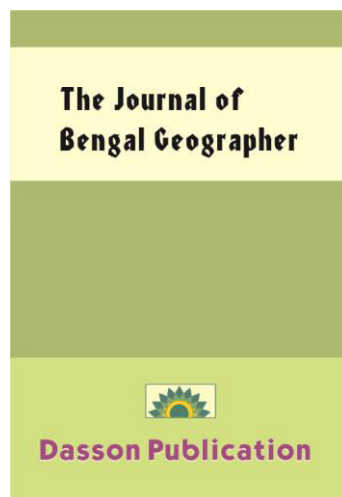


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Causes of soil pollution and alternative measures to reduce it in Choto Sangra Mouza of Birbhum District, West Bengal

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Abstract

The causes of soil pollution are complex and far reaching. Actually it has economic impacts and this in turn causes social impacts. Agriculture is the base of village economy. It has been evolved through different stages, from the past to this modern era. In traditional agriculture farmers used to depend on farm manure and cow dung as natural sources of plant nutrients. This traditional system of applying manure could only support low yields but there was no strain on the inherent of the soil. Modern agriculture largely depends on the use of high cost inputs such as chemical fertilizers, pesticides, insecticides, herbicides etc. The application of such inputs has undoubtedly increased the production but there is growing concern over the adverse effects of the use of chemicals on soil productivity and environment quality. Now in case of Choto Sangra, only organic manure was used for crop cultivation before forty to fifty years. So, the production of crop was less than now but now with chemical fertilizer, HYV seeds etc the production of this village has no doubt become increased. Negative effect of modern agriculture is also found that the excessive use of chemical fertilizer has reduced the fertility of field. Undergone demonstration is not practiced here. So, sometimes farmers use chemical fertilizers and pesticides unscientifically. Consumption of chemical pesticides had increased during 1990-91 and decreased during 1995-96 and further come down to about 1998-99 while it is necessary to add the required amount of plant food nutrients in the soil to increase crop production. Continuous removal of micronutrient due to excessive amount of chemical inputs application is depleting the soil fertility. It is however, easy to standardize the optimum levels of production factors at the experimental sites but very difficult to popularize them among the vast majority of farmers. Due to tropical climate, organic carbon status, phosphate status of this soil is low. Potash, a nutrient is adequate in the soils of Choto Sangra village. As remedial measure, organic agriculture should be practiced. It relies upon crop rotations with leguminous crops, addition of crop residues, animal manure, bio fertilizer and bio pesticides.

Key words : 1. Soil pollution, 2. Chemical fertilizer, 3. Rural compost, 4. Farmyard manure, 5. Organic farming.

Introduction

Soil is produced after erosion of rock. Among different horizons nutrients are found only on the top layers. Bio-degradable elements are found there which are decomposed by the bacteria, fungus and other decomposers and humus is thus produced which increase the nutrition and fertility of the soil on the other hand, due to the evil activities of human beings bring different kinds of toxic elements like heavy metals. Thus the soil pollution takes place due to different reasons. Now-a-days different chemical fertilizer, pesticide, DDT spray etc. are used in agriculture. It has different effects. Soil becomes black, hard and its productivity is decreased. Besides, in rainy season when heavy rainfall occurred, some portion of these chemicals flow out from agricultural field to pond with the rain water. As a result the water of pond is polluted. It is used by villagers. As a result they have to

suffer by different water born diseases. The chemical toxic components, fertilizer and pesticide will be released down to the water bodies to contaminate the quality of water. The present study has been done on causes of soil pollution and alternative measures to reduce it in Choto Sangra mouza of Brigham district, W.B.

Literature survey

Alan Wild (1992) has discussed about the soil in a natural and man-made environment, soil properties and processes soil components, texture and structure, soil pollution due to unlimited chemicals application.

Bandara (2006) represented the impact of soil pollution on the agriculture including crop production, cropping pattern etc. He emphasized on training of farmers on cropping techniques through the farmers field schools exposed them to crop husbandry and significant increase in the yield of rice.

Eric Lighthouse, (2009), observed the positive side of organic farming, pest control and remediation of soil pollutants, fertilizer and their characteristics in India.

Jayanta kumar Saha, (2012), discussed about the integrated management of polluted soils for enhancing productivity and quality of crops in Indian agriculture.

M.M Rai (2014) has shown about soil formation, properties, soil organic matter, soil temperature and soil pollution of Indian rural agriculture and their effect on economy.

Sharmistha Pal, A.K. Patra, S.K Reza, Walter widi, John pote, December 2010, discussed about the Use of bio-resources for remediation of soil pollution, constraints in the use of bio indicators and their ill effect on rural agriculture.

Objectives of the study

This study possess following objectives :

- (1) To study the socio-economic characteristics of the farmer and the agricultural farms which are affected by soil pollution?
- (2) To find out the causes of soil pollution in the study area.
- (3) To observe the effects of soil pollution on agricultural landscape.
- (4) To uncover the problems of soil pollution and to suggest alternative measures which will reduce soil pollution?

Data base and Analytical procedure

The study has been on both primary and secondary sources of data. The primary data, obtained from field survey, are related to caste, educational status, amount of total land holding, amount of land under different type of irrigation, water quality, effect of drainage condition, soil erosion etc. As agriculture is the primary activity of the villagers, so the researcher have also taken the name, amount of chemical fertilizer, organic manure and the amount of productivity in agricultural field. As the production can be decreased by pest attack and which has bad effect on economy, so different name of plant diseases, pesticides, insecticides and their amount of application has also been taken. To know about the evil effect of these chemical fertilizer, pesticides on human body, the name of some chronic diseases of poisoning have also included into it e.g. Dysentery, respiratory problem, drowsiness, abdominal pain, diarrhea etc. what are the problems regarding soil pollution, its effects on animal and human bodies, what are the different possible measures to solve the problem etc are the core searching area of the researcher. The secondary data on the physical aspects of the study area have been collected from west Bengal district gazetteers, Brigham written by Durgadas Maunder (Dec.1975).The data on irrigation, drainage, drought problem, rainfall, temperature, soil

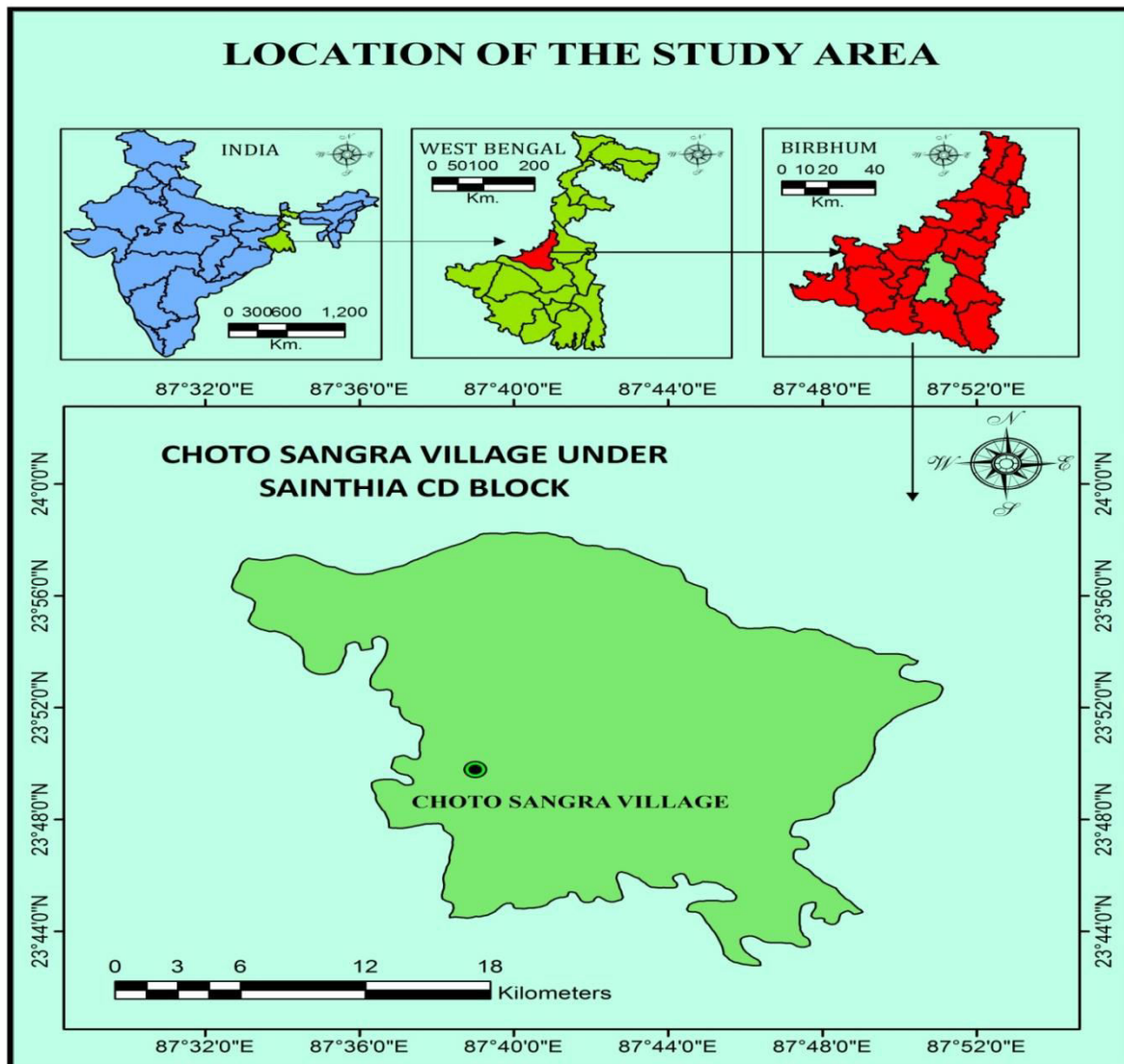
etc. have been collected from the records of the respective offices e.g. irrigation office, principal agricultural office at Suri ,different agricultural farms of Choto Sangra and from district census handbook, Brigham 1981 and Office of the detailed soil survey unit (Mayurakshi command area), Brigham.

Methodology

The step of methodology is concerned with the collection of data and information about the causes of soil pollution and alternative measures to reduce it in Choto Sangra village. It has been done on 50 households of this village. Map of choto Sangra mouza, previous literatures etc. have been collected and systematically arranged in proper method. Published data regarding climate, land use, year wise coverage of different crops in Brigham district, source wise irrigation of birbhum etc. have been collected from the respective offices. Direct observation and indirect personal interview have been done. Later these data have been processed. For data processing chi-square testing, bar graph, pie graph have been computed and Microsoft excel software have been used for simple tabulation and calculation. Choropleth map has been made for this purpose.

Location of the study area

Choto Sangra mouza is situated in the southern part of Sainthia block of Brigham district (Map: 1). It is also the southern part of Brigham district. It is at the south-western part of West Bengal and at eastern part of India. It is included into Rarh region. Mayurakshi River flows along its northern part and Ajay River along its southern part. The latitudinal and longitudinal position of the village is 23°51'30"N and 87°39'39"E, approximately. On its boundary, it is surrounded by Mayurakshi River in north, Ajay in south, Labpur in east and Suri in west. Choto Sangra is only 18 km away from its nearest town Suri.



Map: 1

Causes of soil pollution

1. Pesticides, Herbicide, Insecticide and Fertilizers

To begin with, the earliest source of the pollution has been pesticides and fertilizers. Modern day pesticides & fertilizers have to deal with the local pests that have existed for hundreds of years along with the new invasive species. And so, they are laden with chemicals that are not found in nature.

Once they have been sprayed, it does not disappear completely. Some of it mixes with the water and seeps into the ground. The rest of is absorbed by the plant itself. As a result, the local streams that are supplied water from the ground become contaminated, as do the animals that eat these crops and plants. A pesticide is a substance or mixture of substances used to kill a pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacteria), antimicrobial, disinfectant or device used against any pest. Pests include insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms) and microbes that compete with humans for food, destroy property, spread or are a vector for disease or cause a nuisance. Although there are benefits

to the use of pesticides, there are also drawbacks, such as potential toxicity to humans and other organisms.

Herbicides are used to kill weeds, especially on pavements and railways. They are most are biodegradable by soil bacteria. However, one group derived from trinitrotoluene (2:4 D and 2:4:5 T) have the impurity dioxin, which is very toxic and causes fatality even in low concentrations. Another herbicide is Parquet. It is highly toxic but it rapidly degrades in soil due to the action of bacteria and does not kill soil fauna.

Insecticides are used to rid farms of pests which damage crops. The insects damage not only standing crops but also stored ones and in the tropics it is reckoned that one third of the total production is lost during food storage.

Chemical Fertilizers and Biocides: The accelerated use of chemical fertilizers and biocides in agriculture is the major cause of soil pollution. They are used to increase the yields and to save the crops from insects, pests and unwanted plant growth. It should be particularly noted that biocides first kill germs and unwanted plants and then degrade the quality of soil.

Among the pesticides, the most widely used are the chlorinated hydrocarbons, e.g. D.D.T., B.H.C., linden and organ phosphorus compounds such as parathion. When these are used in excess, their remnants are absorbed by soil particles and contaminate crops grown in such soils.

They are further transferred into carnivores through herbivores and finally enter the human bodies in course of food chains. They are responsible for several incurable diseases and even cause death. Biocides are, thus, called as creeping deaths.

The use of biocides gained momentum in India with the commencement of Green Revolution in 1966-67. The introduction of high yielding varieties (HYV) of seeds gave birth to heavy doses of chemical fertilizers and biocides.

For reducing the impact of chemical fertilizers, it is suggested that use of organic manures, composts, and agriculture wastes should be encouraged. Composition of NPK in different farmyard manures and composts is given in Table 1.

Organic farming refers to farming which does not use any form of chemical fertilizers or other agro chemicals and is dependent entirely on organic sources of crop nutrition and crop husbandry. Organic farming can also be defined as system in which the maintenance of soil fertility and the control of pests and diseases are achieved through the enhancement of biological process and ecological interaction.

The major component of organic farming is the maintenance of soil fertility through maximizing nutrient recycling and minimizing losses. Organic farming also helps in improving the physical properties, microbial production and humus content of soil while increasing its water holding capacity.

Table-1: Composition of npk in different farmyard manure and compost (In percentage)

Waste	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Total nutrient
Rural compost	0.75	0.5	0.5	1.75
Farmyard Manure	0.60	0.20	0.60	1.40
Poultry droppings	3.00	2.60	1.40	7.00

Source: Field survey

The organic farming involves the use of farmyard manure (FYM) which has been used as a resource for plant nutrient since the ancient times. It also includes the application of vermin-composts, green manure and bio-fertilizers. FYM consists of animal dung, waste, crop residue, poultry manure/litter, etc. The urban or rural wastes composted are also sources of plant nutrients.

Green manure involves cultivation of fast-growing leguminous crops and ploughs them back into the soil as fertilizers. Bio-fertilizers help leguminous crops fix atmospheric nitrogen into the soil.

2. Contaminated water

Contaminated water used for irrigation is one further source of pollution. Much of the water we use comes from ground water reservoirs, canals and through the rains. While plenty of it is clean and pure water, other sources are polluted with organic compounds and heavy metals. This happens due to the disposal of industrial and agricultural waste in local bodies of water.

As a result, the crops are exposed to water which has small amounts of mercury, arsenic, lead and cadmium dissolved in it. The process of agricultural pollution becomes harder to fight when such water poisons the livestock and causes crop failure.

3. Soil erosion and sedimentation

Further problems are caused by soil erosion and sedimentation. Soil is comprised of many layers and it is only the topmost layer that can support farming or grazing. Due to inefficient farming practices, this soil is left open for erosion and leads to declining fertility each year. Whether eroded by water or wind, all this soil has to be deposited somewhere or the other. The resulting sedimentation causes soil build up in areas such as rivers, streams, ditches and surrounding fields. And so, the process of agricultural pollution prevents the natural movement of water, aquatic animals and nutrients to other fertile areas.

4. Livestock:

In the olden days, farmers would keep as much livestock as their land could support. The cattle, sheep, pigs, chickens and other animals were fed natural diets, which was supplemented by the waste left over from the crops. As a result, the animals contributed to keeping the farm healthy as well.

As of now, livestock is grown in cramped conditions where it is fed unnatural diets and sent to slaughterhouses on a regular basis. As a result, they add to the process of agricultural pollution by way of emissions.

Table-2: Distribution of use of Chemical fertilizer.

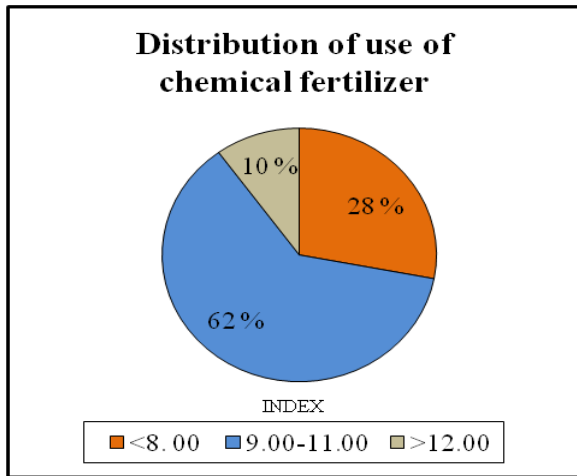
Amount of chemical fertilizer (Q/ Acre)	Number of household	%
<8.00	14	28
9.00-11.00	31	62
>12.00	05	10
	50 (Total)	100 (Total)

Source: Field survey
Graph-1

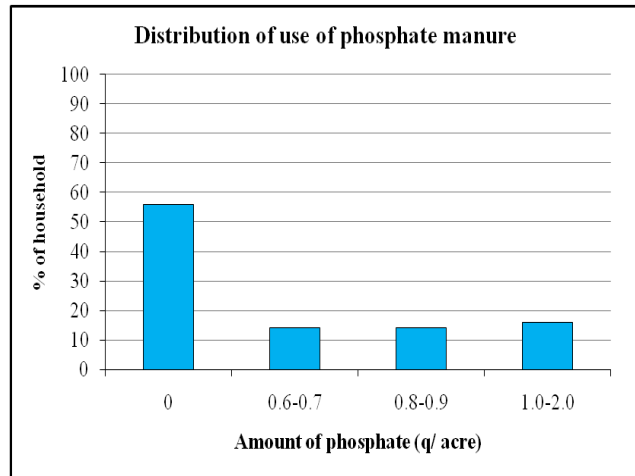
Table-3: Distribution of use of Phosphate manure.

Amount of phosphate (q/ acre)	Number of household	%
0	28	56
0.6-0.7	07	14
0.8-0.9	07	14
1.0-2.0	08	16
	50 (Total)	100 (Total)

Source: Field survey
Graph-2



Source: Field survey.
Graph- 3



Source: Field survey.
Graph- 4

5. Pests and weeds: Growing exotic crops and reducing the natural species in a certain area has become the norm for agriculture. However, it is simply adding to the process of agricultural pollution. With the arrival of new crops, the native population has to deal with new diseases, pests and weeds that it is not capable of fighting.

As a result, the invasive species destroy the local vegetation and wildlife, altering the ecosystem permanently. This is especially the case with Genetically Modified foods, which create plant and animal species that can wipe out the existing species in a matter of years.

Table-4: Distribution of organic manure.

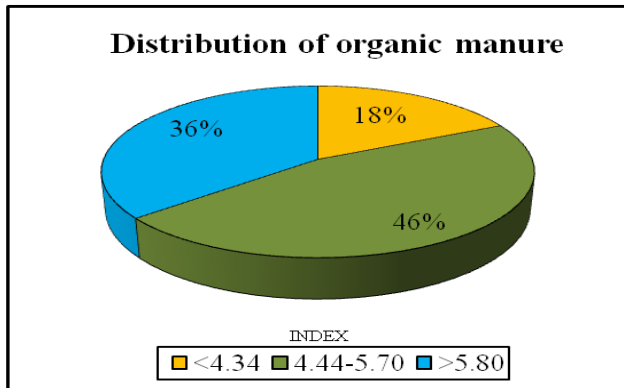
Amount of organic manure(Q/ Acre)	Number of household	%
<4.34	9	18
4.44-5.70	23	46
>5.80	18	36
	50 (Total)	100 (Total)

Source: Field survey.
Graph-5

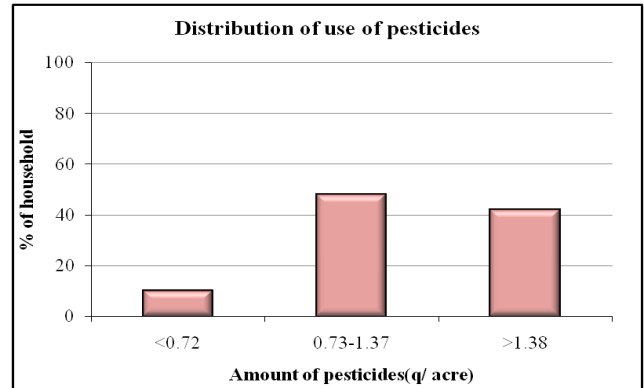
Table-5: Distribution of use of pesticides.

Amount of pesticides(Q/ Acre)	Number of household	%
<0.72	05	10
0.73-1.37	24	48
>1.38	21	42
	50 (Total)	100 (Total)

Source: Field survey.
Graph-6



Source: Field survey
Graph-7



Source: Field survey
Graph-8

Table-6: Distribution of area affected by soil pollution

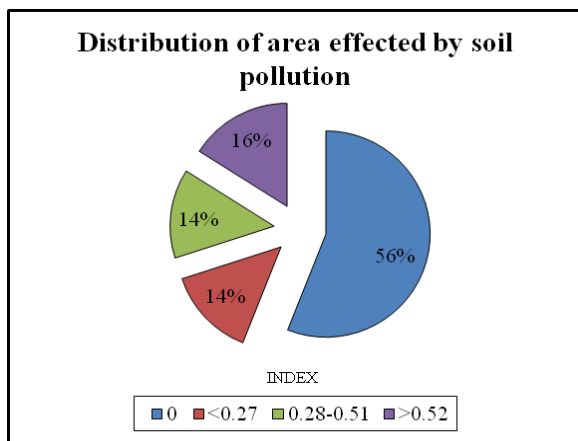
Area (Acre)	Number of household	%
0	28	56
<0.27	07	14
0.28-0.51	07	14
>0.52	08	16
	50 (Total)	100 (Total)

Source: Field survey.

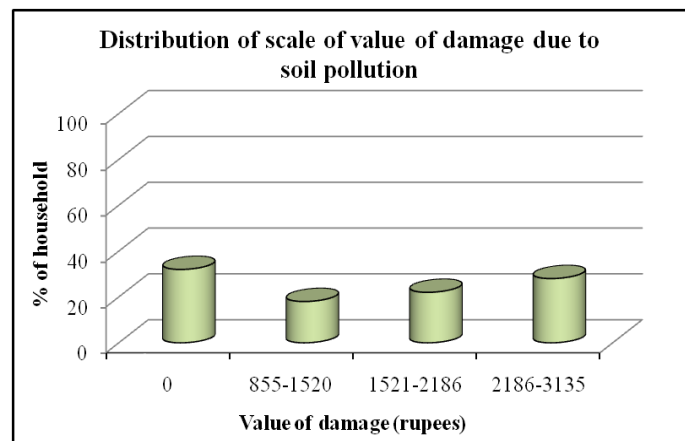
Table-7: Distribution of scale of value of damage due to soil pollution.

Value of damage (Rupees)	Number of household	%
0	16	32
855-1520	09	18
1521-2186	11	22
2186-3135	14	28
	50 (Total)	100 (Total)

Source: Field survey.



Source: Field survey
Graph-7



Source: Field survey
Graph-7

Table-8: Correlation matrix.

	Use of chemical fertilizer (per acre) 1	Increased production after fertilizer application (quintal) 2	Uses of pesticides (per acre) 3	Increased production after pesticide application (quintal) 4	Uses of phosphate manure (per acre) 5	Use of organic manure (per acre) 6	Increased production after organic manure application (quintal) 7	Decreased production after pest attack (quintal) 8	Use of sludge (per acre) 9
1.	1.00	-0.02	0.21	0.06	0.26	-0.10	0.16	0.15	-0.10
2.	-0.02	1.00	0.002	0.13	0.20	0.14	0.33*	0.11	0.14
3.	0.21	0.002	1.00	-0.13	0.02	0.25	-0.06	-0.30	-0.25
4.	0.06	0.13	-0.13	1.00	0.08	0.11	-0.05	0.19	0.11
5.	0.26	0.20	0.02	0.08	1.00	0.009	0.20	-0.24	0.009
6.	0.10	0.14	-0.25	0.11	0.009	1.00	-0.15	0.17	1.00
7.	0.16	0.33*	-0.06	-0.05	0.20	-0.15	1.00	0.29*	-0.15
8.	0.15	0.11	-0.30	0.19	-0.24	0.17	0.29*	1.00	0.17
9.	-0.10	0.14	0.25	0.11	0.009	1.00	-0.15	0.17	1.00

Source: Field survey.

N=50, R=0.36, CV=2.67, TV=2.66, Significant at 1%**

R=0.28, CV=2.03, TV=2.00, significant at 5%*

Problems and Alternative measures to reduce soil pollution

- Soil can be polluted by toxic chemicals which are often used on the agricultural field. It cause death of friendly detrevour and others and thus the amount of nutrition cannot be regenerated.

To reduce this problem, we have to use the chemical fertilizer in a little amount and in place of chemical fertilizer we should use organic manure. Rotation of crops, judicious use of fertilizers, intensive cropping, proper drainage and irrigation are also necessary.

- Pesticides are often considered a quick, easy, and inexpensive solution for controlling weeds and insect pests in agriculture. However, pesticide use comes at a significant cost. Pesticides have contaminated almost every part of soil. Pesticide residues are found in soil. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants. Contrary to common misconceptions, even herbicides can cause harm to the environment. In fact, weed killers can be especially problematic because they are used in relatively large volumes.

The best way to reduce pesticide contamination (and the harm it causes) in our environment is for all of us to do our part to use safer, non-chemical pest control (including weed control) methods.

- Soil can be polluted by virus, created from the dumping place of domestic waste materials. This virus is carried by the farmers to the agricultural fields and cause soil pollution. So, the illiterate, immobilized farmers should change their habits, so that soil pollution can be controlled.
- It is found that organic pesticides often pollute the soil.
- So, farmers should use these pesticides within a specific limit.

Plastic materials, Solid wastes from household and industries also pollute land and enhance land degradation. Solid wastes include things from household waste and of industrial wastes. They include ash, glass; peelings of fruit and vegetables, paper, clothes, plastics, rubber, leather, brick, sand, metal, waste from cattle shed and cow dung. Chemicals discharged into air, such as compounds of sulfur and lead, eventually come to soil and pollute it. The heaps of solid waste destroy the natural beauty and surroundings become dirty. Pigs, dogs, rats, fly, mosquitoes visit the dumped waste and foul smell comes from the waste. The waste may block the flow of water in the drain, which then becomes the breeding place for mosquitoes. Mosquitoes are carriers of parasites of malaria and dengue. Consumption of polluted water causes many diseases, such as cholera, diarrhea and dysentery.

Avoid unnecessary or wasteful packaging of products. Dispose the waste after separating them into biodegradable and non-biodegradable waste material. Villagers have to Start a compost heap or use a compost bin. This can be used to recycle waste food and other biodegradable materials.

Conclusion

Now-a-days in the strategies of regional development, the emphasis was laid on the location and investment on the basic heavy industries. Therefore in a country like India where the monetary fund is limited, there relatively smaller amount of investment can be made in agriculture and that creates enormous problems in agriculture of Choto sangra village is also suffered by it. E.g. more than $\frac{3}{4}$ the of the total population depend upon the agriculture but due to negligence, irrigation facilities is not up to the mark. Other technological and infrastructural facilities which are needed for the development of agriculture are by and large lacking which cause low agricultural productivity. Villagers' standard of living is low. As a result can't take higher education about agriculture. So, it must be said that there is a need to plan more efficient strategies for solving of the agricultural problems in rural areas including Choto Sangra.

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