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INFLUENCE OF ADJACENT AQUACULTURE ACTIVITIES ON SOIL PROPERTIES OF SANDY SOILS UNDER PADDY CULTIVATION IN GODAVARI DELTA.

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ABSTRACT

Soil salinization of agricultural lands around aqua ponds due to seepage of water from ponds was studied in the year 2017-2020. The ponds selected were aqua ponds with sandy texture with and without any trench. Soil samples(50 no.) were collected from 0 meters (outer side of the pond or trench bund) up to 50meters distance from the pond and 10cm to 30 cm depth and analysed for pH, EC, Organic carbon, available Nitrogen, Phosphorous, Potassium, Sodium and TDS etc. The results indicated that pH and electrical conductivity decreased with increase in distance from the pond upto50 m distance from the pond. Available Nitrogen, Phosphorus and Potassium increased with distance from the aquapond with shrimp upto 50 m. Seepage is more in case of a pond without any trench when compared to a pond with trench. Salinization due to seepage was observed to a long distance in case of sandy soils.

Key words: Aqua pond, SalinitySeepage,Soil fertility.

INTRODUCTION.

Aquaculture is the fastest growing food sector in coastal areas. In the past decades aquaculture around the world has been pursued only on the basis of economic costs without considering the social costs and negative impacts on the environment. Approximately 47% of the population lives in the coastal states and 60% of the labor force is occupied in agriculture (Marale and Mishra, 2011). Brackishwater shrimp farming is a popular practice due to an abundance of resources (12.4 lakh ha), and its high profit compared to the traditional farming common on the east coast of India. Shrimp, a major item of export, shares 51.35% of the total US dollar earnings in India. Since coastal populations survive mainly on marine resources, the overexploitation of essential resources has threatened the security and sustainability of the ecosystem (UNEP 2003; UNEP/GPA ,2006). Owing to huge profits from brackishwater shrimp culture, the conversion of rice fields to shrimp ponds has taken place on a large scale and the selling of agricultural land to shrimp growers at elevated prices has increased. These changes often take place in areas where income from rice farming is low, indebtedness is high, and limited off-farm employment opportunities exist.After e”10 years of the practice, many farms have been found to crash because of virus infection, the development of

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pathogens from shrimp and feed waste or infections in the pond that prevent further use. As a result, the farming is shifted to neighboring fields.In the process, more and more crop lands becomes shrimp ponds and the coastal farmland is more likely to become saline and unproductive in the near future. Salinisation of soil in nearby agricultural land is one of the major environmental issues in acquaculture areas. (Jayanthi *et al,* 2004).

The unplanned expansion of brackishwater shrimp farming has resulted in severe environmental degradation including water scarcity, increased salinity and health hazards, decreased land productivity and a loss of biodiversity that eventually exacerbated food insecurity and livelihood vulnerability (Rahman *et al*, 2013).The intrusion of salinity, the salinization of cropland and the decrease of soil fertility due to the unauthorized expansion of brackishwater shrimp farming are also reported from several locations across coastal areas (Hossain*et al*, 2013). Rice farms are favoured sites for conversion into aqua ponds because they pose several characteristics well suited for aquaculture (Siddique *et al,* 2012). Seepage of salt water into the adjacent agricultural lands from aquaculture ponds is well documented and sometimes it makes cultivation impossible. The salinity and sodicity of soil were found to be inversely proportional to the distance from the sea and aquaculture ponds. Thus , the present study focussed on the influence of adjacent aquaculture on soil properties of sandy soils under paddy cultivation.

MATERIAL AND METHODS

The aqua ponds (25 samples from villages of aquaponds without trench) and 25 samples from villages with trench) were selected from different farmers cultivating prawn with trench and without trench. The changes in soil properties were recorded by following the standard procedures mentioned below.The data on changes in soil properties were recorded from the aquaponds cultivated prawn without trench from the villages Bhatlamogaturu, Sriramapuram, Vissakoderu (Palakoderu Mandal), Kopparru and Saripalle. The yield and yield parameters of paddywere collected at a distance of 50m and to identify the changes in soil properties,soil samples were collected at a distance of 0,10, 20,30,40, 50m distance from the adjacent pond to the paddy field. The soil samples were analysed for pH, electrical conductivity, organic carbon and available NPKand TDS. The yield and yield parameters of paddy was recorded from the farmers cultivating shrimp with trench and the soil samples from the paddy fields cultivatedshrimp with trench were collected from Kuppanapudi ,Penumanchili, Ganapavaram, Penumantra and Attili villages were collected at distances of 0,5,10,20,30,40,50 m to identify the changes in soil properties. The collected soil samples were analyzed for the

S.No	Nutrient	Procedure	Scientists
1	pH	Soil and water 1: 2.5 ratio	Jackson 1973
2	Electrical conductivity	Soil and water 1: 2.5 ratio	Jackson 1973
3	Available N	Alkaline permanganate method	Subbaiah and Asija, 1956
4	Available P_2O_5	Olsens method	Olsen *et al,* 1954
5	Available K_2O	Neutral Normal ammonium acetate method	Muhr 1965

chemical properties viz pH, EC, OC, available NPKand TDS.Paddy cultivation with aquatic ponds growing prawns in sandy soils without trench was identified in five different villages Bhatlamogaturu, Sriramapuram ,Vissakoderu , Kopparru and Saripalle and the soil samples were analysed for different properties pH, electrical conductivity, available NPK, Sodium percentage and TDS at distances of 0,10,20,30,40 and 50m distance from the aquapond.

RESULTS AND DISCUSSION

Aquaponds without trench in prawn cultivation

The soil samples from the areas Bhatlamogaturu, Sriramapuram ,Vissakoderu , Kopparru and Saripallegrowing prawns without trench (5 samples from each village) were collected at different distances and analysed for different parameters.The results revealed that the pH and electrical conductivity decrease with increase in distance from the pond (0 – 50 m). The organic carbon status increased with increase in distance i.e from 5m to 50m. (0.35 - 0.42%). The influence of salinity decreased with increase in distance from the pond.Das *et al* (2017) also reported that salinity (TDS 4.93 to 203%), Na, Ca and Mg contents were also intensified with shrimp cultivation adjacent to paddy field. (Na: 1.11 to2.45,Ca: 0.39 to3.78andMg: 0.33 to 2.32 times).The available nutrients nitrogen (135-165 kg ha^{-1}) potassium (309-435 kg ha^{-1})and phosphorus (18.6-34.8 $kgha^{-1}$) contents were very low adjacent to aquatic pond and their availability increased with increase in distance from the pond (upto 50 m distance) shows that the influence of salinity decreased with the distance from the pond. These findings were supported by Das *et al*(2017) stated that the shrimp pond water was 1.66 to 1.84 times more salt stressed, and contained excess amounts of Na (2.11 to 3.35 times), organic carbon (1.33 to 3.46 times) and K (1.92 to 2.86 times) . Due to leaching of salts along with percolating water,the Na content of fields adjacent to aqua pond decreased from 188 ppm to 127 ppm.The potassium content of soil showed an increase from 309-435 kg ha^{-1} with an increase in distance from 5 to 70 m of aqua pond. This could be due to the decreased salt content (Na, Ca, Mg salts) in soil with the distance from the pond. A higher concentration of these was found adjacent to the aqua pond due to saturation of soil colloidal complex with these ions, thus resulting in a loss of potassium through leaching, thus available K_2O in soil was lower in the field neither to aqua ponds. Due to the lack of trench, the adjacent paddy field effected severely due to the salt stress existed in the pond and also due to the percolation and seepage losses the salt water entered into the paddy field and changes the properties of the soil which in turn impairs the yield of paddy.

Aquaponds with trench in prawn cultivation

Paddy cultivation with acquatic ponds growing prawns with trench was identified in five different villages Kuppanapudi, Penumanchili, Ganapavaram, Penumantra and Attili villages. The soil samples were collected, analysed and recorded the changes in soil properties at a distance of 0,10,20,30,40 and 50 m distance from the aquapond. The results revealed that the changes in soil properties not much varied due to the excavation of trench between the aquapond and the paddy field. The seepage water and the percolated water enter into the trench thus the soil properties were not impacted much and the paddy crop might not be secondary salinization due to

Table 1. Changes in soil properties with prawn cultivation without trench

S.No	Distance from pond	pH	EC	Organic carbon	Available nutrients Nitrogen	Phosphorus	Potassiu	Na	T.D.S	S
	(m)		dSm^{-1}	(%)		(kg/ha)		ppm	ppt	ppm
1	5 m	8.0	4.2	0.35	135	18.6	309	180	1.60	14
2	10 m	8.0	4.1	0.35	138	25.2	321	167	1.80	10
3	20 m	7.5	4.0	0.36	145	27.5	365	155	1.75	9
4	30 m	7.0	3.9	0.35	148	28.9	402	145	1.62	8
5	40 m	6.5	3.8	0.38	156	30.6	415	142	1.42	8
6	50 m	6.2	3.8	0.40	158	31.5	421	135	1.10	7
7	60 m	6.0	3.6	0.42	163	32.6	432	134	1.08	7
8	70 m	6.0	3.2	0.42	165	34.8	435	134	0.98	7

Table 2. Changes in soil properties with prawn cultivation with trench

S.No	Distance from pond	pH	EC	Organic carbon	Available nutrients Nitrogen	Phosphorus	Potassiu	Na	T.D.S	S
	(m)		dSm^{-1}	(%)		(kg/ha)		ppm	ppt	ppm
1	5 m	7.0	2.1	0.5	215	35.2	341	135	1.40	9
2	10 m	7.0	2.0	0.52	210	33.5	341	137	1.50	8
3	20 m	6.5	1.8	0.55	212	33.0	325	127	1.35	8
4	30 m	6.2	1.2	0.55	200	32.5	352	125	1.32	8
5	40 m	6.0	1.0	0.56	198	32.0	385	122	1.22	8
6	50 m	6.1	0.5	0.60	190	32.5	392	120	1.00	8
7	60 m	6.0	0.5	0.60	190	32.6	390	120	0.92	8
8	70 m	6.0	0.5	0.60	190	34.8	390	120	0.82	8

aquaponds.The aqua ponds with trench preserve the soil moisture and due to the soil moisture the salt content decreased and the pond without trench the seepage losses were more and the salts percolate to the adjacent paddy fields causes more salinity/sodicity in the paddy fields.

CONCLUSION

The distance between aqua pond and paddy field in sandy soils should necessarily be more than 50 m to reduce the impact of salinity on the adjacent paddy fields. Aquaculture without trench between paddy

field and pond causes salinity problem and its impact reduces the yield of the crop and impaired soil health. Aquaculture with trench in between paddy crop and aquapond reduced the impact of salts on crop growth and also on soil health. Hence,the paddy cultivation can coexist successfully in coastal areas if there are buffer zones in between. The trench between the pond and paddy field is found to be helpful in preventing salinization of adjacent agricultural fields.

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