

# Preliminary evaluation of soil and water of the rice fields for rizi-pisciculture in five rice producing areas of Vizianagarm district in Andhra Pradesh

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## ABSTRACT

*The elimination of the use of harmful chemicals and pesticides from agriculture is an urgent need. Rizi-pisciculture is a good option in this direction. Suitability of the site is the prime requirement for the success of this system. The physico-chemical parameters of the water and soil from five rice producing villages in Vizianagaram district of Andhra Pradesh were studied to evaluate their suitability for rizi-pisciculture. The chemical parameters of water such as pH, Nitrogen, Phosphorous, Ammonia, Ca and Mg, play a vital role in the biological process in water bodies. Soil characteristics like Soil texture, water holding capacity, pH, EC, organic carbon, Nitrogen, phosphorous, iron, Ca and Mg promote the production of rice and fish. The test results were given evaluation points according to their beneficial role. The evaluation scores for the five sites were presented.*

**Key words:** *Evaluation, Physico-chemical parameters, Rizi-pisciculture, Soil, Water*

## I.INTRODUCTION

The Rizi-pisciculture system helps in the conservation of biodiversity in paddy fields since the input of chemicals in the form of pesticides and insecticides is limited. Fish culture in rice fields provides cheap and fresh animal protein and control mosquito larvae, which are carriers of disease causing pathogens [1],[2]and[3]. Vizianagaram is a northern coastal district of Andhra Pradesh. Paddy crop is the principal food crop cultivated throughout the district. The rice fields can be integrated with fish culture if the soil and water parameters are suitable. The soil and water resources of the rice fields of five rice producing areas of Vizianagarm district were studied to evaluate their suitability for Rizi-pisciculture.

## II. MATERIAL AND METHODS

The samples of soil and water from five rice producing areas of Vizianagaram district were collected and tested in the laboratory to evaluate their suitability for rizi-pisciculture.

### 2.1. Study area

The study was conducted in the five rice producing areas of Nellimarla, Anamaraju peta, Dharmapuri, Pandrangi and Pedavemali near Vizianagaram.

### 2.2. Soil sampling

The soil samples were collected at random from the field at 15 m interval in each area. They were taken at 0-15 cm and 15-30 cm depth. The soil was mixed together and a small portion of the soil that is a 'grab sample' was taken out of it and allowed to dry in the air. The dried soil was powdered and passed through 2 mm sieve. The

particles larger than 2 mm were weighed as gravel content and discarded. The sieved soil sample was used for conducting the tests[4].

### 2.3. Water sampling

The water samples were collected from their primary sources from where the rice fields are being irrigated regularly.

### 2.4. Texture of the Soil

The texture of the Soil was determined by estimating the relative percentage of sand (0.2- 0.02 mm), silt (0.02- 0.002 mm) and clay (0.2-0.002 mm) which were estimated by adopting International pipette method [4]. The values were fitted in the Textural triangle and determined their class of texture of the soil.

### 2.5. Water holding capacity of the soil

The Water holding capacity of the soil is the percentage volume of water contained in the soil which was estimated following DIRD [4].

### 2.6. Chemical tests of water and Soil samples

The pH was determined with a pH meter. The Electrical Conductivity (EC) was measured by using the Conductivity meter. Organic carbon was determined by Walkley and Block method [4]. Calcium and Magnesium were estimated by adopting E.D.T.A titrimetric method following DIRD [4]. Iron, Ammonia, Phosphate and Nitrogen contents were estimated by adopting standard methods following DIRD [4].

### 2.7. Evaluation of soil and water quality for Rizipisciculture

The values of quality parameters estimated were given evaluation points, dividing them into three categories, based on their prominent role played in agriculture and aquaculture production performance of the field as presented in Table-1.

Table-1: Standard evaluation points allocated for each quality parameter of soil and water

S.No	Quality parameter	Category wise evaluation of parameter					
		Category-A		Category-B		Category-C	
		Value	Points	Value	Points	Value	Points
1	Soil texture	1.SandyClay 2.SandyClay Loam	30	1.SiltClay 2.SiltClayLoam 3.Clay	20	1.Sandy 2.Sandy loam	5
2	Soil Water holding capacity	>20%	30	15%-20%	20	10%-14%	10
3	Soil pH	6.1-7.9	20	5.5-6.0 & 8-8.9	15	<5.4 & 9	5
4	Soil Organic Carbon	>2.0	10	1.0-2.0	5	<1.0	3
5	Ca & Mg content of soil	>2.0	5	1.5-2.0	3	<1.5	1

6	Water pH	6.5-7.5	3	5.5-6.4 & 7.5-8.9	1	<5.4 & 9	0
7	Ca +Mg content of water	>1.5	2	1.0	1	<1.0	0
	Total		100		65		

The cumulative score was used for evaluating suitability of the site. The site with cumulative score below 64 are not suitable and those with score above 64 are suitable. The individual score of each parameter indicates the required corrective steps to be taken before taking up rizi-pisciculture.

### III.RESULTS AND DISCUSSION

The estimated soil texture and water holding capacity of the soils of five rice producing areas are given in Table-1 and the soil quality parameters in Table-2 and water quality parameters in Table-3.

Table-2: Texture and Water holding capacity of soils of different areas

Place	Texture of soil	Water holding capacity
Nellimarla	Sandy clay loam	18%
Dharmapuri	Sandy clay	20%
Annamaraju peta	Sandy clay loam	19%
Pandrangi	Sandy clay loam	24%
Pedavemali	Sandy clay	22%

Table-3: Soil Quality parameters observed in different areas of the district

Soil constituent	Nellimarla	Dharmapuri	Anamarajupeta	Pedvemali	Pandrangi
Soil pH	6.7	6.9	7.5	7.5	6.9
EC	0.38	0.48	0.48	0.51	0.49
Org Carbon(g/kg)	2.3	1.4	3.0	1.25	2.9
Nitrogen (mg/kg)	96	86	106	105	99
Ca+Mg (mg/kg)	1.98	1.23	1.02	1.78	2.34
Iron (mg/kg)	21.46	22.54	31.76	32.79	29.77
Phosphorous(mg/kg)	17.5	10	15	18	16.4

Table-4: Water quality parameters observed in different areas of the district

Water quality	Nellimarla	Dharmapuri	Anamarajupeta	Pedvemali	Pandrangi
Water pH	6.5	6.6	7.3	7.6	7.8
Ca+Mg( mg/l)	1.22	1.13	1.01	1.56	1.87
Nitrate ( mg/l)	0.04	0.03	0.05	0.04	0.6
Phosphate ( mg/l)	0.24	0.28	0.22	0.27	0.09
Ammonia ( mg/l)	0.09	0.05	0.06	0.06	0.36

Table-5: Evaluation score of the five rice producing areas of Vizianagaram District

S.No	Quality parameter	Name of the area and it's respective score for each quality parameter				
		Nellimarla	Dharmapuri	Anamarajupeta	Pedvemali	Pandrangi
1	Soil texture	30	30	30	30	30
2	Soil Water holding capacity	20	20	20	30	30
3	Soil pH	20	20	20	20	20
4	Soil Organic Carbon	5	10	5	10	10
10	Ca & Mg content of soil	3	1	1	3	5
6	Water pH	3	3	3	3	3
7	Ca +Mg content of water	1	1	1	2	2
	Total	82	84	80	98	100

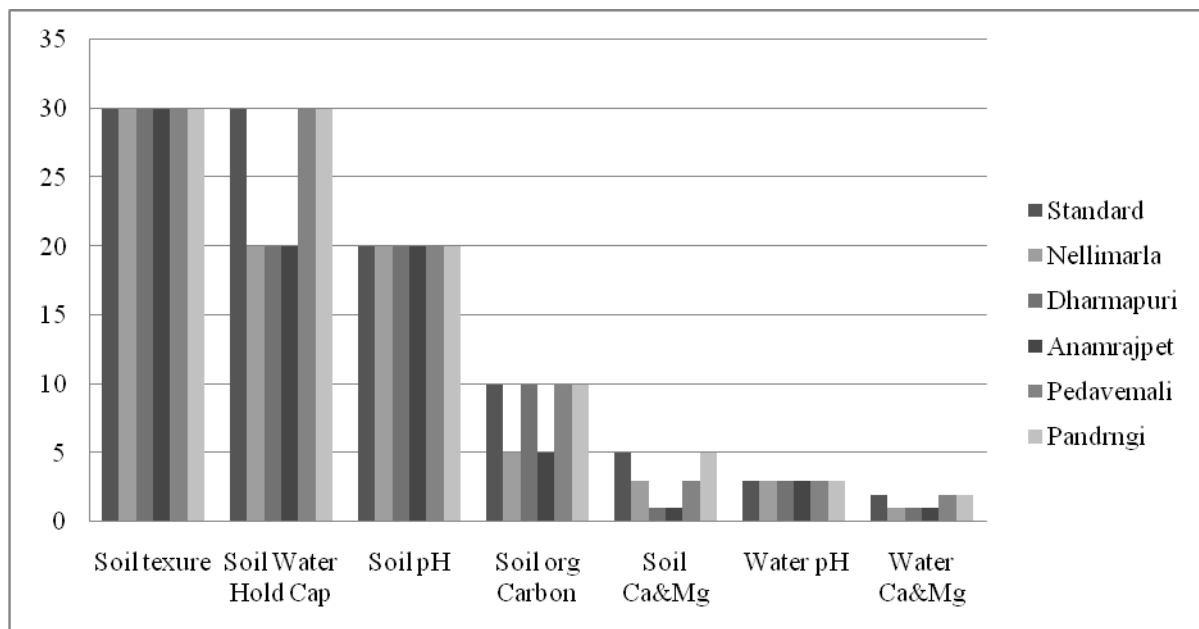


Fig-1: Evaluation of soil and water parameters of five rice producing areas of Vizianagarm District

The determination of texture and water holding capacity of soil is important for aquaculture and agriculture activities. A well decomposed organic matter increases the water holding capacity. Soil pH is important as it plays a great role in the availability of nutrients to plants and fish. Soil nitrogen occurs largely in organic form. The availability of nitrogen is associated with the activity of micro-organisms. Phosphorous has an important

and significant effect on plant functions and qualities. Soils with good amount of Ca and Mg allow free movement of water without stagnation and contain sufficient air for proper aeration of plant roots making the soils productive.

The evaluation points of each parameter pertaining to five rice producing areas are given in Table-4 and the values are plotted in a graph in Fig-1. It is clear from the data that Nellimarla, Dharmapuri and Annamarajupeta sites require improvement in water holding capacity of soil by adding organic manure. The soil and water pH is suitable in all the sites. The organic carbon content of the soil needs to be improved at Nellimarla and Annamarajupeta sites, which also require organic manure. Calcium and Magnesium content of the soils is to be improved in all the sites, except in Pandrangi, by supplementing with the compounds of these elements which also takes care of the deficiency of these elements in the source waters.

Abubakar Baba Misau et al., [5] studied various quality parameters of soil and water of rice fields to evaluate the sites for Rice cum fish culture and concluded that soil texture of loamy sand are suitable. Bera Tarun kumar et al.,[6] observed that the Physico-chemical characteristics of soil and water are very significant in Paddy cum Fish culture field which in general controls the productivity of water bodies. The bottom soil plays an important role in the fertility of the water bodies. Lemna Desta et al., [7] studied the physico- chemical parameters in the water and soil to understand the suitability of the area for Paddy cum Fish culture system.

#### **IV.CONCLUSION**

The present study found that the soil and water of five rice producing areas were suitable for rice-pisciculture and the steps to be taken in each site to improve them was also revealed.

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