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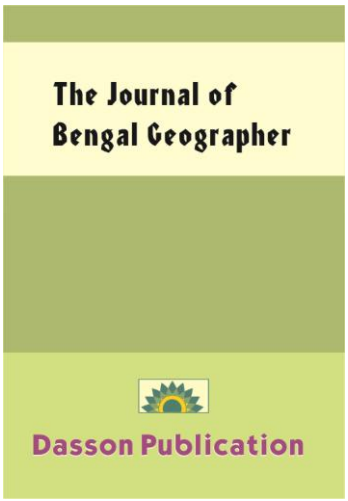

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Impact of modern agricultural technology on environment: a case study in Memari block of Burdwan district, West Bengal

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Abstract

The present study is an attempt to identify major environmental impacts due to application of modern technologies in agriculture. Technology refers to how to cultivate a crop successfully. This success can be obtain by knowing how to apply fertilizer, control pests and take care of crops for its healthy and good growth. There are no way to doubt that modern technologies are the best method of improving the yields of crops, protecting crops against disease and pest, making livestock healthy at all the time, but there are also some environmental issues relating to this improved agricultural inputs. Rapid population growth & economic development (mainly due to agricultural expansion and development) are threatening the environment through expansion and intensification of agriculture, uncontrolled growth of urbanization, industrialization and destruction of natural habits. The growing population put immense pressure on land at the cost of forest and engages on land modification and extensification because the demand of food could not increase substantially to population. Thus horizontal extension of land has fewer scopes and relies mostly on vertical improvements (i.e. production) that is supported by technical development in the field of agriculture i.e. HYV seeds, fertilizers, pesticides, herbicides, and agricultural implements. All these particles are causing degradation and depletion of environment with multiplying ratio. The main objective of the present study is to study the significant Spatio-temporal change in both its agricultural practice and environmental impact. A case study method has applied in this study in order to obtain field level data collection.

Key Words *: 1.Agricultural development, 2. Modern technologies, 3.Use of improved inputs, 4.Major environmental impacts.*

Introduction

Agriculture is one of the most important and significance economic sector. Agriculture has a major contribution to employment, foreign exchange, food and its linkage with other economic sector. Agricultural system is the result of a complex interaction of a number of interdependent components, like soil, water, seeds, crops, livestock, labor and other resources within an environmental setting. There exists a deep relationship between agricultural land use and environment. As different land use practice requires different sets of environmental condition. The scale and magnitude of agricultural practice affect the natural environment. Modern agricultural practice has undoubtedly given fresh lease to agricultural land use but at cost of environmental consequences (Mather, 1986)Since the mid sixties of the present century the traditional agricultural practice have been undergone and considerable changes with the adoption of technological innovation in agricultural field to feed the increasing population especially like our developing country. But the environmentalists are very deliberate by these innovations because they adversely affected the total environmental system.

Statement of problem

With the increasing rate of growing population in recent few decades leads to invent some new technologies in the field of agriculture and manipulative sectors to produce more to fulfill the growing needs of human populations. Here two facts come in hand :

1. The area of arable land decreases due to multidimensional aspect of population growth and their activities.

2. Production remains increasing even decreasing land. So, simple result in this regard that human's external influents are exerted on agricultural land which leads to broken the balanced ecological structure and exert a great impacts on environment.

The impact of natural process on human activities and the manipulative impacts of human activities on environmental process, arising out problems of these interactions and remedial measures leading to environmental management and natural or man-made disaster reduction on forehand. High level of deforestation to fulfill the food demand of growing population and increased intensity of irrigation mainly in term of ground water extraction are main cause of environmental degradation. The data have been analyzed from various secondary and primary sources. Finally some suggestion has been made to reclamation of agricultural field in productive purpose and finds some alternative sources of irrigation to save ground water resources.

Objectives

It is necessary to assess Environmental impacts to identify more effective mode of technological application to larger scale in agriculture. In this context, I decide to carry out a study on "Impact of Modern Agricultural Technology on Environment: A Case Study in Memari Block of Burdwan District, West Bengal." The key objectives of the present study are:

1. To identify the major changes in agricultural inputs in the study area
2. To assess the impacts of influential agricultural activities in Memari Block of Burdwan district
3. To analysis factors behind the environmental impacts of those activities
4. To identify the environmental problems associated with the changes in agricultural activity and agricultural land use in the study area
5. To suggest some remedial measures and alternatives avenues to mitigate such environmental problems

Value of the study

Scientific Value	Practical Value
1. The study result will contribute to improvement of scientific basis for development and management of environment through sustainable agricultural practice.	1. The study will help the farmers in this region in more effective agricultural practice and production which not damaging the ecological environmental balance.
2. The study result will serve as scientific basis for orientation in sustainable exploitation and protection of environment toward agricultural planning.	2. The study will contribute to the increase of public awareness toward environmental planning viewing sustainable development.

Study area

Physio-socio-economic aspect

The study area represents a small tract of east-central Burdwan district comprising the Memari block (Memari-I and Memari-II). This area extended from 23°10'34" N to 23°15'55" N latitude and

88°06'25"E to 88°08'59"E longitude. Total area covers by this block are 385.89 sq km. It have an average elevation of 25 meters (82 feet). The summer temperatures in this block ranges between 26 °C (79 °F) and 40 °C (104 °F) while the winter temperatures range from 13 °C (55 °F) to 19 °C (66 °F). The annual average Rainfall ranges between 200 to 400 cm. Adequate rainfall in the plains area influences crop production. The hot wet climate is good for the production of Rice and cold winter climate is good for Potato production. On 2011 census, Memari had a population of 38191.00 among which 52% male and 48% female. This block has an average literacy rate of 69%. In 30 years time span (1981-2011) there is 52.2% population increase in the whole block. The study area is predominantly agriculture with 77.12% (2011) of its population is engaged in agriculture and allied activities. The study area has experienced significant Spatio-temporal change both its agricultural practice and environmental impact during the time span.

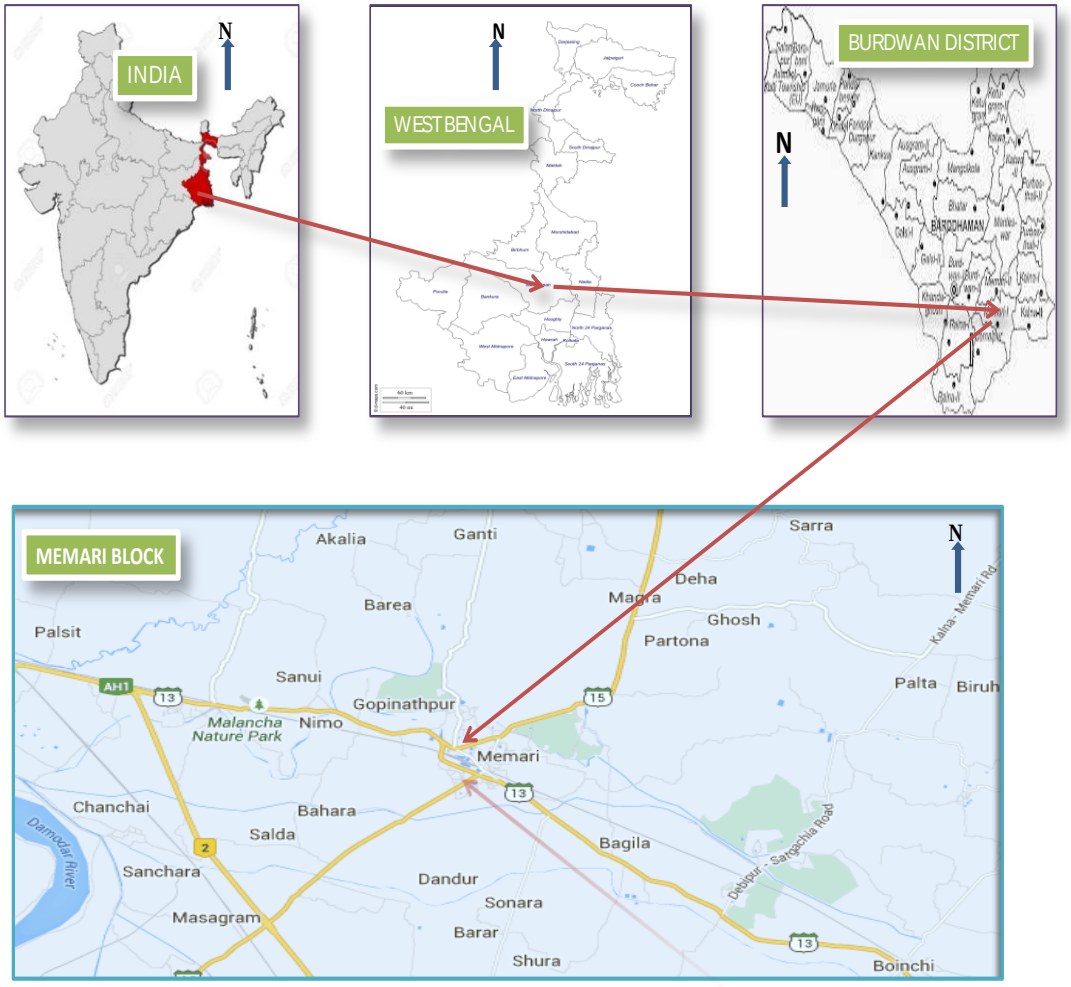


Fig: 1. Location map of the study area (Not to scale)

Sourse of data & method of study

The Methodology of the present study includes collection of research material over the field study and direct observation method. The study is based on both primary and secondary data. Primary data had collected based on a case study method during March of 2015 from the agricultural field of the study area. Primary data had also been collected by direct observation in the field and interview method with the local farmers. Secondary had been collecting from various authenticate

sources like District census handbook, Directorate of agriculture, Govt. of W.B and Bureau of economics & statistics, Govt. of W.B., District Census Handbook (1981, 1991, 2001 & 2011), reference books, various literatures, research papers and article related to this topic.

Major findings & hypothetical analysis

The environmental impacts of agriculture based on the wide variety of agricultural practices employed around the study area. Ultimately the environmental impacts depend on the production practices of the system used by the farmers. The connection between emission into the environment and the farming system is indirect, as it also depends on other climatic variables such as rainfall and temperatures. On an average about 70% of the total population belongs to the agricultural .The eastern, northern, southern and central areas of the block are extensively cultivated. The cultivation in the block has improved since 1953 with the implementation of the irrigation projects undertaken by the Damodar Valley Corporation (DVC). Up to 1953 the cultivation was entirely dependent on the monsoon, and irrigation facilities were rather inadequate and more or less primitive. The position has since been changed and an all-round agricultural development has become possible. At present with the utilization of mini and cellow (in local term) with the assistance of West Bengal Government, the problems related to irrigation are solved.

Cropping pattern of the block

Rice and potato is the most important crop of the block. The rice grown with its numerous varieties can broadly grouped under the three primary classes distinguished from one another by distinct characteristics and they are: The Aus or autumn, the Aman or winter and the Boro or the summer rice. Paddy covers maximum of the gross cropped area in the block. Productivity of the major crops grown in the district is indicated below. Major **cropping patterns include paddy-wheat-vegetables, paddy – potato – sesame, paddy – vegetable – mustard and jute – paddy – vegetables.** It is evident from the agricultural calendar (**Fig: 2**) of the block that there is a close relation between the pattern of cultivation i.e. cropping pattern and the prevailing climate. This can be illustrated by the following facts;

Rice (Aman) - is sown between July and mid of August i.e. during the onset of monsoon. During monsoon, it is left to be grown on the field and harvesting is done in the post monsoon period i.e. between December to the mid of January.

Rice (Boro) - is sown in-between mid of December to mid of January; and left to be grown on the field up to the end of March and generally harvested in April and May.

Potato- is sown from November to the mid of December and some time up to the mid of February. It takes time to grow and is harvested at the last week of March.

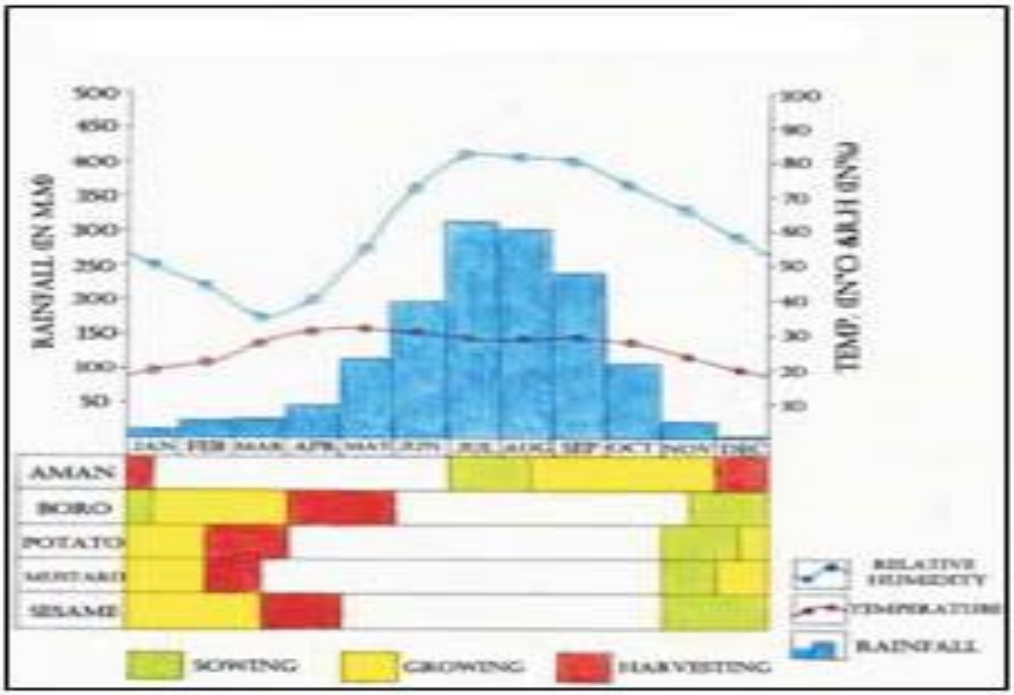


Fig: 2. ERGOGRAPH, showing the relationship between Temperature, Rainfall and Crop.

As the main objectives of the present research is to identify the major impacts on the environment due to the agricultural practices with advanced technologies. An extensive investigation was done through case study method in the local agricultural field to obtain the real experiences about the spatial and temporal changes in agricultural fields and surrounding environment. The most expected findings came in this regard are-

Use of Improved Agricultural Inputs & Effect on the Environment

- **Use of Chemical Fertilizers and effect on cultivated soil**

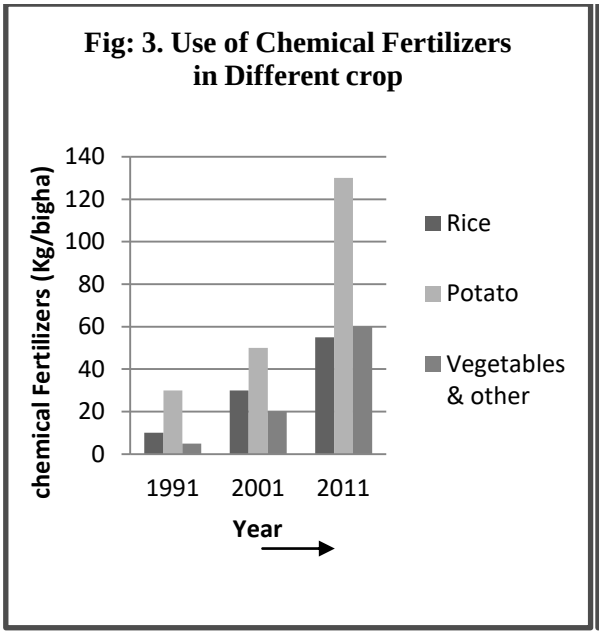
the agriculyural productivity of the study area are completely dependend on chemical fertilizer. A marginal farmer uses more than 130kg chemical fertilizers (**100kg 10: 26: 26 + 20kg Urea + 10kg other**) in one bigha potato field in the study area. The soil of the study area has no power to produce anything without the use of chemical fertilizers. But just before 30 years there were no use of chemical fertilizers, only bio-fertilizers were there. So, only in 30 year time span there come huge change in agricultural inputs.

Table: 1. Trends in changes of Agricultural Inputs during 1991- 2011.

Crop type	Use of Chemical fertilizers (Kg/ Bigha)			Use of Bio-fertilizers (Kg/ Bigha)		
	1991	2001	2011	1991	2001	2011
Rice	10	30	55	35	10	--
Potato	30	50	130	90	40	05
Vegetables & others	05	20	60	50	10	--

Note: -- Nil.

Source: Data Tabulated by author from District Handbook- 2011.



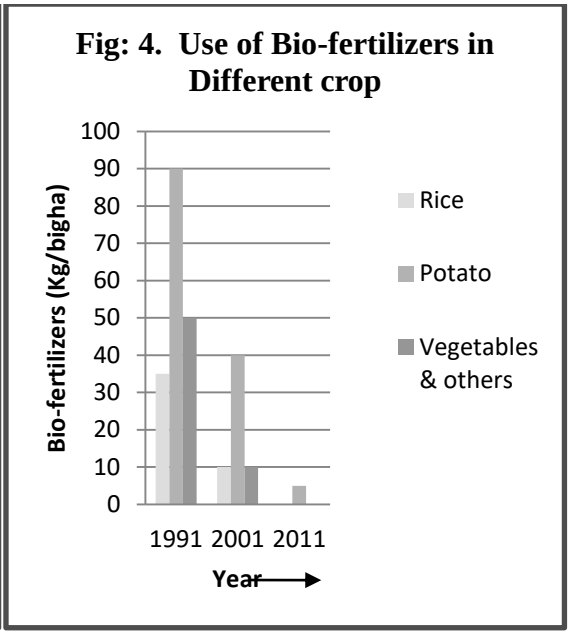
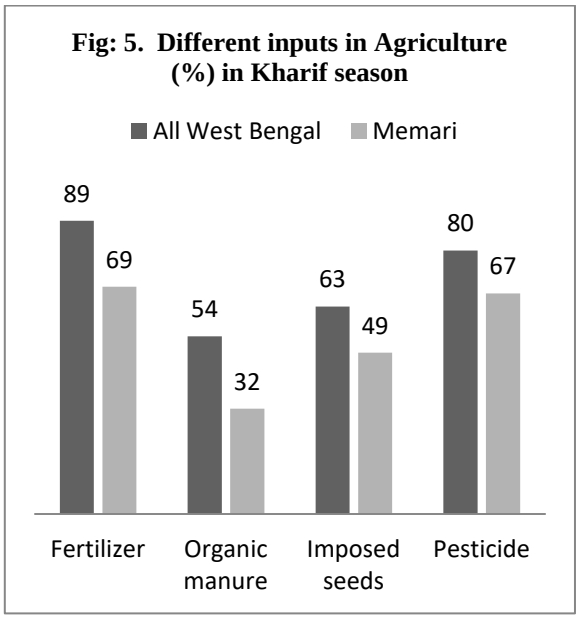
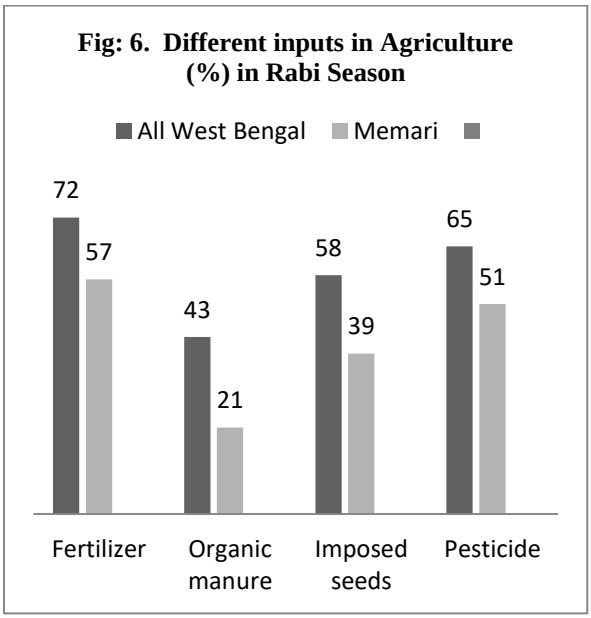


Table: 2. Distribution of Farmers Holding using different inputs (In %)

	All West Bengal		Memari block	
Input	Kharif	Rabi	Kharif	Rabi
Fertilizers	89	72	69	57
Organic manure	54	43	32	21
Imposed seeds	63	58	49	39
Pesticides	80	65	67	51

Source- N S S Report No. 496, some aspect of farming- 2009.





The chemical properties of soil were influenced by different sources of soil nutrients (organic and chemical). Soil pH varied significantly with the treatments and it decreased with organic manures application and combined application but increased with only chemical fertilizer application. The result is supported by Yadav et. al. (2002). Soil organic matter was decreased by chemical

fertilizer application but was increased with all types of organic manure application and that was recorded the highest with combined application. The result is supported by Wells et. al. (2000). Availability of major plant nutrients like N, P, K and S were also affected by organic cultivation of brinjal (**photo: 1**). In all cases the nutrient availability increased and the highest availability of N, P and S was found from poultry manure and the highest availability of K was from cowdung followed by poultry manure. In all the cases the lowest value was found from chemical fertilizer application. The result might be due to improvement of other physical and chemical properties for organic manure application compared to the chemical fertilizer application. It was found that the use of chemical fertilizers increase day by day (**Fig: 3. & 4.**)which highly damage & degrade the cultivated soil in the study area. (**photo: 2 & 3**.)

Photo: 1. Use of chemical fertilizers in agricultural field

Photo: 2. Effect of Pesticide and herbicide on cultivated soil

Photo: 3. Sample collection by author (soil with high pH value)

Source: Photos are collected by author during field study.

- **Use of machineries & effect on land use:**

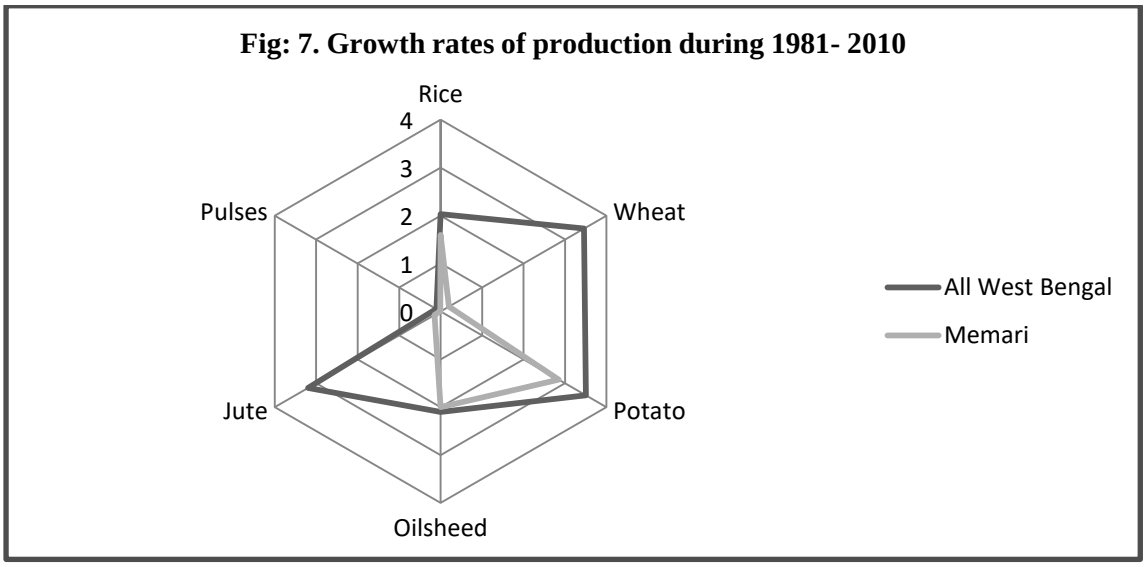
With the application of high-tech machineries in agricultural process, the production become increased more than two-times than before but the cultivated land gradually towards degraded. **Table. 3** Shows the grdual growth rate of production in study area.

Table: 3. Trend in Growth Rates Of Production Of Different Crops. During 1981-2010. (In 0000' tons)

Crop types	All West Bengal.	In Memari Block
Rice	2.03	1.60
Wheat	3.46	0.20
Potato	3.50	2.85
Oilseeds	2.10	2.00
Jute	3.20	0.15
Pulses	0.10	0.01

Source- Govt. of West Bengal. Economic Review, 2008-2009.

Fig: 7. Growth rates of production during 1981- 2010



Heavy agricultural machinery results in more permanent damage to the soil than previously believed by researchers. This may lead to poorer crop yields and increased pollution from agricultural land, is the message of a group of Nordic researchers. The result is called soil compaction and it concerns the negative effect of driving heavy machinery on soil that is used for growing plants. Soil compaction is characterized by increased density of the soil, reduced air volume and a reduced ability to drain off surplus water (The Research Council of Norway). The same case happened in the study area, now soil compaction and other cultivated land related problems are very commom in Memari block of Burdwan District (**Photo- 5**). The application and use of improved machineries in agricultural field at present day (i.e. Tractor, Rotavator, Harvester, etc) engages with various changes with land use pattern, irrigation system, and water composition (**Photo- 4 & 6**).

Photo: 4. Machineries are engaged in land modification

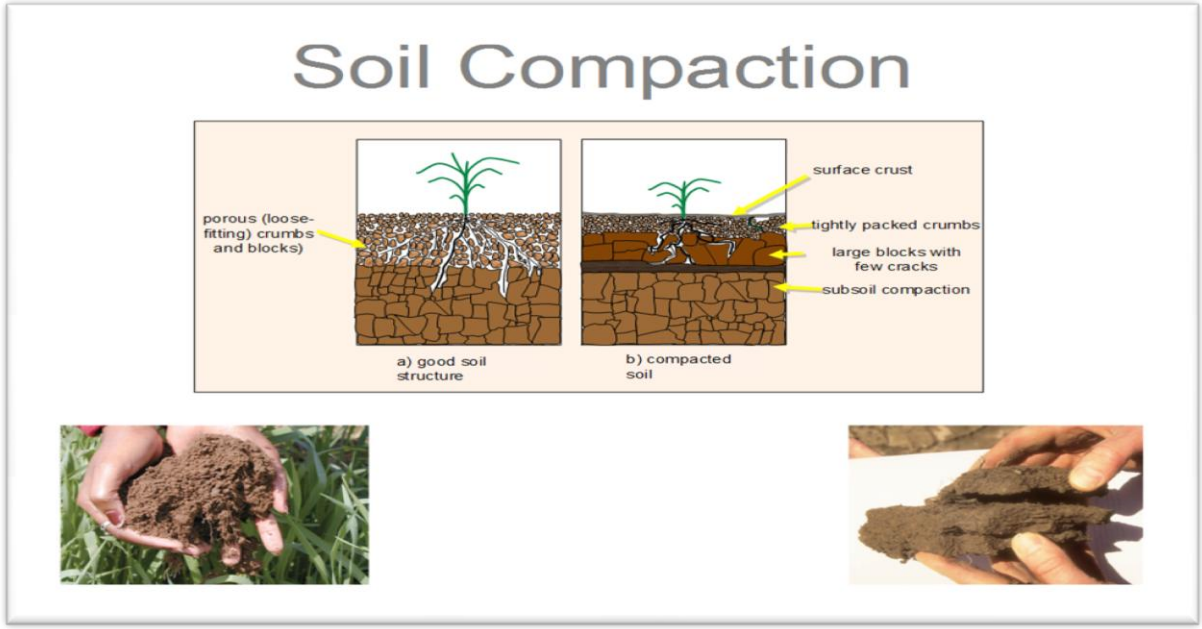


Photo: 5. Soil Compaction and effect on Crop growth

Photo: 6. Agricultural land Effected in compaction by heavy macheniries.

- **Irrigation, Ground water exploitation and its Impact on environment**

Irrigated area has increased about 20% during these 30 years of time span in the whole block mainly by hand of canal irrigation and ground water extraction by deep tube wells. The **environmental impacts of irrigation** relate to the changes in quantity and quality of soil and water as a result of irrigation and the effects on natural and social conditions in river basins and downstream. Excessive canal irrigation with improved drainage system has resulted in destabilization of water balance. Loss of ground water recharge in a high rate is take place in this area, which destroyed the ground water cycle and result in water crisis that evident from the decrease beyond the level of water table during summer.

Photo: 7. Eutrophication & water degradation due to irrigation.

Source: Photos are collected by author from study area.

- **Pollutants &degradation of soil**

Agricultura is a necessary means of survival, without which there would be famines all over the world. For thousands of years, agricultural was a natural process that did not harm the land it was done on. In fact, farmers were able to pass down their land for many generations and it would still be fertile as ever. However, modern agricultural practices have started the process of agricultural pollution. This process causes the degradation of the eco-system, land and environment due to the modern day by-products of agriculture.With the use of Chemical fertilizers, Insecticides, Pesticides and Herbicides that develops the growth of crops but affect the environment from various aspect including soil and air which also affect the human life by suffering many disease e.g. respiratory problems, different type of cancer that leads towards **CREEPING DEATH (Fig. 8)**

Fig: 8. Process of CREEPING DEATH

Another aspect is the soil; the soil of the study area is adversely affected by acidity. Some soil sample collected from the agricultural field of Amadpur Mouza (Memari-1) which tested in laboratory and find an approximate ph of 4.5 that is moderately acidity. It is the affect of Nitrozen fertilizers (**Photo- 8**)

Photo: 8. Soil effected by Nitrozen Fertilizers

Source: Photos are taken from Gopinathpur Mouza of Memari- I

- **Others**

More uncertainty in weatheric phenomena i.e. unevenness in rainfall and temperature as compared with past. Different type of birds to be extinct that were seen in past in agricultural fields. Negative environmental impacts from unsustainable Agricultural practices include:

- Land conversion & habitat loss
- Wasteful water consumption
- Soil erosion and degradation
- Pollution
- Climate change
- Genetic erosion

Remedial measures (Implication of Sustainable Agriculture)

The exponential population growth in recent decades has leads to increase the practice of agricultural land to meet the demand for food of growing population by destroying of ecological balance and conversion of land that affect our environment.

Organic farming (is a form of agriculture that relies on techniques such as crop rotation, green manure, compost, and biological pest control.) is a multifaceted sustainable agriculture set of practice that can have a lower impact on environment. Most of the negative impacts from agriculture on the environment can be reduced or prevented by an appropriate mix policies and technological changes. the term ‘‘sustainable agriculture’’ means an integrated system of plant and animal production that protect the environment, public health, human communities, and animal welfare. This form of agriculture enables us to produce healthful food without compromising future generations' ability to do the same. The long-term benefits of sustainable agriculture are:

- Satisfy human food and fiber needs;
- Enhance environmental quality and the natural resource base upon which the agriculturaleconomy depends;
- Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- Sustain the economic viability of farm operations; and
- Enhance the quality of life for farmers and society as a whole.

Through education can bringing a better farming practice and other beneficial options. Other specific method includes- Sustainable agriculture, Permaculture and biodynamic agriculture which incorporates spiritual elements.

Conclusion

Over 30 years of time span the study area has experienced a wide range of changes in agricultural land use pattern. It is true that the block experiencing a positive change in term of agricultural development but a negative change in term of environmental development. After the whole investigations and discussions it may be concluded that the farmers should be practiced those type of alternative inputs for growing agricultural outputs instead of those inputs which adversely affect the environment and damage the biological diversity (i.e. air &soil).

To promote Sustainable agriculture various methods should be applied. These are polycultures in term of fallow rotation, use of residues, bio-manuring, alley cropping, contour planning, etc (Santra, 2010). Social forestry programmes may be affected in this context, because it may increase the green cover in fallow land which may conserve the soil and maintain biological cycle.

Refereces

1. *Dr. S. Thomas & K. Siddhartha. (2007), BIOSPHERE A Geography of Life. Kisalaya Publication Pvt. Limited, New Delhi.*
2. *Majid Husain. (2012), Geography of India. Tata McGraw Hill Private Limited, 7 West Patel Nagar, New Delhi.*
3. *Santra, S.C. (2010), Environmental Science. New Central Book Agency (P) Ltd (2nd Edition, Reprint) Delhi.*
4. *Wells, A.T., Chan, K.Y. and Cornish, P.S. (2000). Comparison of conventional and alternative vegetable farming system on the properties of a yellow earth in New South Wales. Agric. Eco. Environ., 80 (1/2), pp 962-966.*

5. *Yadav, A.C., Sharma, S.K. and Batra, B.R.(2002). Effect of sodic water, FYM and Gypsum on the soil, growth and yield of brinjal. Ann. Agric. Biol. Res., 7(1), pp 73-77.*
6. *District Census Handbook of Burdwan District, West Bengal: Govt. of India.(2011)*
7. *Bhutani, S. (1997): "Spatial Patterns of Change in Indian Sex Ratio: 1981 – 1991", Asian Profile, vol. 25, No. 2, pp. 157 – 168*
8. *Chandna, R. C. (1986): Population Geography – Concept, Determinants and Patterns, Kalyani Publishers, New Delhi.*
9. *Chandna, R. C. (2006): Population Geography - Concepts, Determinants, and Patterns, Kalayani Publishers, New Delhi.*
10. *Chandna,R. C. & Sidhu, M. S. (1980): "Introduction of Population Geography", New Delhi, p78.*
11. *Clarke, J. I. (1960): "Rural and Urban Sex Ratio in England and Wales", Tij Descriptor, Economic and Social Geographic, p.29.*
12. *Franklin, S. H. (1956): "The Pattern of Sex Ratio in New Zealand", Economic Geography, Vol. 32, p. 168.*
13. *Ghosh, B. N. (1985): Fundamentals of Population Geography, Sterling Publishers Pvt. Ltd., New Delhi, p.97*
14. *Gill, M.S. (2000): "Sex Ratio Differentials in Northwest India", Population Geography, vol 22, Nos. 1 & 2, pp. 71 – 86.*