is a moral responsibility of each individual. Nonetheless, modern insurgency and populace blast are the principle explanations behind harming soil. Lopsided preparation and irrational advancing practices additionally make an installment impressively to drop down ripeness of the soil. Under these conditions, scientists have been compelled to look through new and better soil for better productivity. Nature of any soil framework is a blend of different soil cycles and offers a proportion of progress in soil condition as identified with highlights like environment designs, land use, cultivating frameworks and trimming successions. At present, the soil quality is characterized as the capacity of a soil to work. To comprehend the nature of water, there are so many waters quality records accessible. However, in contrast to this, there are only a couple of soil qualities records are in presence. Staffs and Students in Bishop Heber College, India have planned a Soil Quality Index called Heber Soil Quality Index (HSQI). In the current work, soil tests were taken in the rice and sugarcane fields from fifteen spots and twelve parameters of Mayiladuthurai District, a Cauvery delta locale of Tamilnadu. The soil examples were arranged as excellent, good or bad for sustaining sugarcane and rice on the premise values of HSQI. By and large HSQI values of all examples were viewed as in the scope of 71.47 – 79.55. This shows that the nature of soils pondered in this work is medium to acceptable and can be utilized for cultivating sugarcane and rice. Heber Soil quality index is a universal indicator and can be used in India and other countries and even in the world. HSQI is the evaluating the tool in the rice and sugarcane fields through the world. HSQI is utilized to find the accessibility of supplements levels in the soil, gauges the ascent in yields and productivity of treatment, gives the reason for computing the necessary manures of any trim and assess the situation with every supplement component and simultaneously discover the supplement the executives. This strategy for evaluation was ended up being exceptionally valuable and savvy.

Key words: Rice; Sugarcane; Heber Soil Quality Index; pH; Water holding limit

1.Introduction

Soil tests do not reach a conclusion as the outcomes are found in the testing research facility. In view of the tests results, agrarian specialists or soil researchers need to guide ranchers about the administration of their soils, example of vegetation, interaction of watering, expansion of right measure of composts, and so on [1-2]. This does not consider for understanding the situation with soils as to supplement levels [3-5]. At the point when soil gives required amount of plant supplements, two, or a great deal of harvests, then, at that point, adding further substitute supplements is not defendable [6-7]. This expects that there is an ideal quantitative connection of interchangeable bases inside the soil which can enhance supplement take-up and hence crop yields [8]. HSQI is considered only 12 parameters. Ripeness of soil is assessed by soil testing. When farmers add the required amount of fertilizers, unwarranted economic loss could be avoided [9]. Soil testing is helpful to support the soil wellbeing. Staffs and understudies of Bishop Heber College, India have planned a Soil Quality Index, which is referred to famously as Heber Soil Quality Index (HSQI). In the current examination, Heber Soil Quality Index (HSQI) has been taken advantage of to survey soil quality in our space which is good for the vegetation of sugarcane and rice. However, in excess of 25 parameters are accessible to determine the wellness of soil for developing sugarcane and rice, simply twelve parameters are considered to be all that anyone could need to investigate the soil quality as per the significant ideas presented by horticultural researchers, soil scientists and different specialists. The twelve parameters considered for the detailing HSQI are Available phosphorus (Kg/ha), pH, Available potassium (Kg/ha), water holding limit ($g.Kg^{-1}$), Available nitrogen (Kg/ha), natural matter ($g.Kg^{-1}$), texture, mass thickness (bulk density) (g/cm^3), electrical conductance (mmhos/cm), absolute hardness ($mg.dm^{-3}$), bacterial substance (SPC/g) and chloride content ($mg.dm^{-3}$) [10]. This HSQI is viewed as profoundly valuable, efficient and monetary one [11].

2.Experimental

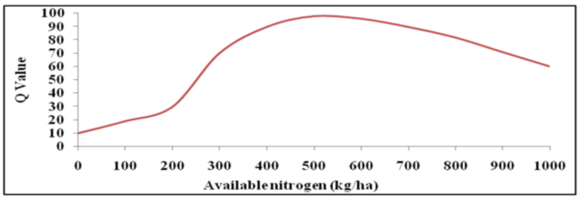
2.1.Study area

New Mayiladuthurai District is (Cauvery delta region) situated at 11° 10' and 79° 65' Longitude (N-E). Sugarcane and rice are the significant harvests being developed here. Texture soils were gathered from 15 different places in and around Mayiladuthurai District like Gangadharapuram (Sample 1), Kodimangalam (Sample 2), Madhirimangalam (Sample 3), Melaiyur (Sample 4), Nakkambadi (Sample 5), Palaiyur (Sample 6), Peruncheri (Sample 7), Thathangudi (Sample 8), Therizhandur (Sample 9), Thirumannancheri (Sample 10), Tiruvaduthurai (Sample 11), Tiruvalangadu (Sample 12), Valuvur (Sample 13), Vanadirajapuram (Sample 14) and Villiyanallur (Sample 15).

2.2.Sampling Method

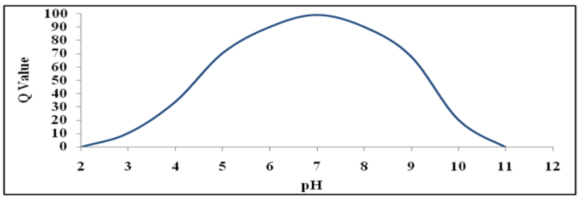
Soil tests were gathered from the previously mentioned region. Initially, the bulk or junk part of the soil was taken out and thrown off from each examining site. Utilizing a spade, Soils were gathered from the four corners and center spot (no less than 15 cm) from five spots of each examining region. Five sub examples gathered from each inspecting region was totally blended and from the combination, 1Kg of the composite sample was taken for lab investigation. These composite samples were totally cleaned to guarantee that they contain no peculiar materials like rocks, stones and roots. The unruffled soil of each examining site was taken in a soil free fabric pack and named with the necessary information. Previously, the samples were exposed to lab examinations for the above said twelve parameters (Table 1), the composite soil tests of every space were squashed utilizing wood mallet and isolated to achieve soil units of 2-mm measurement.

To outline the HSQI table, factual outcomes were accumulated from agricultural researchers and other prominent of this examination zone. They were encouraged to: (i) collect the picked twelve parameters in their request for merit, (ii) grant scoring on a 10 - point scale with '0' showing the least appraising and '10' the most elevated, (iii) designate weighting bend value (Q - Value) (Table 1) and (iv) sketch the chart for each factor according to their passable and resilience limits. Soil tests were exposed to lab investigation to measure the twelve parameters. Then ‘Q’ value for each parameter was determined using their respective ‘Q’ diagram (Figure 1). Eventually, overall or the total Heber Soil Quality Index (HSQI) was found out to characterize soil samples as excellent, good and poor with special reference to the nurturing of rice and sugar cane.



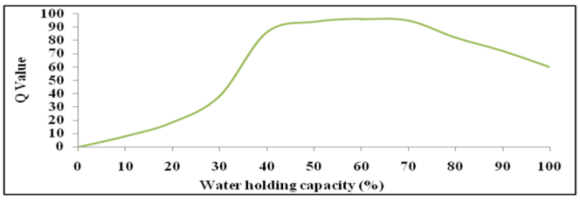
If accessible 'N' > 1000; Q = 60

Std 'Q' graph for accessible 'N'



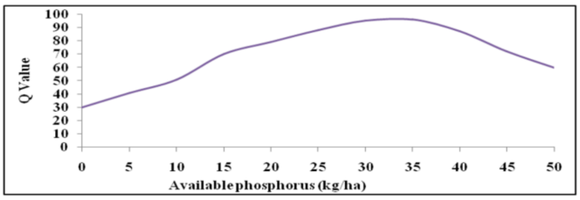
If pH > 11; Q = 0

Std 'Q' graph for pH



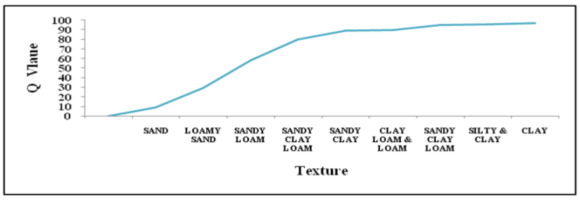
If WHC > 100; Q = 60

Std 'Q' graph for Water holding limit

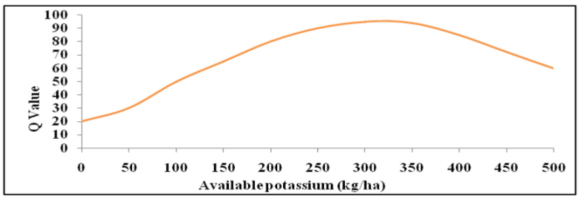


If Available 'P' > 50; Q = 60

Std 'Q' graph for accessible 'P'

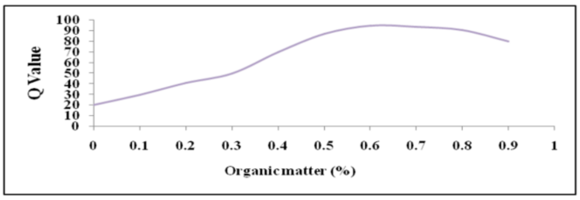


Std 'Q' graph for Texture



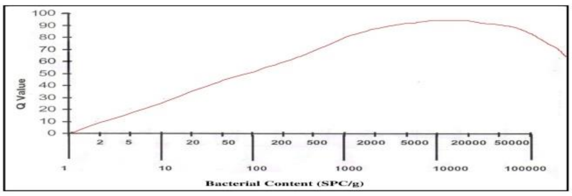
If Available 'K'> 500; Q = 60

Std 'Q' graph for accessible 'K'



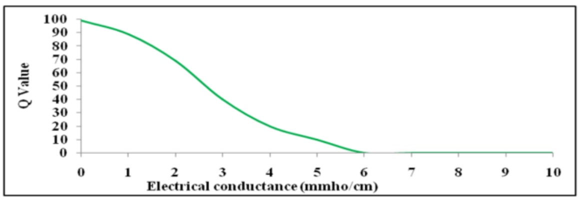
If OM > 1; Q = 70

Std 'Q' graph for natural organic matter



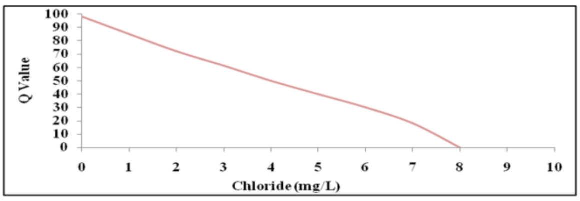
If BC > 10^5; Q = 60

8. Std 'Q' graph for BC



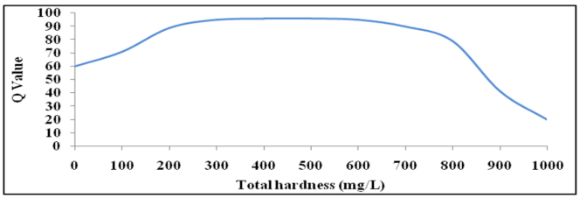
If EC > 6; Q = 0

Std 'Q' graph for EC



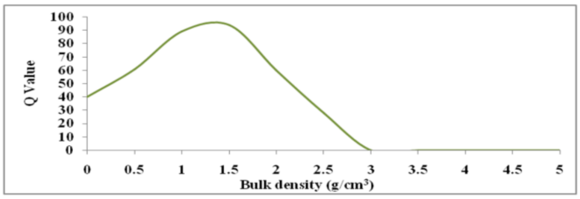
If Cl^- > 8; Q = 0

Std 'Q' graph for Cl^-



If TH > 1000; Q = 20

Std 'Q' graph for Complete hardness



If BD > 3; Q = 0

Std Q graph for Mass thickness

Figure 1. Std 'Q' Graph for each parameter

Table 1. Methods of Determination, Optimum Range and Weighting factor of Various Parameters

Parameter	Methods	Range	Weighting Factor
Accessible 'N' (Kg ha^{-1})	Alkaline permanganate method	>328	0.095
pH	Electrometric method	4.5 – 8.0	0.095
Water holding limit (%)	Weight loss method	40 – 55	0.093
Accessible 'P' (Kg ha^{-1})	Olsen's method	> 30	0.090
Texture	International pipette method	Clay and Clay loam	0.089
Accessible 'K' (Kg ha^{-1})	Flame photometer method	>305	0.087
Natural organic matter (%)	Walkley and Black method	0.34 - 0.95	0.084
BC (SPC g^{-1})	Standard plate count method	$10^8 – 10^9$	0.082
EC (mmho/cm)	Digital conductometric method	< 1	0.076
Cl^- (mg L^{-1})	Titrimetric method	< 4	0.075
Complete hardness (mg L^{-1})	Titrimetric method	< 1.5	0.070
Mass thickness (g cm^{-3})	Clod Method	1.23 – 1.5	0.069

Table 2. Soil of Gangadharapuram (Sample 1), Kodimangalam (Sample 2), Madhirimangalam (Sample 3), Melaiyur (Sample 4), Nakkambadi (Sample 5)

Sampling Site		Gangadharapuram			Kodimangalam			Madhirimangalam			Melaiyur			Nakkambadi		
Parameter	Weighting Factor	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total
Accessible ‘N’ (Kg ha^{-1})	0.095	209.5	32	3.04	235	56	5.32	196.5	30	2.85	179.5	29	2.76	212.5	35	3.33
pH	0.095	7.5	95	9.03	7.8	93	8.84	6.1	95	9.03	7.1	97	9.22	7.5	95	9.03
Water holding limit (%)	0.093	48.8	93	8.65	48.21	93	8.65	46.14	92	8.56	50.14	94	8.74	48.96	93	8.65
Accessible ‘P’ (Kg ha^{-1})	0.090	104	60	5.40	374.75	60	5.40	391.6	60	5.40	340.45	60	5.40	135.85	60	5.40
Texture	0.089	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46
Accessible ‘K’ (Kg ha^{-1})	0.087	192	80	6.96	171.55	75	6.53	254.3	90	7.83	295.35	95	8.27	219.1	80	6.96
Natural organic matter (%)	0.084	0.69	95	7.98	0.83	92	7.73	0.69	95	7.98	0.81	92	7.73	0.69	95	7.98
BC (SPC g^{-1})	0.082	$3.5x10^5$	60	4.92	$3.6x10^6$	60	4.92	$3.8x10^5$	60	4.92	$6x10^5$	60	4.92	$2.6x10^5$	60	4.92
EC (mmho/cm)	0.076	0.805	91	6.92	1.073	89	6.76	0.731	93	7.07	0.719	93	7.07	0.894	88	6.69
Cl^- (mg L^{-1})	0.075	3.1	60	4.50	4.2	50	3.75	3.6	45	3.38	2.8	62	4.65	1.7	75	5.63
Complete hardness (mg L^{-1})	0.070	258	93	6.51	470	96	6.72	353	94	6.58	857	60	4.20	702	90	6.30
Mass thickness	0.069	1.45	92	6.35	1.21	94	6.49	1.35	92	6.35	1.25	94	6.49	1.69	85	5.87
Total HSQI				78.70			79.55			78.39			77.88			79.19

Table 3. Soil Soil of Palaiyur (Sample 6), Peruncheri (Sample 7), Thathangudi (Sample 8), Therizhandur (Sample 9), Thirumannancheri (Sample 10)

Sampling Site		Palaiyur			Peruncheri			Thathangudi			Therizhandur			Thirumannancheri		
Parameter	Weighting Factor	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total	Test Result	HSQI ‘Q’ Value	HSQI Total
Accessible ‘N’ (Kg ha^{-1})	0.095	142.5	23	2.19	146.5	25	2.38	196	30	2.85	163	28	2.66	155	26	2.47
pH	0.095	8	90	8.55	7.4	95	9.03	7.5	95	9.03	7	98	9.31	7.8	93	8.84
Water holding limit (%)	0.093	46.83	92	8.56	51.42	95	8.84	45.76	91	8.46	44.92	91	8.46	48.12	93	8.65
Accessible ‘P’ (Kg ha^{-1})	0.090	606.1	60	5.40	371.8	60	5.40	73.15	60	5.40	503.8	60	5.40	368.5	60	5.40
Texture	0.089	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46
Accessible ‘K’ (Kg ha^{-1})	0.087	170.45	78	6.79	124.75	60	5.22	276.2	95	8.27	237.5	88	7.66	210.6	83	7.22
Natural organic matter (%)	0.084	0.6	95	7.98	0.74	93	7.81	0.72	93	7.81	0.72	93	7.81	0.55	90	7.56
BC (SPC g^{-1})	0.082	$5x10^5$	60	4.92	$3.2x10^6$	60	4.92	$2.8x10^5$	60	4.92	$5.9x10^6$	60	4.92	$9x10^4$	60	4.92
EC (mmho/cm)	0.076	0.665	95	7.22	0.806	92	6.99	0.659	95	7.22	0.629	95	7.22	0.865	91	6.92
Cl^- (mg L^{-1})	0.075	2.9	60	4.50	3.1	60	4.50	3.6	55	4.13	4.4	45	3.38	2.2	70	5.25
Complete hardness (mg L^{-1})	0.070	994	20	1.40	297	94	6.58	599	94	6.58	756	79	5.53	731	85	5.95
Mass thickness	0.069	1.78	80	5.52	1.75	80	5.52	1.65	85	5.87	1.74	80	5.52	1.79	80	5.52
Total HSQI				71.47			75.63			78.98			76.32			77.15

Table 4. Soil of Tiruvaduthurai (Sample 11), Tiruvalangadu (Sample 12), Valuvur (Sample 13), Vanadirajapuram (Sample 14), Villiyanallur (Sample 15)

Sampling Site		Tiruvaduthurai			Tiruvalangadu			Valuvur			Vanadirajapuram			Villiyanallur		
Parameter	Weighting Factor	Test Result	HSQI		Test Result	HSQI		Test Result	HSQI		Test Result	HSQI		Test Result	HSQI	
			‘Q’ Value	Total		‘Q’ Value	Total		‘Q’ Value	Total		‘Q’ Value	Total		‘Q’ Value	Total
Accessible ‘N’ (Kg ha^{-1})	0.095	229	40	3.80	163	28	2.66	278.5	67	6.37	229	50	4.75	245.5	60	5.70
pH	0.095	7.9	91	8.65	7	98	9.31	8	90	8.55	7.9	91	8.65	7.8	93	8.84
Water holding limit (%)	0.093	51.12	95	8.84	48.96	93	8.65	52.26	96	8.93	47.14	92	8.56	48.24	93	8.65
Accessible ‘P’ (Kg ha^{-1})	0.090	73.15	60	5.40	158.95	60	5.40	78.1	60	5.40	157.3	60	5.40	177.1	60	5.40
Texture	0.089	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46	Silty Clay Loam	95	8.46
Accessible ‘K’ (Kg ha^{-1})	0.087	212.6	84	7.31	231.65	87	7.57	233.3	87	7.57	219	85	7.40	269.6	93	8.09
Natural organic matter (%)	0.084	0.84	85	7.14	0.94	76	6.38	1.03	70	5.88	0.99	70	5.88	0.98	70	5.88
BC (SPC g^{-1})	0.082	$2.7x10^{6}$	60	4.92	$3x10^{6}$	60	4.92	$2.1x10^{6}$	60	4.92	$5x10^{5}$	60	4.92	$4x10^{6}$	60	4.92
EC (mmho/cm)	0.076	0.687	93	7.07	0.752	91	6.92	0.96	88	6.69	0.8	90	6.84	0.68	95	7.22
Cl^{-} (mg L^{-1})	0.075	3.5	56	4.20	2.7	65	4.88	2.9	60	4.50	3.8	53	3.98	4.8	43	3.23
Complete hardness (mg L^{-1})	0.070	126	75	5.25	138	73	5.11	120	71	4.97	138	73	5.11	320	95	6.65
Mass thickness	0.069	1.72	80	5.52	1.71	80	5.52	1.83	80	5.52	1.75	80	5.52	1.87	60	4.14
Total HSQI				76.54			75.77			77.75			75.45			77.17

3. Results and Discussion

The scientific information of the soils analyzed is displayed in tables 2 – 5. The net HSQI values of all samples ranged from 71.47 – 79.55 showing that the nature of these soils is medium to useful (good) for the development of rice and sugarcane.

Among the different soil tests dissected, Kodimangalam (Sample 2) (Table 2) was found to have high HSQI value, 79.55. This shows that this sample is useful for cultivation of rice and sugarcane. Among the twelve parameters tried for this example, the test aftereffects of the parameters like pH (7.8), water holding limit (48.21 $g.Kg^{-1}$), texture (silty earth topsoil), Available potassium (171.55 kg/ha), organic matter (0.83 $g.Kg^{-1}$), complete hardness (470 $mg.dm^{-3}$), electrical conductance (1.073 mmhos/cm) and mass thickness (1.21 g/cm^3) were viewed as astounding as per the ideal reach needed for the best procurement of rice and sugarcane. Texture detailed in the soil example is silty mud topsoil (Silty Clay loam), which causes that high water holding limit of the soil since it contains little pores and water move gradually in these pores. So that, water holding limit of these soils was viewed as high. The aftereffects of the soil examples uncover that it has high natural matter just as high-water holding limit. High electrical conductivity of soil test shows that, it contains high salt concentration. The HSQI values of pH, water holding limit, texture, Available potassium, organic matter, complete hardness and mass thickness were viewed as incredibly great with 8.84, 8.65, 8.46, 6.53, 6.72 7.73 and 6.49 respectively. The parameters like Available nitrogen (235 kg/ha) and Available phosphorus (374.75 kg/ha) contributed reasonably to the nature of this soil example with the HSQI values of 5.32 and 5.40 individually. Bacterial substance and chloride content do not fundamentally add much to the nature of this example.

The Palaiyur (Sample 6) (Table 3) enlisted low HSQI value, 71.47. This recommends that this example is of mid-range quality for the cultivation of rice and sugarcane. The pH (8.0), water holding limit (46.83 $g.Kg^{-1}$), texture (silty mud soil), organic matter (0.60 $g.Kg^{-1}$), electrical conductance (0.665 mmhos/cm) and mass thickness (1.78 g/cm^3) were viewed as great according to the ideal reach needed for the best growing of rice and sugarcane. The HSQI values of pH, water holding limit, texture, organic matter and electrical conductance were found to have 8.55, 8.56, 8.46, 7.98 and 7.22 respectively. The parameters like Available phosphorus (606.1 kg/ha), Available potassium (170.45 kg/ha) and bacterial substance ($5 X10^5$) values contributed reasonably to the nature of this example with HSQI values of 5.40, 6.79 and 4.92 respectively. The test aftereffects of Available nitrogen (142 kg/ha) and chloride content (2.9 $mg.dm^{-3}$) were viewed as very low and they render low quality to the soil. This uncovers that the soil example experiences the inadequacy of Available nitrogen, Available phosphorus and Available potassium.

3.1.Examination of Available nitrogen

Nitrogen is one of the essential supplements and makes up 1-4% by weight of plants. It structures chlorophyll, amino acids, proteins, alkaloids and cellular material [12]. Available nitrogen is a basic component in beneficial sugarcane and rice creation [13]. The ideal amount of Available nitrogen suggested by the soil specialists and researchers for the beneficial procurement of rice and sugarcane in Indian soil culture is >328 kg/ha (Table 1). Available nitrogen of the examples researched in this review was found to be in the range of 142.5 – 278.5 kg/ha. This reach shows that all the soil examples taken in this examination seriously experience the ill effects of nitrogen inadequacy. The justification for low nitrogen content in all the soil examples may presumably because of (i) filtering (ii) denitrification (iii) coarse – finished nature, (iv) helpless water holding limit and (v) precipitation or water system which moves water through the root zone (vi) volatilization from the outer layer of the soil (vii) soil disintegration and run-off [14]. To battle the issue of nitrogen deficiency, the ranchers of these spaces ought to be encouraged to (i) try not to apply compost close to texture water or on steeply inclining land, (ii) keep application rates adequately low to forestall run – off, (iii) blend fertilizer into the soil straightaway in the wake of applying it [15]. Nitrogen will be reused for future harvest utilizes as yield deposits and composts kept in the soil. The accessibility of nitrogen to the plants is associated on other soil quality parameters like organic matter, soil texture and water holding limit, and so on [16]. All the soil examples in this not really set in stone to have organic matter in the scope of 0.55 – 1.03 %. These higher qualities propose that the pace of disintegration of nitrogen is high. Soil texture of soil tests announced as silty soil topsoil, which shows that the pace of nitrogen deficit through a draining interaction is low. The water holding limit of the multitude of tests picked in this review went somewhere in the range of 44.92 and 52.26 $g.Kg^{-1}$. Taking everything into account, the pace of nitrogen scarcity is low. The accessibility of supplements is straightforwardly influenced by soil pH. In case, the soil's pH is excessively high or too low, a few supplements become insoluble, restricting the accessibility of these supplements to the plant root framework. A soil pH scope of around 6 - 7 builds the most promptly Available plant supplements. Microorganisms that decay soil natural matter are blocked in firmly acidic soils. pH of all the soil examples went from 6.1 – 8.0 (marginally acidic to somewhat basic), which upholds the low nitrogen scarcity. The electrical conductance of the examples ranged from 0.629 – 1.073 mmhos/cm, higher electrical conductivity values shows that the pace of nitrogen deficiency is high.

3.2.Investigation of pH

While plants might encounter the results of a pH irregularity, the real pH unevenness stays in the soils, not in the plant. The pH of the soil is appraised on a size of 3.5 - 9.0, and most plants do best in soil that test inside the unbiased scope of 6.0 - 7.0 [17]. Cultivation might in any case happen if the soil tests higher or lower than this, however plants might display the impacts of an ill-advised equilibrium through helpless turn of events and fruiting [18]. pH of all the soil examples is on the scale of 6.1 – 8.0, which uncovers that the nature of these soils is acidic to basic. The scope of pH suggested for the better yield of rice and sugarcane is 4.5 - 8 (Table 1). Soil tested in Valuvur (Sample 13) and Palaiyur (Sample 6) showed a high pH (8.0), which demonstrates that this soil is basic (Table 4 and 3) and soil of Madhirimangalam (Sample 3) recorded low pH (6.1), which gathers that this soil is acidic (Table 2). Different examples showed middle pH values. Soil pH is subject to factors like soil texture. To the extent the texture of the soil examples broke down in this review is concerned, practically all soil examples are found to be silty clay loam type. Soils of this type have a greater cation exchange capacity; higher organic matter and a greater water holding capacity and therefore could buffer against acidification.

3.3.Examination of Water holding limit

Soil water holding limit is the amount of water that a given soil can hold for crop use. Earth soils having the best water-holding limit and sands the least [19]. At the point when expansion of natural matter of soil expands, water holding limit additionally increments. The higher the % of natural material in soils the higher the soil's water-holding limit [20]. All the soil examples in this not set in stone to have natural matter in the scope of 0.55 – 1.03 $g.Kg^{-1}$, which shows that water holding limit of soil tests are acceptable. The water holding limit of the multitude of tests picked in this review went somewhere in the range of 44.98 and 52.26 $g.Kg^{-1}$. According to the proposals of the farming researchers, soils with water holding limit in the scope of 40 – 55 $g.Kg^{-1}$ (Table 1) is useful for the estate of rice and sugarcane from which is better yield is expected. Since, practically this load of tests examined in this review have great water holding limit, this load of tests is viewed as excellent taking everything into account. Valuvur (Sample 13), Kodimangalam (Sample 2) and Therizhandur (Sample 9) recorded as high (52.26 $g.Kg^{-1}$) (Table 4), moderate (48.21 $g.Kg^{-1}$) (Table 2) and low (44.92

g.Kg^{-1}) (Table 3) water holding limit values respectively. Therefore, as far as soil texture is concerned Silty clay loam, which gets good in water holding capacity. Therefore, as far as this parameter is concerned, all samples are rated good.

3.4.Examination of Available phosphorus

Phosphorus (P) is fundamental for the combination of adenosine triphosphate and various other phosphorylated compounds [21]. This supplement additionally upgrades photosynthetic action and builds root advancement, prompting expanded supplement take-up, more noteworthy tillering, and better return in rice and sugarcane [22]. 'P' insufficiency instigates biochemical change to such an extent that leaf phosphatase corrosive action is contrarily connected with amassed 'P' [23]. This relationship could be utilized for early analysis of phosphorus sustenance in rice and sugarcane. The suggested an incentive for the viable growing of rice and sugarcane is >30 kg/ha (Table 1). Available phosphorus of the samples determined in this study ranged from 73.15 – 606.1 kg/ha. Soil pH plays a significant part in phosphorus accessibility in soils. Accessibility of phosphorus is most extreme at pH range 6 – 7. pH of all the tried soil tests went from 6.1 – 8.0, which shows that the measure of Available phosphorus present in soil is good (acceptable). For the most part, higher soil natural matter levels are identified with more prominent phosphorus accessibility. All the soil examples in this not really set in stone to have organic matter in the scope of 0.55 – 1.03 g.Kg^{-1}. As far as organic matter is concerned, Available phosphorus is good.

3.5.Examination of Available potassium

Potassium plays many pivotal roles in plants [24]. We regularly center around its job in keeping up with osmotic potential and affecting water relations with the soil, yet it likewise assumes a significant role in catalyst initiation of responses that sway photosynthesis and protein union just as works with movement of proteins and sugars from sources to sinks (leaf tissue to harvestable material) [25]. The ideal worth of Available potassium for the better cultivation of rice and sugarcane is >280 kg/ha (Table 1). The examples picked in this review were viewed as in the scope of 124.75 – 295.35 kg/ha. The Melaiyur (Sample 4), Nakkambadi (Sample 5) and Peruncheri (Sample 7) recorded high (295.35 kg/ha) (Table 2), moderate (219.1 kg/ha) (Table 2) and low (124.75 kg/ha) (Table 3) values of Available potassium respectively. Available potassium in soil can be expanded by the addition of gypsum with potassium additionally assists with dropping potassium down in extremely fine finished soils.

3.6.Examination of organic matter (OM)

Soil organic matter makes up only 2–10 % of most soil's mass and plays a significant role in the physical, substance and organic capacity of farming soils [26]. Soil natural matter adds to supplement maintenance and turnover, soil structure, dampness maintenance and accessibility, debasement of contaminations, and carbon sequestration [27]. The ideal scope of organic matter is 0.6 - 0.8 $g.Kg^{-1}$ (Table 1). All the soil examples in this not set in stone to have organic matter in the scope of 0.55 – 1.03 $g.Kg^{-1}$. The Valuvur (Sample 13), Peruncheri (Sample 7) and Thirumannancheri (Sample 10) enlisted high (1.03 $g.Kg^{-1}$) (Table 4), medium (0.74 $g.Kg^{-1}$) (Table 3) and low (0.55 $g.Kg^{-1}$) (Table 2) values of organic matter respectively. Soils have high in earth content and residue has higher in OM content than sandy soils. This is perceived to limited air circulation in fine-finished soils, lessening the pace of natural substance oxidation, and the limiting of humus to mud particles, further shielding it from deterioration.

3.7.Examination of bacterial content

Bacterial content determined by standard plate count method. It can be Soil microbes have been utilized in crop creation for quite a long time. The principal elements of these microscopic organisms are (i) to supply supplements to crops (ii) to animate plant development (iii) to control or hinder the action of plant microorganisms; (iv) to further develop soil design and (v) bioaccumulation or microbial filtering of inorganics [28]. In the time of economical harvest creation, the plant–organism cooperation in the rhizosphere assume a significant role in change, preparation, solubilization, and so forth of supplements from a restricted supplement pool, and therefore take-up of fundamental supplements by plants to understand their full hereditary potential [29-32]. In the samples taken for the examination, the bacterial substance went from 9×10^4 – 5.9×10^6 SPC/g. The ideal scope of bacterial substance suggested for any harvest is 10^7 – 10^8 numbers for every gram (Table 1). The Therizhandur (Sample 9), Valuvur (Sample 13) and Thirumannancheri (Sample 10) have high (5.9×10^6) (Table 3), moderate (2.1×10^6) (Table 4) and low (9×10^4) (Table 3) bacterial substance values respectively.

3.8.Examination of electrical conductance

In soil, electrical conductivity (EC) is a proportion of the capacity of the soil to direct an electrical flow. In particular to fruitfulness, EC means that the accessibility of supplements in the soil [33]. The higher the EC, the more contrarily charged locales (earth and natural particles) there should be in the soil, and thusly the more cations (which have a positive charge) that are being held in the soil. In order for EC to be used as a soil health indicator, and therefore inform farm management, it is important to understand the interaction between EC and other soil properties [34]. Soil EC, similar as pH, is a decent general pointer of soil ripeness. It very well may be utilized to show the limit of the soil to store supplements, as a pointer of soil texture and as a sign of an overabundance of soil supplements (for example exorbitant sodium levels prompting saltiness) [35]. Good soil fertility management practices will contribute to maintaining optimal EC levels. Soil EC is likewise identified with explicit soil properties that influence crop yield, like soil profundity, pH, salt focuses and water-holding limit. The electrical conductance of the examples went from 0.629 – 1.03 mmhos/cm. The ideal scope of electrical conductance suggested by soil scientific experts for rice and sugarcane is < 1 mmhos/cm (Table 1). The Kodimangalam (Sample 2) enrolled high electrical conductance value (1.073 mmhos/cm) (Table 2). Tiruvalangadu (Sample 12) showed medium value of electrical conductance (0.752 mmhos/cm) (Table 4) and Therizhandur (Sample 9) had low level of electrical conductance (0.629 mmhos/cm) (Table 3).

3.9.Investigation of chloride content

Chloride is a fundamental micronutrient and all harvests require chloride in little amounts. Notwithstanding, it is frequently connected with saltiness harm and harmfulness [36]. Plants take up chloride as Cl^-particle from soil arrangement. It assumes some significant roles in plants, remembering for photosynthesis, osmotic change and concealment of plant infection. Nonetheless, high convergences of chloride can cause poisonousness issues in crops and decrease the yield. The harmfulness results from aggregation of chloride in the leaves. Normal manifestations of chloride harmfulness in plants incorporate sleaze of leaf edges and tips, which ordinarily happen in more established leaves first. Exorbitant leaf consume may ultimately bring about leaf drop [37]. Chloride can likewise cause leaf harm when kept on leaves in overhead water system. In the event that chloride has under 70 $mg.dm^{-3}$ it is for the most part alright for all plants. In the event that chloride content somewhere in the range of 70 $mg.dm^{-3}$ and 140 $mg.dm^{-3}$ it harmed touchy plants. In the event that, chloride content somewhere in the range of 141 $mg.dm^{-3}$ and 350 $mg.dm^{-3}$ it harmed modestly lenient plants. If chloride content over 350 $mg.dm^{-3}$, it can create extreme issues. Chloride content of the still up in the air to be in the scope of 1.7 – 4.8 $mg.dm^{-3}$. The standard value of chloride content is <4 $mg.dm^{-3}$ (Table 1). The Villiyanallur (Sample 15) had highvalues of chloride

(4.8 mg.dm^{-3}) (Table 4). Tiruvaduthurai (Sample 11) showed medium (3.5 mg.dm^{-3}) (Table 4) and Nakkambadi (Sample 5) enrolled worth of low chloride (1.7 mg.dm-3) (Table 2). Proper irrigation and fertilization management practices should be taken into consideration where the irrigation water contains high concentration of chlorides.

3.10.Examination of Total hardness (Complete hardness)

The complete hardness of tried examples ranged from 120 – 994 mg.dm^{-3}. The suggested ideal scope of complete hardness is (< 1.5 mg.dm^{-3}). The Palaiyur (Sample 6) had high complete hardness (994 mg.dm^{-3}) (Table 3). Madhirimangalam (Sample 3) showed medium (353 mg.dm^{-3}) (Table 2) and Valuvur (Sample 13) contained low value of complete hardness (120 mg.dm^{-3}) (Table 4). Practically every one of the samples was found to have outrageous hardness which would not give great yield for the procurement of rice and sugarcane [38].

3.11.Examination of Bulk Density (Mass thickness)

Mass thickness is a pointer of soil compaction. It is determined as the dry load of soil divided by its volume. This volume incorporates the volume of soil particles and the volume of pores among soil particles. Mass thickness mirrors the soil's capacity to work for underlying scaffolding, water and solute development, and soil air circulation. It is utilized to communicate soil physical, synthetic and natural estimations on a volumetric reason for soil quality appraisal and examinations between the board frameworks. High mass thickness is a pointer of low soil porosity and soil compaction. It might make limitations root development, and helpless development of air and water through the soil. Compaction can bring about shallow plant establishing and helpless plant development, affecting harvest yield and diminishing vegetative cover accessible to shield soil from disintegration. By lessening water penetration into the soil, compaction can prompt expanded overflow and disintegration from slanting area or waterlogged soils in compliment regions [39]. As a general rule, some soil compaction to limit water development through the soil profile is helpful under bone-dry conditions, however under damp conditions compaction diminishes yields [40]. The mass thickness of the examples was found to have the reach from 1.21 – 1.87 mg/cm^3. The ideal scope of mass thickness values for the productive grow of sugarcane and rice is 1.23 – 1.50 mg/cm^3 (Table 1). The Villiyanallur (Sample 15) showed high mass thickness value (1.87 mg/cm^3) (Table 4). Tiruvaduthurai (Sample 11) enlisted medium (1.72 mg/cm^3) (Table 4) and Kodimangalam (Sample 2) low (1.21 mg/cm^3) (Table 2).

4.Conclusion

The farmers in and around Mayiladuthurai District is predominantly rely upon the cultivation of rice and sugarcane for their income. Since, these money plants are predominantly grown in their spaces. In the current work, fifteen samples were collected from in and around Mayiladuthurai District and they were taken to the soil lab and dissected for the previously mentioned twelve parameters. Results were taken care of into Heber Soil Quality Index. Profoundly helpful and recently formed HSQI was taken advantage of in this review to rate the soil examples as excellent, good or bad. The all-out HSQI values of the multitude of tests explored in this review went from 71.47 – 79.55 which recommends that these soil examples are good and fit for giving better yield of sugarcane and rice. Advances for these designs are accessible, yet are minimal utilized due to the cost. Nonetheless, numerous non-mechanical techniques have been utilized for quite a long time by ranchers. The ranchers were met and exhorted that they need to examine their soil examples in the research center and periodical examination ought to be made to work on the yield. This work will be overwhelmingly valuable and may bring about better homestead the executives through more confidence supplement choices. The HSQI is viewed as exceptionally valuable, less tedious one and more efficient. All things considered, this work is by all accounts a stunner for the youthful scientists to take up a comparative work for different regions and they can likewise form a comparative kind of soil quality list for different harvests. This is time and cost effective one.

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