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Effect of Coal Based Power Plant on Betel Cultivation

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Abstract
Industry and agriculture are the two pillars of a society. The development of industry has both positive and negative impact on societal growth. Generally the nature of impacts of industry depends on nature of the industry and its by product, characteristic of the site of production etc. Coal based power plant is considered as one of the worst pollution causing industry in the world. It releases solid, liquid and gaseous elements which damage the local agricultural resources, if proper management system is not followed. Kolaghat Thermal Power Plant (Purba Medinipur, India) is such an industry which has lead to the economic and commercial development of Haldia , Kolkata located at a distance of 60-70 kilometer from the centre of generation but at the same time an important cash crop of this area, Betel (*Piper betel L')* has been affected much.

Keywords: Betel; thermal power plant; cash crop; fly ash

1. Introduction
Thermal power plant seems to be pollution free industry at the area of supply but at the centre of generation it causes deterioration of environment leading to damage of local resources. Betel - an important cash crop is such a resource. Betel is a perennial tropical plant. Betel leaves help in digestion and its extract has some medicinal application. So the leaves are very commonly chewed by the people in India. It is an important cash crop of Purba Medinipur District of West Bengal, having good demand not only in India but abroad also. Tamluk subdivision of this district is famous for betel cultivation not only for quantity but also for quality. Among seven blocks of this subdivision Saheed Matangini holds the first position in terms of area and productivity of betel plant in the Medinipur District in the 1970s and 1980s (Principal Agricultural Office, Purba Medinipur). With production, processing, handling, transportation and marketing of betel leaves in different parts of the country, the rural economy of this block was flourished. But now it has lost its glory to other distant blocks such as Nandakumar and Mahisadal (Source: Principal Agricultural Office, Tamluk, Purba Medinipur). According to the local farmers the declining trend was started in the 1990s after the development of coal based power plant (Kolaghat Thermal Power Plant) in this locality and later on aggravated by some other factors. So in this paper an attempt has been made to find the present status of betel cultivation in this block and to find out the probable causes for declining trend of betel cultivation.

2. Objectives of the study
a) To discuss the favorable condition for cultivation of betel plants
b) To analyze the trend in area and productivity of betel cultivation in Saheed Matangini Block
c) To find out the probable causes for decline in betel cultivation
d) To find out some remedy to this problem

3. Methodology
Primary as well as secondary data are collected for the present study. Survey method is used for collection of primary data. Various books, journals, website and official records from Block and District Level Agricultural Department were consulted for secondary data and other relevant information. The primary and secondary data related to the study are processed, tabulated and verified in the form of percentages.

4. Ideal Climatic Conditions for its Cultivation

The betel plant *('Piper betel L')* is an evergreen and perennial creeper, with glossy heart-shaped leaves. It is valued both as a mild stimulant, breath-freshener and for its medicinal properties.It grows best under the shaded ecological conditions with a rainfall of about 2250-4750 mm, relative humidity of 45-80% and temperature ranging from and 15-40°Centrigrade. A well-drained fertile sandy or sandy loam or sandy clay soil with pH range of 5.6 –8.0 is considered suitable for its cultivation. However, in the areas with lower rainfall (<2000 mm) the crop is cultivated with the help of less but frequent irrigation. In this case watering is required every day in summer and every 3-4 days alternatively in winter.

5. Recent Trends in Area and Productivity

There are three types of betel plants cultivated in the study area as well as in the whole Medinipur District. They are known as *Sanchi, Mitha and Bangla* in local Bengali language. Among these *Mitha* is the best quality and it has great demand because of its flavor and sweet taste; *Sanchi* is the most pungent type and less popular among betel chewer. *Bangla type* has also good demand as it does not possess pungent taste like *Sanchi.* In the 80s when other blocks mainly cultivated *Bangla type*, Saheed Matangini Block used to cultivate mainly *Mitha type*. In 1980-81 about 74% of betel producing area (239 out of 324 hectares) of this block was under *Mitha type*. In 1990-91 the *Mitha type* area was increased to 258 hectares. But after that it has decreased to 228 hectares in 1995-96 and according to the agricultural officials it has remained almost constant up to 2009-10. Like *Mitha, Sanchi* - area has also increased from 36 hectares in 1980-81 to 60 hectares in 1985-86 but from 1990-91 its yield rate has started to decrease. But the exception is *Bangla* type, the area of which has increased from 49 hectares in 1980-81 to 77 hectares in 2001-02 to 88 hectare in 2009-10. Because of unavailability of continuous data of productivity the available data have been divided into phases and average productivity has been measured for two phases and lastly changes has been measured in terms of percentage.

To analyze the present trend of Betel leaves productivity of Saheed Matangini block, it has been compared with the other betel leaves producing blocks located at a distant place from the power plant. From the above table it is clear that the productivity of *Mitha* type for which the block was very famous in the 1980s has decreased the most (20.35%), though the productivity of *Sanchi* types has increased slightly and *Bangla type* has increased moderately.

Table 1: Changes in area under betel cultivation in Saheed Matangini Block

Year	Area in Hectares			Total Area(Hectare)
	Sanchi	Bangla	Mitha	
1980-81	36	49	239	324
1985-86	60	40	250	350
1990-91	55	60	258	373
1995-96	38	76	228	342
2000-01	38	77	228	343
2005-06	40	77	230	347
2009-10	38	80	225	343

Source: Based on data and information collected from Block Agricultural Office.

Table 2: Changes in Average Productivity of Sanchi Type (Betel leaves) in Different Blocks

Period	Sanchi Productivity(motte/ hectare)		
	Saheed Matangini	Nandakumar	Mahisadal
	Located within 12 kilometer distance from power plant	Located at a distance of 20 kilometer from power plant	
(1980-1990)	347.5	312.5	480
(1995-2006)	366.6667	400	350
Change in %	+5.515597	+28	-27.0833

Source: Based on information collected from District Agriculture Office, Tamluk, Medinipur and Primary Survey done at 2010. (1 motte = 10000 leaves)

Table 3: Changes in Average Productivity of Bangla Type (Betel leaves) in Different Blocks

Period	Saheed Matangini	Nandakumar	Mahisadal
(1980-1990)	460	505	508.75
(1995-2006)	550	650	600
Change in %	+19.56522	+28.71287	+17.93612

Source: Based on data collected from District Agriculture Office, Tamluk, Purba Medinipur and Primary Survey done at 2010 (1 motte = 10000 leaves)

Table 4: Changes in Average Productivity of Mitha Type (Betel leaves) in Different Blocks

Period	Mitha Productivity(motte/ hectare)		
	Saheed Matangini	Nandakumar	Mahisadal
(1980-1990)	565	495	393.5
(1995-2006)	450	500	456.6667
Change in %	-20.35	+1.010101	+16.0525

Source: Based on data and information collected from Principal Agriculture Office, Tamluk, Purba Medinipur and Primary Survey done at 2010 (1 motte = 10000 leaves)

6. Causes for Declining Trend

To know the reasons of this trend, sample survey was done in few villages of this block. On the basis of the interaction with the betel plant farmers and traders, the following reasons can be identified:

6.1 Development of Thermal Power Plant

The hazardous effects of coal based thermoelectric plants are well documented by Ramachandra et al[1] (2012), Arun and Azeez (2004) [2]and others.According to the experienced farmers, living within 5 kilometer radius area of the plant, the declining trend started in the 1990s after installation of Kolaghat Thermal Power Plant – the 2nd largest thermal power plant (1260 mw) of West Bengal. The main unit of plant was developed at a co- ordinate of 22 °25´North Latitude and 87° 55´ East Longitude at the bank of river Rupnarayan, along the boundary area of two blocks of Purba Medinipur namely Saheed Matangini and Kolaghat. As it is a coal based power plant, the main pollutant emitting is ash - mainly fly ash. According to the plant authority, [3] in the audit year 2006-07 the total ash generated in the plant was 1689357 million ton of which the volume of fly ash was 1351233 and that of bottom ash was 338124 million ton. The available data provided by West Bengal Pollution control Board (WBPCB) [4] also prove the higher level of particulate material (P.M) above National Ambient Air Quality Standard and the organization declared the surrounding area as critically air polluted area in 2003.

The plant was developed in two phases- 1st phase (1984-90) and the 2nd phase (1991-93). The units of the 2nd phase were equipped with Electro Static since the beginning but the first three units started functioning without ESPs (Electro Static Precipitator). Though the ESPs were being installed later on, it does not work efficiently throughout the years. So when the ESPs do not work, there is maximum dispersal of ash. Besides, the stacks of first three units were shorter (120 meter tall) as compared to that of second stage which is 220 meter high. So the first unit stacks cause more pollution at the immediate surroundings.

Mitha type is very sensitive and cannot tolerate any type of extremity .So *Mitha Type* has suffered the most. According to local farmers, the problem faced were discoloration of betel leaves with yellowish and brownish spots on the leaves along with reduction of the leaf sizes and brightness. Due to the spots the longevity of betel leaves and market value gets reduced. The falling of ash particles on the leaves and subsequent spraying of insecticides used to keep the particles stick to the leaves. So the repeated wash after the plucking reduce the market value of the leaves and ultimately the profit. This entire problem made the farmers discouraged to expand their business. Thus the dwindling situation that was started by the power plant increased with time due to combined effects of other factors.

6.2 Rising of Input Cost

Betel leaves were once considered as green gold. But now farmers do not find betel fcultivation lucrative anymore. Besides low demand, the rising of input cost are

discouraging farmers to cultivate betel plants. Betel is not cultivated in open space rather it is grown by vegetative propagation from the cuttings under partially shaded and humid environment inside a greenhouse (called *baroj* in local language). It is made up of locally available bamboo stems, jute sticks, etc. The entire structure is being covered by dried coconut leaves, paddy straw, leaves of banana from the outside .Inside the greenhouse bamboo or jute sticks are placed to support the single vine creeper so that it can entangle. The cost of jute and bamboo stick has increased more than 3 times in the last ten years.

6. 3 Tough Competition in the Market

Heavy downpour and gusty winds brought by cyclone Aila (2009) destroyed most betel gardens in South 24 Pargana district. Farmers, who were rebuilding betel fields, started using chemical fertilizers profusely to overcome the losses. According to the much experienced betel farmers the use of chemical fertilizers help in quick maturing of the plants and plucking of the first batch of leaves within a month of setting up the *boroj* instead of two-three months. But at the same time, it deteriorates the quality and longevity of betel leaves. In spite of that, the farmers of South 24 Pargana use chemical fertilizers and they sell it to the local retail markets at Saheed Matangini Block. As the local farmers use organic manure in the form of a mixture of cow dung, vermi compost and oil cakes of mustard, groundnut etc, the local cost of production is higher as compared to the outsiders. So the local farmers are facing competition in the market and many betel farmers have shifted either to flower or vegetable cultivation.

6. 4 Lack of Expert Farmers:

The crop is usually cultivated by the poor farmer generation after generation following the traditional methods. It is grown by vegetative proliferation from the cuttings. Usually cuttings from 3-5 years old vines are planted in the furrows (8-10 cm deep) of sterilized soil with spacing of 55-60 cm X 15-20 cm during rainy or autumn season in a hut like structure. To keep the soil moist and maintain the inside temperature and humidity, farmers need to sprinkle water regularly. They also need to look after the plant regularly. All these activities make betel cultivation labour intensive farming which discourages the young generation to be engaged in betel cultivation. In the Saheed Matangini Block the cultivation has become old and retired men's job. So they are also reluctant to continue this laborious job.

6.5. Fluctuation of Price Level

Like the flower market, the market price of betel leaves are highly fluctuating and the price may vary significantly in the evening compared to morning. Such superfluous fluctuation in price of betel leaves also discourage cultivation of the crop.

6. 6 Self Life of Betel:

Betel is vulnerable to even the slightest weather change. According to local farmers betel leaves turned yellow and premature dropping occurs if the temperature goes beyond 40^{o}C. In the past few years the temperature has risen above 40^{0} C.

7. Suggestions

1) First, the government should give emphasis on cultivation of betel because a small betel field of about three decimal areas can generate employment opportunity for an agricultural worker throughout the year (Bhowmick, 1997) [5]. If the betel fields are maintained properly they can provide considerable profit for more than ten years.

2) The government needs to recognize betel leaves not only as an important trading commodity but also as raw material because of high medicinal value.

3) KTPP authority should follow some measures to make the Electro Static Precipitator efficient to minimize the fly ash problem. They should take some steps to rejuvenate this age old traditional system of cultivation. They in association with research organizations may take some initiatives to explore the huge medicinal value of betel leaves.

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