

FARMER'S RESPONSE REGARDING IMPACT OF INDUSTRIAL WASTES ON CROP PRODUCTION

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Abstract

The essence of the present study was to determine the farmer's response regarding the impact of industrial wastes on crop production. The study was conducted in Mirzapur union under Gazipur sadar upazila of Gazipur district. Data were collected using a pre-designed interview schedule during November, 2009 to March, 2010. A sample of 90 respondents was selected from 2103 industrial wastes affected farmers using simple random technique. Yield and quality of produced rice, fruits and vegetables were found reduced to a substantial amount due to indiscriminate discharge of industrial wastes. Significant differences were found between pre and post establishment of industry in terms of yield and quality of rice, fruits and vegetables. Proper treatment of industrial wastes and implementation of environmental act might be acted upon to increase crop production and compensate for the affected farmers in future.

Key word: Industrial wastes, crop production

Introduction

The disposal of industrial wastewater is a serious problem as it is affecting the fresh water resources, human health and agricultural productivity. Release of toxic gases, inadequate sewerage system, expensive wastewater treatment methods and huge amount of untreated waste water disposed off in the drainage system are creating a number of environmental issues. It becomes the source of pollution for air, water, soil as well as crops. The crop

growth and yield may be affected by the use of untreated waste water. Growth period and environment under which plant is grown are the important factors in the life history of rice plant. It is convenient to regard the life history of rice in terms of three growth stages: vegetative, reproductive and ripening (Yoshida, 1981). The practice of using untreated waste water for irrigation on agricultural land is common in industrial areas. Respondents of the villages around Mokesh Beel stated

that the polluted sediment was responsible for their poor crop yields. They also reported about the decreased rice production in that area (Ullah *et al.*, 2007). Problems in flowering and fruit settings in different fruit trees were observed in Eppyllion dyeing industrial areas in Gazipur (Zebunnesa *et al.*, 2009).

However, very few research studies have so far been reported in this context. Information regarding the impact of industrial wastes on crop production in the vicinity of industrial areas of Bangladesh are still lacking. Therefore, the researcher was interested to find out answers of the questions as: What are the farmer's responses regarding impact of industrial wastes on rice, fruits and vegetables? What happened regarding their quality during pre and post establishment of industry and so on? The objective of this study was therefore undertaken to determine the farmer's responses regarding impact of industrial wastes on crop production.

Methodology

Locale of the study

The study was carried out in Mirzapur union of Gazipur sadar upazila of Gazipur district. Mirzapur was purposively selected as the locale of the present study because a number of industries are located in that union and all of those industries discharge their

effluents directly into the agricultural field (Chowdhury and Clemett, 2006). The Researchers also considered easy accessibility of the study area in case of site selection.

Population and sampling

Total number of farm families in Mirzapur union were 9560. All heads of these farm families were taken as the population of the study. But, the sufferer farm family heads were considered as the target population. From this target population, 90 respondents were selected randomly as the sample of the study. Data were collected through face to face interview by the researcher herself. For data collection a pre-designed interview schedule was used.

Measurement of farmer's response on the change in yield of crop

The respondents were asked to mention the yield of different crops (rice, fruits and vegetables) during pre and post establishment of industry. Rice yield was measured in metric ton/hectare (Mt/ha). The respondents were categorized into three groups on the basis of rice yield. The ranges for low, medium and high yield group were up to 3.72 Mt/ha, from 3.73 to 7.44 Mt/ha and 7.45 Mt/ha or above, respectively. Yield of fruit and vegetable was measured by using a 4-point rating

scale which was very low, low, high and very high. Score of 1, 2, 3, and 4 were assigned against each response. Finally, the respondents were classified into four groups (very high, high, low and very low) based on their responses on yield of fruits and vegetables.

Measurement of farmer's response on the change in quality of crop

Quality of rice, fruits and vegetables was measured in terms of size and shape, taste, color, odor and market value for both the period of pre and post establishment of industry. For each of the statement, score of 1, 2, 3, and 4 were assigned against very bad, bad, good and very good, respectively. Each score of the quality (size and shape, taste, color, odor and market value) was added up to obtain the final scores of rice, fruit and vegetable quality between before and after situation. On the basis of obtained scores the respondents were classified into three categories for all the cases. The categories were -low quality (up to 7), medium quality (8 to 14) and high quality (15 and above).

Statistical analysis

Data collected through direct interviewing were compiled and coded for processing and analysis. Tabular presentation of data was intensively used to arrive at a meaningful

conclusion. The SPSS version 12.0 was used to analyze the data. Descriptive statistics like frequency, percentages, mean and standard deviation were calculated to achieve the objectives. The typical variation between two time periods was determined by testing the following null hypothesis: "There is no significant difference between pre and post establishment of industry in respect of changes in crop production." Paired-t-test was used to test the significant difference of before-after data.

Results and Discussion

Impact on yield of rice

The yield of rice is dependent on many factors like seed quality, soil fertility, management, irrigation, pest attack etc. However, results furnished in Table 1 indicate that before establishment of industry, most of the respondents (61%) got high yield of rice. But after the establishment of industry, all but 11 percent respondents got low yield of rice.

It means that yield of rice was reduced after establishment of industry though the respondents have been using modern varieties of rice and their modern management practices for rice production.

The average yield variation of rice between two time periods was tested. The null hypothesis was: "There is no significant change in yield of rice of the

Table 1. Distribution of the respondents according to change in yield of rice

Category	Before establishment of industry			After establishment of industry		
	Number	Percent	Mean	Number	Percent	Mean
Low (up to 3.72 Mt/ha)	0	0		80	89	
Medium (3.73-7.44 Mt/ha)	35	39	8.06	10	11	2.35
High (7.45 Mt/ha and above)	55	61		0	0	
Total	90	100		90	100	

study area between before and after establishment of industry". The calculated t-value was 28.70, which was significant at 1% level with df 89. Based on the results the null hypothesis was rejected. Hence it was concluded that yield of rice in the study area changed significantly after establishment of industry. Kurnia (1999) revealed that after 20 years of contamination by industrial wastes, the average rice yield had decreased by about 80 percent. The initial rice yield of about 4-6 Mt/ha had become 1 Mt/ha in the later stages. The results obtained from rice production are in line with the findings of Dutta and Boissya (2000) who reported that the Naogaon Paper Mill effluent significantly ($p \leq 0.05$) reduced the yield components of rice as compared with the rice grown in areas beyond the reach of the Paper Mill effluents. In another study Islam *et al.* (2006) also reported similar findings.

Impact on quality of rice

Information furnished in Table 2

indicate that size and shape of rice was very good (56%) to good (44%) before establishment of industry whereas most of the respondents (66%) stated it as good followed by 18 percent bad, and a little portion (9%) very bad after the establishment of industry. It indicates that after establishment of industry size and shape of rice changed to some extent. Before establishment of industry, taste of rice was very good (59%) but after the establishment of industry, most of the respondents (41%) stated it as good and a mentionable portion of the respondents (56%) were found under bad to very bad category. So, it can be said that taste of rice deteriorated after establishment of industry.

Rice color was good as stated by most of the respondents during both before and after establishment of industry which means that color of rice is more or less similar during two time period. The odor of rice was also (50%) very good, and (50%) good before the

Farmer's Response Regarding Impact of Industrial Wastes on Crop Production

Table 2. Distribution of the respondents according to their response for size and shape, taste, color, odor and market value of rice during pre and post establishment of industry

Food quality	Categories	Rice			
		Before		After	
		F*	P*	F	P
Size and shape	Very good	50	56	6	7
	Good	40	44	60	66
	Bad	-	-	16	18
	Very bad	-	-	8	9
Taste	Very good	53	59	-	-
	Good	37	41	40	44
	Bad	-	-	28	31
	Very bad	-	-	22	25
Color	Very good	29	32	-	-
	Good	61	68	73	81
	Bad	-	-	8	9
	Very bad	-	-	9	10
Odor	Very good	45	50	-	-
	Good	45	50	44	49
	Bad	-	-	17	19
	Very bad	-	-	29	32
Market value	Very good	34	38	-	-
	Good	48	53	22	24
	Bad	8	9	42	47
	Very bad	-	-	26	29

F* = Frequency, P* = Percentage

establishment of industry, but currently it appears undesirable, (32%) very bad and bad (19%). Hence, it means that rice has lost its previous odor quality. Before establishment of industry,

market value of rice was good (53%) but it becomes bad to very bad (76%) currently. It reveals that market value of rice has also reduced after establishment of industry.

Information presented in Figure 1 show that high quality of rice was found before establishment of industry which turns to medium quality currently as stated by almost all the respondents (93%). Therefore, it is noted that rice has lost its quality after establishment of industry to a great extent.

was concluded that quality of rice has changed significantly after establishment of industry.

Impact on yield of fruit

Fruits are grown usually in the high land. Fruit yield depends on different

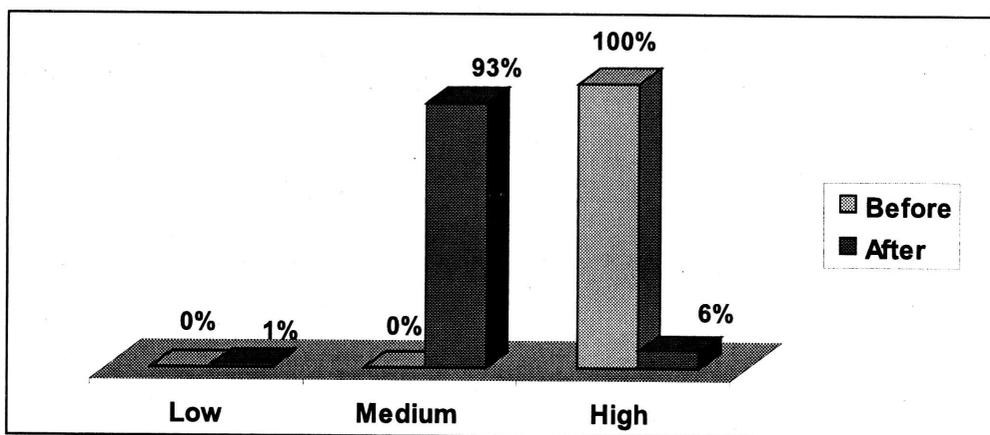


Figure 1. Comparison of rice quality between pre and post establishment of industry.

The typical variation between before and after establishment of industry in respect of quality of rice was tested by applying the following null hypothesis: "There is no significant change in rice quality of the study area between before and after establishment of industry". The calculated t-value was 27.35, which was significant at 1% level with df 89. Based on the results the null hypothesis was rejected. Therefore, it

factors like insect infestation, drought, nutrient availability, environmental stress etc. Facts furnished in Figure 2 show that previously fruit yield was high as stated by most of the respondents (87%) but after establishment of industry most of the respondents (71%) stated it as low followed by 29 percent very low. Therefore, it is observed that yield of fruit reduced after the establishment of industry.

Farmer's Response Regarding Impact of Industrial Wastes on Crop Production

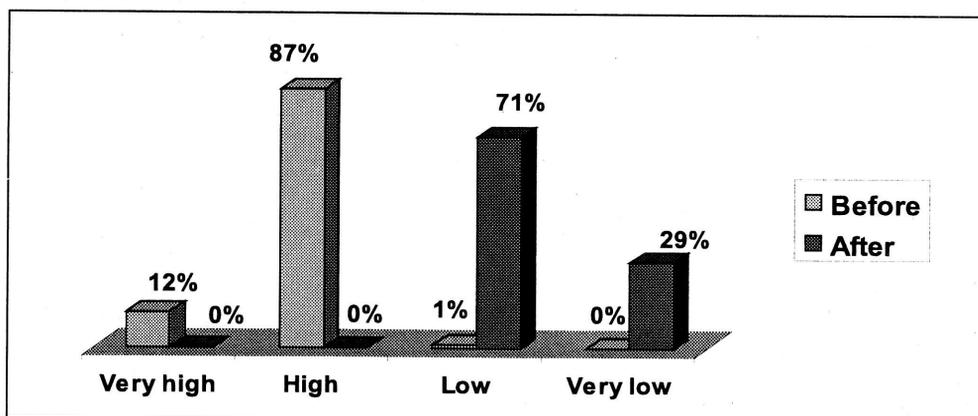


Figure 2. Comparison of fruit yield between pre and post establishment of industry.

The typical yield difference of fruit between before and after establishment of industry was computed by testing the following null hypothesis: "There is no significant change in yield of fruit of the study area between before and after establishment of industry". The calculated t-value was 23.03, which was significant at 1% level with df 89. Based on the results the null hypothesis was rejected. Therefore, it indicated that yield of fruit changed significantly after establishment of industry. Different gases like carbon dioxide, carbon monoxide, nitrogen dioxide, sulfur dioxide produced from combustion in industry might be the causes of this change.

Impact on quality of fruit

Size, shape and taste are the important components determining the quality of

fruit. The entire respondents opined that size and shape of fruit was good to very good before establishment of industry but most of the respondents (41%) stated it as bad after establishment of industry followed by 38 percent good, and 21 percent very bad (Table 3).

It indicates that after establishment of industry more than half of the respondent (62%) considered size and shape of fruit in deterioration. Before establishment of industry the taste of fruit ranged from very good (48%) and good (52%) but after establishment of industry it ranged from good (50%) and bad (50%). So, it can be said that taste of fruit changed after establishment of industry. Fruit color was considered as good to very good categories before as stated by all the respondents, while 53 percent of the respondents stated it as good followed by 39 percent bad

Table 3. Distribution of the respondents according to their response for size and shape, taste, color, odor and market value of fruit during pre and post establishment of industry

Food quality	Categories	Fruit			
		Before		After	
		F	P	F	P
Size and shape	Very good	41	46	-	-
	Good	49	54	34	38
	Bad	-	-	37	41
	Very bad	-	-	19	21
Taste	Very good	43	48	-	-
	Good	47	52	45	50
	Bad	-	-	45	50
	Very bad	-	-	-	-
Color	Very good	48	53	7	8
	Good	42	47	48	53
	Bad	-	-	35	39
	Very bad	-	-	-	-
Odor	Very good	48	53	7	8
	Good	42	47	59	65
	Bad	-	-	24	27
	Very bad	-	-	-	-
Market value	Very good	41	46	9	10
	Good	49	54	26	29
	Bad	-	-	32	35
	Very bad	-	-	23	26

F* = Frequency, P* = Percentage

category during current time. It means (53% very good and 47% good) before that after the establishment of industry the establishment of industry but it fruit quality has changed in respect of ranged from 65 percent good to 27 color. The odor of fruit was as usual percent bad after establishment of

industry. Hence, it reveals that fruit odor has changed towards bad quality after establishment of industry. Market value of fruit ranged from good (54%) to very good (46%) before establishment of industry but most of the respondents (35%) stated it as bad followed by 29 percent good and 26 percent very bad after establishment of industry. It reveals that market value of fruit reduced substantially after establishment of industry.

All the respondents considered that fruit quality was high before establishment of industry (Figure 3) but currently it changed to medium quality as stated by almost all the respondents

confirmed reduction of fruit quality which occurred after establishment of industry.

The variation between before and after establishment of industry in respect of quality of fruit was computed by testing the following null hypothesis: "There is no significant change in fruit quality of the study area between before and after establishment of industry". The calculated t-value was 25.48, which was significant at 1% level with df 89. Based on the results the null hypothesis was rejected. Therefore, it was concluded that significant change has occurred in fruit quality after establishment of industry.

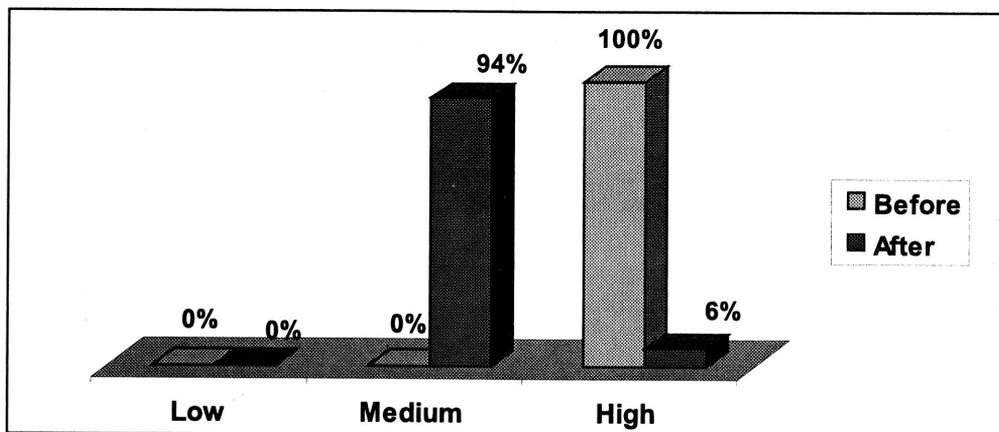


Figure 3. Comparison of fruit quality between pre and post establishment of industry.

(94%). A negligible portion of the respondents (6%) mentioned quality of fruit remaining unchanged even currently. Thus, it is clear that the opinions of the majority of the farmers

Impact on yield of vegetable

Vegetables are usually grown in both medium and high land. Production of vegetables depends on various

environmental factors like soil, water etc. However, most of the respondents (86%) opined that yield of vegetable was very high before establishment of industry (Figure 4). But after establishment of industry most of the respondents (67%) got high yield while 28 percent respondents got low yield of

Based on the results the null hypothesis was rejected. Therefore, it was concluded that yield of vegetable changed significantly after establishment of industry. Waste water irrigation in vegetable field could be the possible cause of this change.

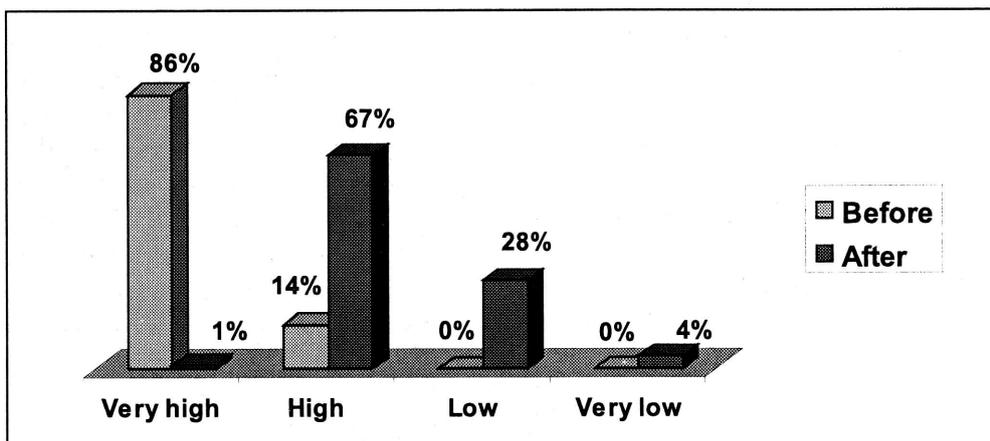


Figure 4. Comparison of vegetable yield between pre and post establishment of industry.

vegetable. It means that yield of vegetable reduced after establishment of industry.

The average yield difference of vegetable between before and after establishment of industry was tested against the null hypothesis: "There is no significant change in yield of vegetable of the study area between before and after establishment of industry". The calculated t-value was 6.86, which was significant at 1% level with df 89.

Impact on quality of vegetable

Before establishment of industry, responses on size and shape of vegetable ranged from very good (57%) and good (43%) but currently it becomes very good (8%), good (74%) and bad (18%) (Table 4). It indicates that size and shape of vegetables reduced to some extent after establishment of industry. Taste of vegetable ranged from very good (48%) and good (52%) before establishment

of industry but after establishment of industry, majority of the respondents (80%) stated it as good followed by 8 percent very good and 12 percent bad. So, it can be said that taste of vegetable

changed after establishment of industry. In the past, vegetable color varied from very good (58%) to good (42%) but after establishment of industry, three fourth of the respondents (73%) found

Table 4. Distribution of the respondents according to their response for size and shape, taste, color, odor and market value of vegetable during pre and post establishment of industry

Food quality	Categories	Vegetable			
		Before		After	
		F	P	F	P
Size and shape	Very good	51	57	7	8
	Good	39	43	67	74
	Bad	-	-	16	18
	Very bad	-	-	-	-
Taste	Very good	43	48	7	8
	Good	47	52	72	80
	Bad	-	-	11	12
	Very bad	-	-	-	-
Color	Very good	52	58	10	11
	Good	38	42	66	73
	Bad	-	-	14	16
	Very bad	-	-	-	-
Odor	Very good	51	57	-	-
	Good	39	43	75	83
	Bad	-	-	15	17
	Very bad	-	-	-	-
Market value	Very good	57	63	13	14
	Good	33	37	60	67
	Bad	-	-	17	19
	Very bad	-	-	-	-

F* = Frequency, P* = Percentage

vegetable color as good, while 16 percent found it as bad. It is obvious therefore that vegetable color has also changed. The odor of vegetable was found very good (57%) and good (43%) before establishment of industry, but currently it has changed to good (83%) and bad (17%). Hence, it reveals that odor of vegetable has also changed after establishment of industry. Previously, market value of vegetable ranged from very good (63%) and good (37%) but after establishment of industry, most of the respondents stated it as good (67%) followed by 19 percent bad. It reveals that market value of vegetable has gradually reduced during post establishment of industry.

All the respondents stated that previous quality of vegetable was high but more than half of the respondents (53%) found it as of medium quality after

establishment of industry (Figure 5). It specifies that vegetable quality has also changed currently towards adverse direction.

The variation of vegetable quality between pre and post establishment of industry was computed by testing the following null hypothesis: "There is no significant change in quality of vegetable of the study area between before and after establishment of industry". The calculated t-value was 20.31, which was significant at 1% level with df 89. Based on the results the null hypothesis was rejected. Therefore, it was concluded that quality of vegetable has changed significantly after the establishment of industry.

From the aforesaid findings it can be concluded that yield and quality of rice, fruits and vegetables reduced adversely due to unwise discharge from the

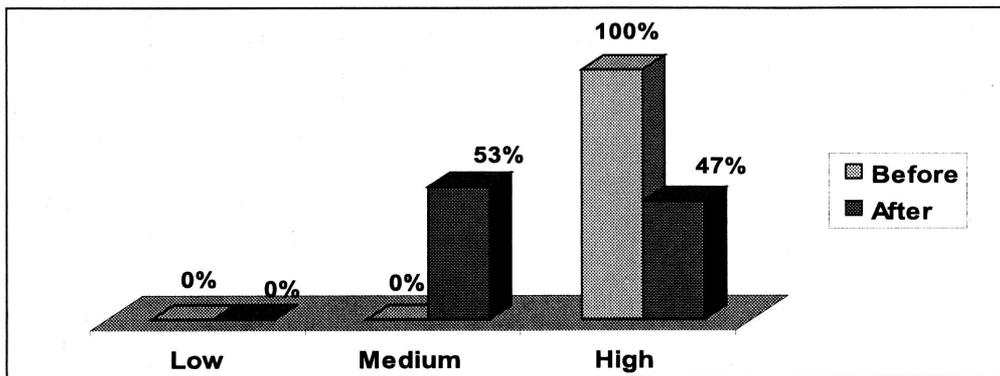


Figure 5. Comparison of vegetable quality between pre and post establishment of industry.

industry. The practice of discharging untreated industrial wastes into water bodies as well as crop field is harmful for crop. Hence, it is recommended that Government departments especially the Department of Environment (DOE), Bangladesh industrial associations and chambers, research institutions, nongovernmental organizations and legal experts need to work together to increase awareness among industrialists to establish effluent treatment plant (ETP) in each industry. Besides, environmental act should be implemented to increase crop production and compensate for the affected people of the study area in future.

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