

# Impact of polluted Yamuna water on the agricultural practices performed by the farming community (Delhi).

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**Abstract—** This paper describes the impact of polluted Yamuna water on the agricultural practices performed by the farming community (Delhi). This study was undertaken to explore the effects on soil, agricultural practices, and cropping pattern due to Yamuna river pollution. For the study two locales, i.e. Mayur Vihar and Okhla were taken in Delhi. In Okhla, the land is reported to be more infertile and resulted in a decrease in crop production. In Okhla, 96.7% of the respondents reported that the quality of crops has been affected by the Yamuna water. In Mayur Vihar as well as the Okhla area, the majority of the respondents reported that incidences of pests have increased in the plants in the last 10 years

**Index Terms—** Yamuna, Delhi, Okhla, Mayur Vihar, Farming community, Agriculture, Pesticides, Water, River

## 1 INTRODUCTION

Water is one of the most essential as well as exploited natural resources. It was mentioned in a UNESCO report that the earth has only 2.5% freshwater; suitable for human consumption. As the human population increases, the stress on water resources also increases because surface water is limited and is being depleted day by day due to human consumption; ecological systems; agricultural and industrial purposes; and economic development. The demand for water in agriculture is increasing day by day. Shortage of freshwater drives farmers to use polluted water for irrigating agricultural fields. The yielding of crops depends on the quality and quantity of water as well as on the properties of soil. The polluted river water contaminates not only plants but also the human. The study conducted in the Faisalabad city, Pakistan concluded that Industries have been discharging waste material in gases, liquid, and solid form which has been destroying the crops and human health. Many diseases like Hepatitis, Lung diseases, Throat diseases, Gastro, Diarrhea, Skin diseases, and many other types of health infections are faced by people [1].

Yamuna River begins from Yamunotri and crosses many states – Himachal Pradesh, Uttar Pradesh, Uttarakhand, Haryana, and Delhi; stretch nearly 1380 km [2]. It is a sacred river and its water is extensively used for various purposes such as irrigation, bathing, domestic water supply, etc. It is estimated that Yamuna water is used by approximately 57 million people a day. In Delhi, sewage drain falling in the Yamuna is around 3296 MLD (million liters per day) and approximately 3.5 lakh jhuggis are on the Yamuna river bed which contributes to huge quantities of waste in Yamuna River within the capital, undoubtedly being one of the most polluted rivers of the country [3]. It is believed that most of the pollution in the Yamuna occurs during its journey. A large amount of heavy metals is found in the Yamuna river and Delhi is highly polluted in terms of the presence of heavy metals [4].

Dangerously high level of metals like cobalt, nickel, zinc, cadmium, chromium in river water causes various diseases (Kumar,2010). Not only the health of people is getting affected by Yamuna pollution but also agriculture. Yamuna water is used in irrigation which contaminates the soil, so the crops grown in that soil get contaminated. According to the report of TERI (2014), common vegetables like brinjals, cauliflower, radish, tomato, and cabbage contain all kinds of the pathogen, high traces of heavy metals and pesticides. Due to urbanization, water is continuously exhaled which leads to a decrease in the water table. Disposal of solid and liquid waste, encroachment upon the river waterway also aids in the degradation of the quality of water bodies threatens the livelihood of people [5]. Groundwater pollution has affected the economic condition through changes in cropping patterns, reduction in crop yield, as well as reduced longevity of irrigation [6].

### Objectives:

- To determine the link between water pollution and agriculture.
- To find out the level of awareness of respondents regarding pollution of Yamuna river water.
- To see and analyze the change in cropping pattern due to Yamuna river pollution.

### Study area:

To ascertain the impact of Yamuna water pollution on agriculture of the agricultural workers living alongside the Yamuna River, Delhi was selected as the locale of the study because of the easy accessibility. In Delhi, the study was conducted on the riverbed area of Mayur vihar and Okhla.

### Methodology:

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To interact with the agricultural workers and to know the changes in cropping patterns due to Yamuna river pollution, a semi-structured questionnaire cum interview schedule was prepared and used in selected locales. The observation method was also used to get a holistic view of these issues.

#### *Semi-structured interview schedule:*

To assess the agricultural impact resulting from river degradation, semi-structured interviews were conducted amongst agricultural laborers who are directly affected by river water pollution. The selection of respondents was taken from two different locations (Mayur Vihar area and Okhla) along the river course who are engaged in agricultural activities. A total of 60 respondents were interviewed from both study locales.

**Table1: Number of respondents taken for the study**

Number of respondents taken for the study	Area of the study
30 respondents	Mayur Vihar
30 respondents	Okhla

The semi-structured interviews were primarily focused on assessing the trend of river degradation, factors, and processes leading to river degradation and their relative contribution and impacts on the agricultural practices of the farming communities living alongside the river Yamuna.

#### *Observation method*

The approach used in this study was observational research in which agricultural laborers were observed to keep an eye on the whole day activities performed by them to get a better understanding of the issue. Whole-day agricultural activities like the type of pesticide usage, methods of irrigation, kind of water used in irrigation, selection of crops, etc. were observed. This method was used to provide a more graphic description of a social life than can be acquired in other ways.

#### **Result and Discussion:**

**Table 2. Distribution of respondents based on income**

Okhla	
Income (Rs/year)	Percentage (%)
Below 15,000	0
15,001– 30000	0
30,001 – 45,000	100
45,001and above	0

\*N=60, 30 respondents each from Mayur Vihar area and Okhla

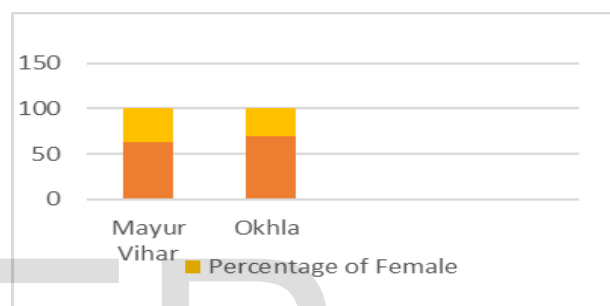
Mayur Vihar	
Income (Rs/year)	Percentage (%)
Below 15,000	0
15,001– 30000	0
30,001 – 45,000	100
45,001and above	0

\*N=60,

30 respondents each from Mayur vihar area and Okhla area

The table 2 suggests that all respondents from both Mayur Vihar area and Okhla area belong to the category of 30,000 to 45,000 Rs/year. As they all are agricultural laborers and they almost have same amount of land to work on; their income level is almost same.

**Graph 1. Distribution of respondents based on gender**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla

Among 60 respondents who were interviewed more than half were male, in both Mayur Vihar (63.3%) and Okhla (70%), as compared to the females 36.7% and 30% in Mayur Vihar and Okhla respectively.

**Table 3. Distribution of respondents based on accuracy of land cultivated**

Mayur Vihar		
Amount of land (in acre)	Frequency (f)	Percentage (%)
Below 1	17	56.6
1.1-1.5	11	36.7
1.6-2	2	6.7
2 and above	0	0

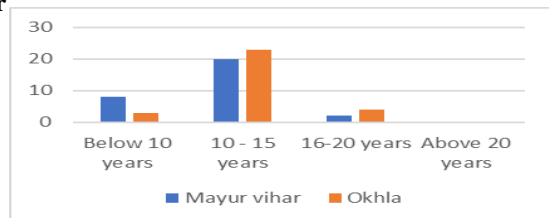
\*N=60, 30 respondents each from Mayur Vihar area and Okhla

Okhla		
Amount of land (in acre)	Frequency (f)	Percentage (%)
Below 1	21	70
1.1-1.5	9	30
1.6-2	0	0
2 and above	0	0

\*N=60, 30 respondents each from Mayur Vihar area and Okhla

During the interview, it was revealed that 56.6% and 70% of the agricultural laborers work on below 1 acre of land in the Mayur Vihar area and Okhla respectively. 36.7% of the respondents of the Mayur Vihar area and 30% of the respondents of Okhla work on land between 1.1 to 1.5 acres of land. Only a few of the respondents (6.7% respondents of the Mayur Vihar area) work on the field between the land of 1.6 to 2 acres.

**Graph 2. Distribution of respondents based on the duration residing near the river**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla

During the interview, it was found that 26.7% of respondents of Mayur Vihar were living nearby years whereas only 10% of respondents of Okhla were living there. More than half of the respondents (66.7%) were living in the Mayur Vihar area for the last 10 to 15 years whereas in Okhla 76.7% of respondents were living for the last 10 to 15 years. Some respondents (6.6% in the Mayur Vihar area and 13.3% in Okhla) were living nearby Yamuna bank for 16 to 20 years.

**Table 4. Distribution of respondents based on their opinion on the status of Yamuna water**

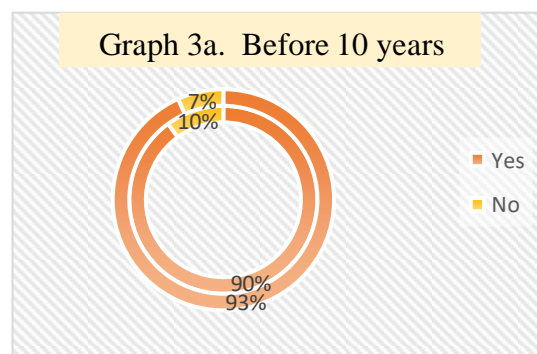
Okhla		
Status of Yamuna water	Frequency(f)	Percentage(%)
Excellent	0	0
Good	0	0
Bad	2	6.7
Very bad	28	93.3

Mayur Vihar		
Status of Yamuna water	Frequency(f)	Percentage(%)
Excellent	0	0
Good	0	0
Bad	24	80
Very bad	6	20

In 2009, the Municipal Corporation of Delhi (MCD) found 15% of Delhi's water to be unfit for drinking. Contamination was found to be highest in South Delhi with 50% of the sample reported to the polluted [8]. The main causes of water pollution of the Yamuna river are untreated industrial effluents, untreated domestic wastewater, agricultural run-off, and religious waste [9],[10]. As per Table 4, 80% of the respondents in the Mayur Vihar area reported that the status of Yamuna water is bad whereas the remaining 20% of the respondents said that its status is very bad. While, in Okhla, most of the respondents (93.3%) said the Yamuna water status is

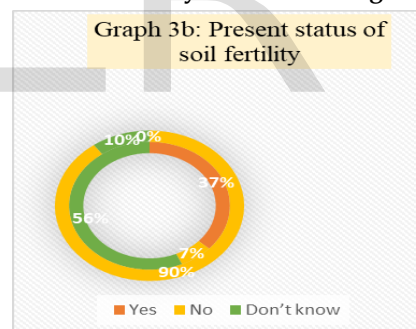
very bad and it is not suitable for drinking purposes at all that is why they use Delhi Jal board's water. Yamuna water is used in agriculture as it is the only source of irrigation in both areas. In the Mayur Vihar area, people do not drink direct water from the Yamuna. The water table of underground water is high near the Yamuna and people pump up the water for drinking purposes. Indirectly people are exposed to Yamuna water for drinking purposes in the Mayur Vihar area.

**Graph 3a. Distribution of the respondents based on their awareness about the fertility of the soil of agricultural fields before 10 years.**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla  
The inner-circle represents Mayur Vihar while the outer circle represents Okhla

**Graph 3b. Distribution of the respondents based on their awareness about the fertility of the soil of agricultural fields.**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla  
The inner-circle represents Mayur Vihar while the outer circle represents Okhla

The researcher tried to get the data on the change of fertility level of soil in the last ten years. Table 3a shows that in the Mayur Vihar area, 56.6% of the respondents were not sure about the fertility of the soil but in Okhla, 90% of the respondents were sure of the view that the land is not fertile the way it used to be ten years ago. Agra canal is the endpoint of the Yamuna in Delhi. It is siphoned off and turned to an open sewer till this end. 93.3 % of the respondents of Okhla said that soil was fertile 10 years ago but is becoming infertile day by day. Whereas in the Mayur Vihar area, 90% of the respondents said that land used to be fertile 10 years ago. A study done by Mohammad and Muzareh (2003) exposed that the Application of Polluted water impacts fertility and chemical parameter of soil [11]. The continuous application may lead to soil accumulation of heavy

metal and plant nutrients which may result in nutrient imbalance, leaching, accumulation of salt. If this is not managed properly then reduces soil fertility and productivity.

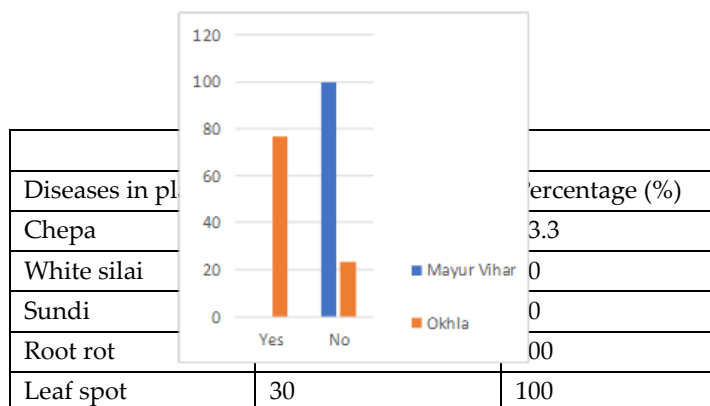
**Table 5. Distribution of the respondents based on their opinion regarding the decrease in crop production**

Mayur Vihar		Okhla	
The decrease in crop production	Percentage (%)	The decrease in crop production	Percentage (%)
Yes	10	Yes	100
No	90	No	0

\*N=60, 30 respondents each from Mayur Vihar area and Okhla

With the advancement of industrialization and urbanization, the amount of water production increases, and this waste drains into the river. Polluted water is used to irrigate agricultural fields which gradually affects the production of crops. During the interview, it was revealed that in the Mayur Vihar area, 90% of the respondents reported that their crop production has not decreased in the last 10 years. Only 10% of the respondents stated that the crop production rate has decreased. In Okhla, all respondents reported that the production of their crops has been affected badly. Their land is becoming infertile and the rate of production is decreasing day by day. A study was conducted in Jamber Khurd, Punjab province, Pakistan, to determine the effects of using polluted water for irrigation which disturbed the quality of groundwater and then its ultimate effects on the environment and health of common man living in the area. It was found that parameters like turbidity, E.coli, conductivity, SAR, RSC exceed National Environmental Quality Standards for irrigation. Metals like Fe, Mn, Zn, Cu, Cr, and Co were found higher in concentration. This polluted water used in irrigation caused a disturbance in the production of crops, health hazards of human beings, and aquatic life [12].

**Graph 4. Distribution of the respondents based on the change in cropping pattern**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla

Graph 4 clearly shows that according to all the respondents of the Mayur Vihar area, no change in cropping pattern has taken place in the last 10 years. They grow vegetables and its demand is all over

Mayur Vihar		
Pests due to Yamuna water	Frequency(f)	Percentage (%)
Yes	25	83.3
No	5	16.7

the year. As per the reason they have been growing for years. In

Okhla		
Pests due to Yamuna water	Frequency(f)	Percentage (%)
Yes	28	93.3
No	2	6.7

Okhla, 76.7 % of the respondents had changed their cropping pattern according to the demand of the market. Whereas another 23.3% of the respondents believed that there was no need to change in their cropping pattern.

**Table 6. Distribution of the respondents based on their opinion on the prevalence of pests in crops caused by Yamuna water**

\*N=60, 30 respondents each from Mayur Vihar area and Okhla

During the interview, it was revealed that 83.3% of the respondents of the Mayur Vihar area believed that the occurrence of diseases and other pests are in crops due to Yamuna water while other 16.7% said that polluted Yamuna water is not responsible for any pests. 93.3% of respondents of Okhla said that incidences of pests have increased because of Yamuna water while 6.7% believed that diseases are not caused by Yamuna water. In 2010, the study "Capacity Development Project on Safe Use of Wastewater in Agriculture" was taken to assess the impact of wastewater. They found that the availability of wastewater is an asset for the farming community as it contributes to irrigating fields. But it increases the incidences of excess weeds, crop diseases, and pests in the field [13].

**Table 7. Distribution of the respondents based on reporting of pests**

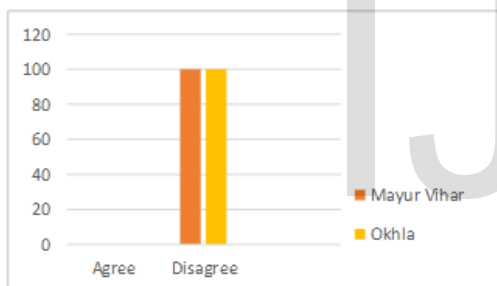
Okhla		
Diseases in plants	Frequency (f)	Percentage (%)
Blight	12	40
Root rot	30	100
Sundi	24	80
Leaf spot	26	86.7

\*N=60, 30 respondents each from Mayur Vihar area and Okhla

\*Multiple answers are given by the respondents

According to the respondents of the Mayur Vihar area and Okhla, diseases like root rot and leaf spots are mostly found in crops. Chepa, White silai, and Sundi were said to be commonly found in the Mayur Vihar area whereas Sundi and Blight were reported to be found in Okhla. A study "Wastewater agriculture in Kurunegala city, Sri Lanka" was taken to assess the relationship between wastewater and insect attack. It was found that incidents of insect attacks are comparatively higher when wastewater is used to irrigate the agricultural area. 77% of the overall attacks were especially by mites and paddy bugs [14]. In the present study, the incidence of leaf spot and root rot in both the locales was also higher.

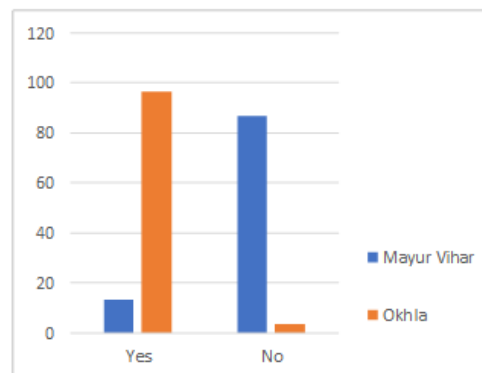
**Graph 5. Distribution of the respondents based on the perception that shining is provided by Yamuna water to the produce**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla

An article covered by India Today (2012) "Vegetable washed in highly- polluted Yamuna could kill you" states that at Delhi's wholesale markets, most of the vegetables are washed in Yamuna water which is highly toxic to give a shine to the produce. All the respondents (100%) of Mayur Vihar and Okhla stated that wax and oils have been used by them to give shine to the vegetables. Although it increases the demand cost of the vegetable also increases. The present investigation found that none of the respondents was of the view of having the shine on the vegetables due to Yamuna water.

**Graph 6. Distribution of the respondents based on the perception of the effects of Yamuna water on the taste of crops**



\*N=60, 30 respondents each from Mayur Vihar area and Okhla

Excessive accumulation of heavy metals in agricultural soils through wastewater irrigation, may not only result in soil contamination, but also lead to elevated heavy metal uptake by crops, and thus affect food quality and safety. In 2009, it was found out that the long-term wastewater irrigation has led to contamination of soils and food crops in the study areas, which affects the quality of the vegetables and crops [15]. It was revealed that 86.7% of the respondents of the Mayur Vihar area did not agree that taste and other quality parameters of crops are affected by Yamuna water whereas the rest 13.3% of respondents agreed that it affects the quality. In Okhla, 96.7% of the respondents agreed that taste and other quality parameters of crops are affected by Yamuna water.

**Table 8. Distribution of the respondents based on the use of Green manuring**

Mayur Vihar		
Usage of Green manuring	Frequency (f)	Percentage (%)
Yes	7	23.3
No	23	76.7

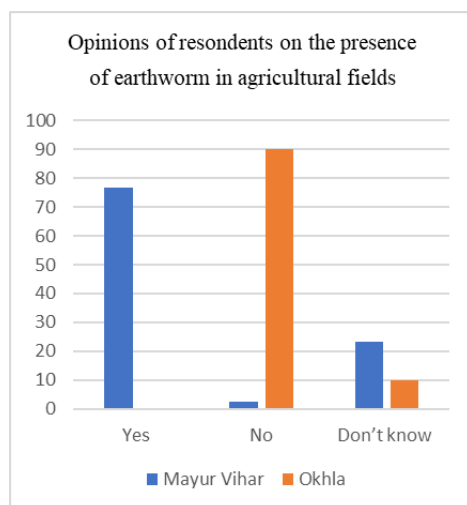
Okhla		
Usage of Green manuring	Frequency (f)	Percentage (%)
Yes	0	0
No	30	100

\*N=60, 30 respondents each from Mayur Vihar area and Okhla

Green manuring plays an important role to maintain the fertility and nutrients of the soil. It was found out that only 23.3% of the respondents of the Mayur Vihar area practice green manuring in their fields about one or two times in a year while 76.7% of the respondents did not practice. Whereas in Okhla, no one practiced green manuring in their agriculture field, so there is a need for intervention in this regard.

**Graph 7. Distribution of the respondents based on the presence of earthworms in the agricultural field**





\*N=60, 30 respondents each from Mayur Vihar area and Okhla

As per graph 7, 76.6% of the respondents of the Mayur Vihar area said that earthworms have been found in their agricultural field while 23.3% of the respondents are not aware of it. Whereas in Okhla, 90% of the respondents said that the earthworm has not been found out in their agricultural field, other 10% of the respondents did not know about it.

### Conclusion:

As the Yamuna river crosses Delhi, it becomes more polluted. The effects of the Yamuna river on the Okhla region are more severe than in Mayur Vihar i.e., decrease in crop production, infertile land, more diseases, and pests on crops.

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