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Economic analysis of sago effluents and its impact on agriculture production

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Abstract

Objectives: This paper is to examine the effect of sago industrial effluents and its impact on agriculture production to has negative effects on crop health and the environment.
Methods/Statistical Analysis: Production function method was used to measure the agriculture production damage costs due to sago industrial pollution by adopting stratified sampling technique. Both qualitative and quantitative types of data have analyzed to achieve the objectives. Multiple regression analysis has used to find out the relationship between effect of sago effluents and agriculture production in Salem district of Tamil Nadu.
Findings: Higher concentrations of water pollutants and increase in environmental unwell near the sago industry prevails. It also leads to losses in agricultural production. Thus pollution by sago industries can affect living conditions in polluted areas.
Application/Improvements: So it can be suggested as either the installed CETPs are not treating the effluents or the area needs more effluent treatment plants for the treatment. There is need for cooperation between the different sago industries and other stakeholder so that they can be able to learn from each other's experience for improved environment, agriculture production, management of the ground water and water bodies.
Keywords: Economic Analysis, Sago Effluents, Impact on Agriculture Production, Damage Cost and Common Effluent Treatment Plant.

1. Introduction

The Salem district is also called as 'land of sago' in the state of Tamil Nadu with the majority of the population has primarily engaged in agriculture and allied activities. The major food grains are cultivated in Paddy, Mango, Bannana, Tapioca, Turmeric, Sugarcane, Cholam, Ragi, Redgram, Greengram, Blackgram, Horsegram and Oil Seeds of this district. The water quality has degraded so much that crops no longer able to cultivate as irrigated by this water causes clogging of salts at the sago extraction. As the result, return from agriculture has subsided and most farmers are driven into the viscous circle of poverty.

During the field survey, farmers informed that three decades ago agriculture production in this area was based on surface and subsurface irrigation but, as the groundwater turned very salty and is polluted, there is no irrigation facility and farmers depend on the Spartan rainfall for cultivation of crops. Pollution of groundwater has led to reduced yields and crop pattern changes which have a direct impact on agricultural income. Crops like Paddy, Sugarcane and Banana which need large volume of good quality water are now substituted by cotton and coconut plantations. The situation put farmers in rural indebtedness, rural unemployment and rural poverty.

Briefly, the following is the review related to sago effluents and its impact on soil quality, water quality and agriculture production. According to [1] the sago industry already affected the pattern of agricultural production and has greatly increased commercially in addition to providing job opportunities to the local people. In [2] studied that the degraded environment and groundwater has been assaulted to land from sago wastewater and leads to polluting both the groundwater and the sounding environment. The sago factory has been consumed 95 per cent of the water leaving as sewage and also large number of factories is being stopped due to the lack of water resources [3]. In addition, it produces an equal quantity of highly organic, foul-smelling, acidic wastewater [4]. According to [5] farmers has been suspected that the use of lactic acid at these sago factories has rigorously simulated to the soil and groundwater resources. The confirm dam constructed transversely the waterways, which convey the excess water from the Panaimarathupatti Lake to Ammampalayam Lake near Mallur, creates the trouble and gets stored in the check dam. According to[6] , all the tapioca industries in Tamil Nadu have conquered with two major issues. First, one is huge amount of water requirement for improved extraction of starch from tubers. Second is the producing large quantity of effluents into the lands. Sago manufacturing industrial units, both medium and large scale have bear from poor treatment and dumping problems [7]. They have released 85 per cent of the whole wastewater, and about 400 units discharge directly into rivers. In[8] evaluated the environmental degradation which affects from sago industrial effluents in Salem district of Tamil Nadu. Accordingly, the agricultural land has been reduced production and more of land averting expenditure through improving land and water quality index. The hedonic model have employed that the farm income and distance between farm and sago factory has significantly positive relationship with the land values.

The above review enables the researcher to have a clear idea about research questions of the present study. It is understood that water pollution has been the major cause for loss of agricultural production and allied sectors.

2. Statement of the problem

Rapid industrialization in the Salem district of Tamil Nadu has aftereffect as an expressive degeneration in water quality. The major problem with the groundwater is that once contaminated, it is difficult to restore its quality. Although industrial effluents, poor infrastructure, foul smell, discharge of sago wastewater mixed into agricultural farms are through the various sources kick in to increased water pollution and alarming to environment. Generally, outstretch vulnerability of water pollution has leads to water quality, soil and agriculture production. Alike, those issues have easily to impose the economic cost takes place from disbursement acquired in leisure and loss of output.Hence there is a need andalarm for the safeguard to management of ground water quality.

3. Methodology

The effluent discharged out of sago factories pose severe environmental problems in Salem district. Salem, Attur, Gangavalli, Valappadi, Rasipuram and Namakkal areas are basically water shortage areas. From these areas contaminated water from sago and starch production are eventually performed into neighboring agriculture forms and channels. Sagoprocessing industries is more water intensive, which resulted in the over extraction of groundwater in many places of Salem were exploited. In general, average level of groundwater in Salem district is 20m to 36m [9]. On the basis of the pollution level identified villages covered by Taluks namely Salem, Attur and Mettur. From these sample villages has selected from polluted area and other is non-polluted to collect detailed information regarding the damage costs due to sago industrial pollution. Having these details, data around 413 households in the polluted area 331 households and 82 households were selected from Non-polluted area selected by adopting stratified random sampling technique to analyze the sago industrial pollution mixed with fresh water and its impacts on agriculture production. Both qualitative and quantitative types of data have analyzed to achieve the objectives. Multiple regression analysis has used to find out the relationship between effect of sago industrial pollution and agriculture production in Salem district of Tamil Nadu.

4. Impact on agriculture production

An increase in agricultural productivity means an increase in production per unit of input, which in turn raises the income of the farmer. The increased income of the family/community paves the way for augmenting savings, which can be used for further development of their agricultural land. On the other hand a decrease in productivity leads to lowering of production. Agriculture productivity loss was estimated to comprehend the degrees of loss caused by the natural resources degradation like water, soil condition on agriculture due to industrial pollution. The details of damage functions used for estimation are presented. The results of the model are reported below:

$$Y = \alpha + \beta_1 TLO - \beta_2 TLASIP + \beta_3 IWASIP + \beta_4 YLT - \beta_5 YLP + \beta_6 YLFV + \beta_7 YLOS + \beta_8 YLM - \beta_9 YLC - \beta_{10} DIS_{sago} + \mu$$

$$Y = 289.962 + 7065.147\ TLO - 27026.732\ TLASIP + 34665.640\ IWASIP + 1.160\ YLT - .594 YLP + 2.068\ YLFV + .678 YLOS + .828 YLM - 2.474 YLC - 88.751\ DIS_{sago} + \mu$$

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Where,

Y = Dependent Variable

Y is the agriculture production

α is Constant

B1-β9 are coefficients to be estimated, and

μis an error term.

Table 1. Determinants of Agriculture Production

Sl.No	Independent Variables	B	SE	t	Sig.
1	*α (Constant)*	289.962	1160.971	.250	.803
2	*TLO*	7065.147	1614.787	4.375	.000***
3	*TLASIP*	-27026.732	988.366	-27.345	.000***
4	*IWASIP*	34665.640	5204.582	6.661	.000***
5	*YLT (Rs.)*	1.160	0.105	11.082	.000***
6	*YLP (Rs.)*	-0.594	0.175	-3.393	.001***
7	*YLFV(Rs.)*	2.068	0.135	15.363	.000***
8	*YLOS (Rs.)*	0.678	0.203	3.340	.001***
9	*YLM (Rs.)*	0.828	0.142	5.816	.000***
10	*YLC (Rs.)*	-2.474	0.217	-11.377	.000***
11	DIS_{sago} *(in km)*	-88.751	347.955	-0.255	.799
N= 413, R^2 = 0.851, F = 228.777,					

Note: *** denotes significant at 1 per cent level.

The above equation represents the determinants of agriculture production loss assessment as a function of

TLO = Total land owned

TLASIP = Total Land Affected by Sago Industrial Pollution

IWASIP = Irrigation Water Affected by Sago Industrial Pollution

YLT = Yield Loss Tapioca (Rs.)

YLP = Yield Loss Paddy (Rs.)

YLFV = Yield Loss Fruits & Vegetables (Rs.)

YLOS = Yield Loss Oil Seeds (Rs.)

YLM = Yield Loss Maize (Rs.)

YLC = Yield Loss Coconut (Rs.) and

DIS_{sago} = Distance Sago Industry to Agricultural Land (in km).

Agricultural productivity loss was estimated to comprehend the degree of loss caused by the natural resources of degradation like water, air, soil condition on agriculture due to industrial pollution. The details of the damage functions used for estimation are presented. The results of the model are reported below. The agricultural value damage function is explained by the value of agriculture related damages due to some of parameters, identified based on household survey. The identified parameters of agricultural value damage function for the entire pollution radius between proximity villages are presented in this technique. Apparently from the technique that the farm level and village level agricultural damages were influenced significantly by effect of pollution on farmland. It is implicit

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that one per cent effect on land productiveness and put down quality cause agricultural lands by 0.85 that means 85per cent from the mean level.

Theoretically, a large number of variables influence the agricultural production. The agricultural damage cost function has shown that the value of agricultural damage cost is a function of size of land owned in acre 1) Marginal Farmers (Less than 1ha), 2) Small Farmers (1.0 to 2.0 ha), 3) Semi-Medium Farmers (2.0 to 4.0 ha), 4) Medium Farmers (4 to 10 ha) (Annual Report and Agricultural Statistics at a Glance (2007)), it obvious that when size of land owned increases, the damage cost also increase.

Opinion about agriculture land affected by industrial pollution (continuous variables) and damage cost correlated respectively, it indicated that these two variables are positively related with independent variable. The damage function links pollution to yield. In this model, value damage functions were developed and employed. While the agricultural damage function considered loss in productivity of cropland and labor, crop output, change in quality of water, damage soil quality, etc. the damage function used for the study was of the following order, Yield Loss Tapioca (Rs.), Yield Loss Paddy (Rs.), Yield Loss Fruits & Vegetables (Rs.), Yield Loss Oil Seeds (Rs.), Yield Loss Maize (Rs.), distance from sago industry to agricultural land (in km) factor productivity loss and pollution point in km and irrigation water affected by industrial pollution (1-yes, 2-no). The above facts and figures have shown the intensity of water pollution in the study villages due to the influence of sago industrial effluent.

Table 1explain that, the R^2 value for the affected villages indicates 0.851 (85 per cent) of variation in the dependent variable is due to change independent in the variable. The '*b*' values tell us about the relationship between loss of agriculture production and land value for each predictor. If the value is positive we can tell that there is positive relationship between the predictor and the outcome, whereas a negative coefficient represents a negative relationship. For these data all six predictors have positive b-values indicating positive relationships. So, as total land owned, irrigation water affected by sago industrial pollution, yield loss tapioca, yield loss fruits and vegetables, yield loss oil seeds and yield loss maize, where the land is polluted and agriculture production are decrease, so the land owners have loss more income. The b-values tell us more than this, though. The results tell us to what degree each predictor affects the outcomes in the effects of all other predictors are held constant:

TLO(7065.147) and *IWASIP*(34665.640) both of this value has point out that as the land is polluted by one acre, the land owner has spent more expenses per acre around Rs.7065 for cultivation and also the irrigation water is polluted the land production are also losses per acre around Rs.34,665. For these variables are positively influenced at 1 per cent level of significance.

TLASIP (-27026.732), *YLP* (-0.594), *YLC* (-2.474) and DIS_{sago}(-88.751) in all these values are negatively influenced. The total land affected by sago industrial pollution (*TLASIP*) is negative sign because nowadays the land value is normally very high. But in this case land value is as well more per acre Rs.27, 026 due to many educational institutions, automobile workshops and very close to Salem to Chennai national highways. So, this result indirectly encouraged for real estate business. In addition, yield loss paddy (*YLP*) and yield loss coconut (*YLC*) is also negative sing at 1 per cent level of significant. For the reason is that paddy and coconut cultivation are decrease proportionately due to lack of groundwater and monsoon, and also the sago factory has exploited huge amount of ground water at the time of sago processing. Distance Sago Industry to Agricultural Land (in km) (DIS_{sago}) value is negative sign and also it is not significant, because the distance some have influenced on the basis of Kilometers.

YLT, YLFV,YLOS, and *YLM* have positive sign such as 1.160, 2.068, 0.678 and 0.828. This is high portion of *YLT* and *YLFV* cultivation expenditure. It explores that when the cultivated land is affected by sago effluents and leads to the cost of cultivation in tapioca and fruits and vegetables also very high. Similarly, oil seeds and maize cultivation also the same for land owners for spending more cost for cultivation. These variables are positively significant at 1 per cent level.

5. Conclusion

The present study of sago industrial pollution undertaken provides impact of water pollution on agriculture and environment. It is very clear and evident from the study that the sample respondents in Salem district have been directly affected by the partly treated or untreated industrial effluents. The magnitude of damage caused to the agricultural sector is very heavy. Likewise, the impact on drinking water was also severe and it was obvious that the materialize water and groundwater were contaminated. Clearly, it was noted that the sample villagers in Salem district were directly affected by the effluent and the damages were heavy to different sectors. So it can be suggested as either the installed CETPs are not treating the effluents or the area need more effluent treatment plants for the treatment. There is need for cooperation between the different sago industries and other stakeholder so that they can be able to learn from each other's experience for improved environment, agriculture production, management of the ground water and water bodies.

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