

CONTROL OF ENVIRONMENTAL POLLUTION FOR SUSTAINABLE AGRICULTURE AS PERCEIVED BY THE FARMERS.

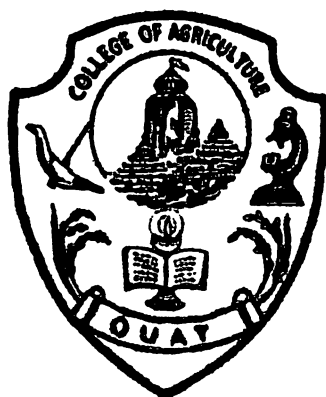
**A THESIS SUBMITTED TO
THE ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESWAR
IN PARTIAL FULFILMENT OF THE REQUIREMENTS**

FOR THE DEGREE OF

**MASTER OF SCIENCE IN AGRICULTURE
(EXTENSION EDUCATION)**

BY

Kalyan Ghadei



**Department of Extension Education
COLLEGE OF AGRICULTURE**

Orissa University of Agriculture & Technology
BHUBANESWAR, ORISSA
1996

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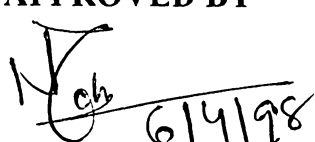
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Organisation

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from immanence to transcendence

from ignorance to enlightenment

from self forgetfulness to self-consciousness

May the divine light manifest in me.

Bhubaneswar

Kalyan Ghadei
23.2.98

Kalyan Ghadei

CONTENTS

<u>CHAPTER</u>	<u>TITLE</u>	<u>PAGE</u>
I	INTRODUCTION	1 - 11
II	REVIEW OF LITERATURE	12 - 27
III	RESEARCH METHODOLOGY	28 - 44
IV	RESULTS AND DISCUSSION	45 - 76
V	SUMMARY, SUGGESTION AND CONCLUSION	77 - 87
	LITERATURE CITED	i - vi
	APPENDICES	

LISTS OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
4.1	Socio economic profile of the farmers.	47
4.2	Perceptions of the farmers about sustainable agriculture	53
4.3	Perception categories of the farmers about sustainable agriculture.	62
4.4	Awareness of the farmers about harmful effects of environmental pollution.	64
4.5	Awareness categories of the farmers about harmful effects.	66
4.6	Farmers perception about different sources of pollution.	68
4.7	Extent of perception by the farmers.	73
4.8	Suggestion of the farmers about control of environmental pollution for sustainable agriculture.	74

LISTS OF FIGURES AND MAPS

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>IN BETWEEN PAGES</u>
1.	Map of Orissa State showing Kurda District.	30 - 31
2.	Map of Kurda District showing the area under study.	30 - 31
3.	Map of Bhubaneswar Block showing the villages under study.	30 - 31

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ABSTRACT

The study entitled "**CONTROL OF ENVIRONMENTAL POLLUTION FOR SUSTAINABLE AGRICULTURE AS PERCEIVED BY THE FARMERS**" with the main objective to study the socio- economic profile of the farmers, perception of farmers about sustainable agriculture, awareness about harmful effects of environmental pollution, perception of farmers about different sources of environmental pollution and suggestions of the farmers about control of environmental pollution for sustainable agriculture. Survey, research design was followed for this study. Four villages were selected randomly from Bhubaneswar block in Khurda district which was selected purposefully. Hundred respondents taking twenty five respondents from each of the villages were selected randomly. The data were collected through pretested structured interview schedule during the year 1997. Appropriate test statistics were used for analysing and interpreting the result.

It was revealed from the study that perception of the farmers about sustainable agriculture was high on "prevention of land from non farm practices", "judicious use of water resources like pisciculture in the bond and plantation crops on the embankments like Bananas" "emphasis on farm yard manure rather than chemical manure" avoidance of synthetic pesticide", "use of indigenous technology on soil and water management," use of botanical preservatives like Neem, Tulsi, Begunia", "Practical implementation of technology" on the parameters of sustainable agriculture like i.e. soil and land management, water management, integrated nutrient management, integrated pest management, conservation of bio diversity, post harvest technology, socio economic political factors and extension management respectively. The farmers were well aware about the occurrence of climatic changes due to environmental pollution. The perceptions of farmers on different sources of pollution indicated that "industrial effluents pollute the water", "excess use of nitrogenous fertiliser in crop pollutes the soil", "automobile emission pollutes the air", use of pesticide in crop pollutes the surrounding were high in the sources, water, soil, air & intensive agriculture respectively. "**EDUCATION IS THE PANACEA OF ALL SOCIAL EVILS**" says **SWAMI VIVEKANANDA**. "This study also revealed the same slogan" that promotion of education and motivation was the important suggestion given by the farmers about control of environmental pollution for sustainable agriculture.

CHAPTER-I
INTRODUCTION

INTRODUCTION

*"Feed the people who are hungry
Educate the people to uplift the world".*

To full fill this dream of Mahakavi Bhartiyar Swami Vivekanada said "first bread then religion". Mahatama Gandhi also remarked "Before these half starved and half naked millions, God could appear only in form of a bowl of rice".

To attain this objective Nehru responded to the call of his master and announced in 1948 that "everything can wait but not agriculture". The world wide movement on agriculture & industry took place during the sixty's in a intensive manner to meet the global need.

The pressure of population and improved skills and tools enabled man to produce and interfere in nature more and more. Thus we reached to the stage of "Seed fertilizer revolution" beautifully termed as "Green revolution". The green revolution helped us to attain a new height of agricultural production, made us self reliant on food front but at the same time it posed problem of water logging, soil erosion, soil acidity, alkalinity and environmental pollution. Heavy dependence on fertilizer and their unbalance application coupled with entranced uptake of all plant nutrients effected the soil productivity adversely. Indiscriminate use of pesticides, fertilizer endangered the environmental quality; consequently, not to talk to boosting productivity further, it is difficult maintain to talk of boosting productivity further, it is difficult to maintain it at the plateau level. In addition we are cursed with pollution problem.

As we are approaching the 21st century and have embarked in the last decade. Another war named silent war is threatening the human civilization. In order to live comfortably man has created this problem which now threatens our own existence. The early news papers during the 1950 and 60's usually carried news items on murders, accidents, riots etc. Today news papers also feature the same item but with additional

news under the headings murder of environment, industrial accident, forest fire hazards etc. The unprecedented changes that man has brought about in the valuable treasures of this planet viz. land, air, water have started to take their toll in an alarming scale. It is estimated that 3,325 plant species and 631 animal species are recorded vulnerable, 5-15% of world's species are likely to become extinct between 1990-2020 and upto 25% by 2050. The developed countries with 25% world's population produce 50% world's greenhouse gas which causes global warming and average temperature is expected to increase 1.5-4.5°C by 2030. Each year 12 mha of tropical wood lands for fuelwood widening in the ozone layer every year reducing the earth's ability to protect life from deadly ultraviolet radiation. Industrial wastes in growing volumes seep downward to poison ground water and upward to destroy the delicate atmosphere. At present with 6 billion population 10¹⁰ tonnes of wastes are deposited annually which will be doubled by the next century. Dramatic changes are taking place in our environment.

India is no exception to global phenomenon of environmental pollution. The effects of poverty on compounding the problem of environment are many and deserve a closer look.

Air pollution is defined as the presence of any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or tend to be injurious in human beings or other living creatures or plants of property of Environment.

According to World Health Organisation, air pollution may be defined as "substances put into air by the activity of mankind into concentration sufficient to cause harmful effect to his health, vegetable, property or to interfere with the enjoyment of his property".

Total emission of the pollutants in India has been estimated to be about 23,412 MT/annum. Out of this 63.42% is contributed by the industrial sector, 29.82% by domestic sector and 6.76% by automobiles. By polluting air, man, the primary causal factor, has not only endangered himself but also caused destruction to plants.

Sources of air pollution may be divided broadly into two categories.

1. **Natural sources.**
2. **Manmade sources.**

a) Respiration by plants and animals (b) Other natural sources of air pollution of significance are decay of vegetable matter, animal wastes and dead bodies of animals which is associated with foul odors and release of gases such as hydrogen sulphide, methane and ammonia into air (c) Storms which may raise dust (d) Evaporation and transpiration which may effect humidity (e) Volcanic eruptions which release excessive amounts of heat energy into the air apart from dust grit and gases (f) Forest fires (g) Air may act as a carrier of pollen, spores, bacteria and virus, noise and heat.

Man made sources :

There is a large variety of human activities by which air is subjected to pollution.

- a) Household activities.
- b) Industrial Emissions : Grit and dust. Emission from coal based units mainly contain particulate matter, carbon dioxide, oxides of sulphur and other volatile matter, carbon-mono-oxide and unburnt hydrocarbons, Chemical process units.
- c) Transportation.

Acid Rain :

What goes up, must come down is a famous saying. In many cases, what comes down is far worse than what went up. This applies exactly to the phenomenon called acid rain.

Usually under normal concentrations and pressure of CO_2 in the atmosphere the rainfall is acidic (pH-5.65). This acidity is due to the presence of CO_2 which forms H_2CO_3 which is a weak acid and dissociates slightly in water. But during recent decades the anthropogenic addition of oxides of sulphur and nitrogen into the atmosphere has resulted in further lowering of pH of rain water as low as 2.4. The precipitation mainly of oxides of S and N with rain is termed as Acid rain, which are the results of burning of fossil fuels-coal, oil and gas though in different ways.

Dust pollution :

Dust is found to travel several thousands of kilometers, across deserts and sea. Air-borne particles of Saharn sand across the Arabian sea and reach India. Though dust particle offer nuclei for cloud formation, the excess amount of dust released from industry became a pollutant which affects the growth and yield of the plants severally.

Water pollution :

The addition of any foreign material (inorganic, biological or radiological) or any physical change in the natural water which may adversely affect the living life (human, agricultural or biological) directly or indirectly.

Sources of water pollution :

1. Sewage, 2. Industrial waste water, 3. Agricultural wastes.

Sewage :

Water pollution has been a problem even since we started disposing sewage into our rivers and other water courses. The problem has assumed serious dimensions during the past 50 years particularly with the increase in pollution due to even increasing pollution. While the natural water sources remain the same in number, the quantum of excremental matter discharged into them has increased several quality, increase in types of water-borne diseases and damage to aquatic life.

Industrial water:

This occurs in large amounts in specific location. Only about 7-8% of industrial waste water have been disposed of in municipal sewerage systems, but they constitute about $\frac{1}{2}$ the total municipal load.

Most of the Indian rivers and fresh-water streams are seriously polluted by Industrial Wastes or effluents which come along waste waters of different industries such as petrochemical complexes; fertilizer factories, oil refineries; pulp, paper, textile, sugar and still mills, tanneries, distilleries, coal, washeries, Synthetic material plants for drugs,

fibres, rubber, plastics etc. The Industrial Water of these Industries and MILLS include metals (Cu, Zn, Pb, Hg, etc.), detergents, petroleum acids, alkalies, phenols, carbamates, alcohols, cyanide, arsenic, chlorine and many other inorganic and organic toxicants. All of these chemicals of industrial waste have been toxic.

Agricultural Waste- Modern techniques employed in agriculture and use of broad spectrum synthetic fertilisers and pesticides have contributed much to environmental degradation, especially to water pollution.

Agricultural waste may be 1. Manure and other wastes from farms and the operation feed lots or poultry houses., 2. Slaughter house wastes. 3. Fertilizer run off from crop land. 4. Harvest Wastes. 5. Pesticides that escape into the atmosphere or into the water supply. 6. Salt and silt drained from irrigated land or eroded land. 7. Miscellaneous Agricultural Wastes-animal disease agents,. Beal animals, Rural domestic wastes, food processing wastes, salinity of irrigated water.

Resources present in nature have continuously been prospected and utilised to the satisfaction of man,. Man as the master of nature utilises the nature's gift without paying much attention on the ecological balance.

The pressing need for increasing agricultural production in the country can only be met with more efficient use of its soil and water resources. With the technical know how man is trying best to increase the yield of crops by irrigation, adoption of high yielding varieties which responds well to the higher doses of fertilisers applied. Harnessing water have been tapped, resulting in submergence to lesser or a greater extent in the catchment area with increase in availability of water resources. The illiterate farmer irrigates his land by flow irrigation (normally excess is more than requirements) which affects the crop indirectly by showing chlorosis in the leaves. All this resulted in soil pollution.

Soil is polluted a) due to application of garbage and waste from houses. b) Due to deposition by products from the industry. c) application of fertilisers, herbicides and pesticides.

Garbage & Wastes are unavoidable in any society. They have become an integral part of our life. These wastes devour our precious landscape and spoil the aesthetic of the surroundings. Any unwanted and / or discarded material thrown away in solid form that has arisen from the normal community activity is waste. Certain physico-chemical, micro nutrients and heavy metal properties of soil are affected by long term application of garbage in agricultural fields.

Industrial solid wastes add to the problem of soil pollution. These wastes are disposed from coal and mineral industries, mining industries metal industries, engineering industries and thermal power stations.

"pesticides" is a term used in broader sense for products, synthetic or natural utilised for the control of insects pest, fungi, Bacteria, nematodes, rodents etc. The use of pesticide is the most convenient, effective and economic method of pest control in agriculture, horticulture and forestry. In India earlier crop losses in traditional farming reckoned at 15.20%/ It is now reported to have increased more than 50% particularly in rice, pulses, cotton and oil seeds under intensive cultivation. Some of the pesticides especially organo-chlorines are quite persistent and consequently, accumulate in tissues. Soil is contaminated by 'fallout' after a crop spray.

Noise pollution is often misunderstood by most of the people as sound pollution. Sound is a pure tone, harmonically related having fixed frequencies and amplitudes, occurring at regular interval and produces meaningful communication and pleasure in hearing, but noise is unwanted sound having complex mixture of numbers of pure tones of various frequencies and amplitudes. These sound waves fluctuate and repeat themselves in highly haphazard manner. Noise pollution caused due to industrialisation, air horn of vehicles, music from loud-speaker which badly affect the peace, patient and student in both urban and rural areas.

Farming system is a complex inter related matrix of soil plant, animalism implements, power, labour, capital and other inputs controlled in parts by the farm families and influence to varying degree of political, economic, institutional and social forces that operates at many levels. Farming system conceptually is a set of elements or components that are inter-related which inter-act among themselves, as the centre of interaction the farmer is exercising the control and choice regarding the type and result of inter action.

The high yield characteristics of modern intensive farming system reflect man's ability to modify the agro-ecosystem in such a way as to remove or diminish natural limitation upon productivity and to provide a more favourable environment for crop growth. These modifications include the introduction of new species or varieties of crop plant and livestock, the elimination of competing plant and other organism by use of pesticides and removal of habitats, the use of high levels of fertilizers, manipulation of soil structural condition by tillage and control of soil moisture by irrigation and drainage. Inevitable, these practices have a fundamental influence on wider environment.

INTENSIVE FARMING IN AGRICULTURE

With the intensification of agriculture, the use of fertilizer is a major factor contributing to higher crop yield but excessive and mismanagement cause pollution such as (a) excess application of nitrogen fertilizer, leached and percolated to ground water in nitrate form causes pollution to drinking water, (b) Leaching nitrogen and phosphates to pond and lake or water reserves causing eutrophication that leads to growth of algae and other organisms, (c) ammonia gas released from nitrogen fertilizer causing acid rain, (d) there is more release of methane gas from wet land rice, (e) repeated and excessive application of phosphate in terms of rock phosphate and single super phosphate increase the fluoride content of soil causing health hazard to human and animals, (f) many fertilizer contain trace element like F, As, Cd, Cu, Hg, Mo, Pb, and excess application to crop lead to their accumulation in soil and health problem.

There are more than 1000 agro-chemicals which are being manufactured and used for agriculture as well as public health purposes. About 80% of the total world production is used in developed countries and remaining 20% in developing countries. On global basis herbicide account for highest consumption (45%), followed by insecticide (36%), herbicide (27%) and other 3%. About 1 million people suffer from pesticide toxicity of which 20,000 die every year and almost one person is poisoned every minute. In India, the consumption of pesticide is around 93,720 MT by 1990 and of these 70% are banned in developed countries.

Amongst the insecticide organo-chlorine, organophosphate, carbamate and pyrethrin derivatives are commonly used. When insecticide applied on a crop, the major portion falls on ground or water standing on field. These unused toxic chemicals or their degraded product known as residue pollute the surrounding environment.

The global problem facing mankind found significant expression in U.N. conference on human development held in Stockholm in 1972, where an action plan formulated with series of recommendations for efficient management. The resulting United Nations Environment Programme (UNEP) operating in Nairobi has reviewed each year the world environment situation in order to ensure that emerging environmental problems of wide international significance receive appropriate and adequate consideration by Government. For many developing countries, the 1980 has been a lost decade, economically as well as environmentally. Many of them, have remained pre-occupied with short term economic and political crises. The environmental and natural resource management and conservation have ranked extremely low on their priority list. The Langkawi Declaration on environment issued by commonwealth Heads of Govt. at Langkawi, Malaysia in 1989 express deep concern at the serious deterioration in environment and the threat thus poses to wellbeing of present and future generation. In June, 1992, about 20 years after the historic Stockholm conference, the U.N. conference on environment and development of the earth summit was held in Brazil to discuss the critical relationship between the environment and economic health of planet and to provide a global frame of work for sustainable development.

The realisation of the need to seek harmony between increasing production through advanced technology for the present and preservation of environmental quality and resources base for the future led to the concept of "sustainable agriculture aims at stability of production overtime. It maybe described as a concept of technically efficient, economically viable and environmental sound production principle enhanced production for the present without affecting the quality of resource base to fulfill the need of future generation.

Sustainable Agriculture

Sustainable agriculture is the successful management of resources of agriculture to satisfy the changing human needs while maintaining or enhancing the quality of environment and conserving natural resources. However in broader sense agriculture is sustainable if it ecologically sound, economically viable, socially just, human and adoptable,. Sustainable agriculture can also be defined as an agriculture that can evolve indefinitely towards greater human utility, greater efficiency of resource use and a balance with the environment that is favourable to human and topmost other species.

Dimentions of Sustainable Agriculture

The major dimension of sustainable agriculture are Technological Appropriability- It refers to how for the agriculture technology be it a seed fertiliser, prestiedic or improved machinery suits the social and infrasttuctural situation of the end users.

Economic feasibility : It refers to the capacity of farmers to afford to incorporate the technology in his farm within his realm of financial status and position.

Economic viability: It refers to the return to investment of every rupee counts.

Environmental Soundness : It refers to the whether the technology results in enriching the environment or at least does not harm the existing Agro ecohological conditions.

Temporal Stability : It refers to whether the positive aspect remain stable over the long run.

Resource use efficiency : It refers to the how efficiently the technology can utilise the inputs to convert them into useful, productive and ecofriendly output.

Local Adoptability : It refers to the extent to which the technology is adoptable to the existing local condition of the farmers.

Social; Acceptability & Social Sustainability : It refers to the extent to which the technology is acceptable by different sector of the society, where as social sustainability means it has to meet the personal needs. Since farmers will still prefer to grow crops which are need for their home consumption, whether or not these crops desirable from the ecological standpoint.

Political tacitness : It refers to whether the technology can be used unhammered in the existing inticasies and implications of political set up.

Administrative manageability : It refers to the extent to which the technology can be practically implemented under the existing bureaucratic structure.

Cultural desirability : I t refers to the extent the technology fits with the culture patterns & values of the society.

Renewability : It refers to the extent to which the technology can be used or re used without much additional efforts or inputs.

Equity : It is a measure of how evenly the product of the agro-ecosystem are distributed among the local producers and consumers.

Productivity : It is a quantitative measure of the rate and amount of production per unit of land or input. It also a measure sustainability of agriculture.

Adoption of sustainable agriculture is the key to pollution control and the control of environmental pollution leads to sustainable agriculture and pollution free production.

Therefore, keeping the sustainable agriculture in mind the researcher has made an attempt to find the out awareness and perception of the farmers about environmental pollution and control of environmental pollution of sustainable agriculture. The specific objectives of the study were as follows.

SPECIFIC OBJECTIVES OF THE STUDY

1. To study the socio-economic profile of the farmers.
2. To find out the perception of farmers about sustainable agriculture.
3. To find out the extent (Degree) of awareness about the harmful effects of environmental pollution.
4. To find out the farmers perception about different sources of pollution.
5. Suggestions of the farmers about the control of environmental pollution for sustainable agriculture.

LIMITATION OF THE STUDY

1. As it is a research conducted by single student, the time and other resources at the hands of the researcher are limited to some extent. This is the reason for which the study was conducted only in four villages of a block.
2. The investigation was purely based on the verbal expression of respondents for which the correctness in getting the information was also limited to some extent.

ORGANISATION OF THESIS

The dissertation includes the chapters, viz., Introduction, Review of Literature, Methodology, Results and discussion and summary and conclusion, Bibliography and Appendices.

The first chapter i.e., "Introduction" deals with the problems objectives, the scope and limitations of the present study. The second chapter is devoted for the Review of Literature, which covers the reviews of selected, important and related studies in the area of present- investigation. The third chapter " Methodology" deals with the locals of investigation, research design, selection of respondents, operationalization and method of measurement of the variables, techniques used for data collection, statistical tools used for the "Results and discussion" of the study. The fifth chapter covers the "Summary and conclusion" of the study followed by "Bibliography" and "Appendices", respectively.

REVIEW OF LITERATURE

The concept of sustainable Agriculture is a quite new phenomena. Literature regarding the research and perception by the farmers are very limited. However, attempt has been made to present brief reviews available pertaining sustainable Agriculture, environment pollution and control of environmental pollution for sustainable agriculture. These are presented under the following heads.

- 2.1 Sustainable Agriculture
- 2.2 Importance of environment
- 2.3 Sources of environmental pollution
- 2.4 Awareness about the harmful effects of environmental pollution
- 2.5 Suggestions of the farmers for control of environmental pollution for sustainable Agriculture

2.1 Sustainable Agriculture

Baier (1990)- Sustainable agriculture is the integration of development technique with environmentally sound, economic viable, social justifiable and more human agricultural systems.

United Nations Conference on Environment Development 1992 at RIO- Stated that involvement of woman is the root towards sustainable & equitable development.

Vijay (1996)- revealed that sustainable agriculture can be referred as alternative farming or conservation farming or regenerative agriculture or organic farming for accepting the principle of eco-existence of soil microbes, livestock and tree component which leads to natural farming for future prosperity.

Yadav, Jha and Pandey (1996) found that the harmony between increasing production through advanced agro technology for the present and preservation of environmental quality and resource base for the future led to the concept of sustainable agriculture. It aims stability of production over time through the location, and situation specific productions principles.

Lahiry (1997)-Sustainable agriculture calls for an environmental friendly technology at the global level and agreement among the nation to respect each others need.

Sundar (1997)- Sustainable development is based on maintaining a fragile balance between productivity function and conservative practices through monetary and industry the status of national resources.

Agrawal (1997)- Ecosustainable agriculture is linked to carrying capacity of the eco-system based on the development planning process by analysing the underlying co-relationship between population poverty and pollution to provide supportive capacity for development and assimilative capacity for maintainance of acceptable quality of environment.

Lahiry (1997)- Stated that sustainable development is a multi dimensional concept with three interacting angles ecology, economics & ethics. The necessary conditions for achieving sustainable development are ecological security, economic ability & social-equity.

Verm (1997)- Revealed that economics of sustainable development is the development that lasts. It means meeting the need of the present without compromising the ability of future generation to meet their needs.

Brut Land Commission (1997)- Sustainability is essentially a holistic notion at which one can exploit exhaustible resources or the level of degradation of renewable resources that may be permitted.

Satapathy & Das (1997)- Stated that specific pin pointed stimulating a extension methods which can be used as per the clients brings sustainability in agriculture. The main drive to development good human beings along with good farmers. This will help us to create ecofriendly situations leading to sustainable agriculture which will encompass stability, productivity & equity.

World life fund,(WIF-1985)- Described that sustainable development is the management of biosphere taking into account ecological relationship as well as social and economic factors, the capability of living and non living resource base and long term advantages and disadvantages of alternative action, while maintaining the potentials of a given eco-system to meet the wants and needs of future generation for food, shelter and other aspect of human life.

Sadangi (1997)- Found that farmers agreed that adoption of proven alternative system would result in even greater economic benefits to farmers and environment gains for the state and the country.

Reserch evidence indicates that very small numbers of farmers (4%) use alternative farm system through crop rotation (44%), intigrated ipm-16%, soil water conservation 9% bio-fertilizer 12%, high yield variety 78%.

The farmers perception of sustainability as found in different studies has shown their growing concern for future of their esnterprise land, water and air.

Basavraj & Patil (1997)- Sustainable crop production not only involves identification & application of improved technology but also sustainable management of natural and renewable resources & maintaining the quality of environment & conserving the natural resources, soil water on a long term basis.

The World Bank (1998) Stated that absolute priority is to be given to human resource & institutional development for sustainable future.

2.2 IMPORTANCE OF ENVIRONMENT

New Encyclopedia Britannica (1943-73), "Pollution is caused when a change in physical or biological conditions in the environment harmfully affect the quality of human life, including effects on other animals and plant, industries and cultural and aesthetic assets". Most pollution may be characterised as a production excess result from manufacturing or growing more than is to be consumed or as a result of discarding products after used.

D. Arge (1971) described the pervasive environmental changes accompanying the development of modern societies have wrought doubts regarding the insignificance of uncontrolled inter dependencies between man and the natural environment. The economic act of production and consumption not only benefit man through his provision but simultaneously involve the creation of wastes with the potential of degrading his environment.

Thompson (1973) reported that ecological problems are very acute in U.S.A. He revealed this fact in this book that every inhabitant of U.S.A. causes 50 times greater damage to the environment than inhabitant of say India.

Gerasimov (1975) reported that the natural environment in which people pursue their everyday productive, domestic and recreational activities as an integrated system of

inter-connected physical object and natural phenomena, such as the relief, mountains rock formation, air, climate, water, soils, vegetation the animal kingdom which all interact with its technological components created by society.

Chandra Sekhar (1976) is of the opinion that the pollution of human environment is multi-dimensional. The ecological crisis is at once the most local and the most international of all man's concerns. The long struggle between man and nature has resulted in a multitude of both beneficent and harmful life style as well as infinite variety of environmental patterns. Man has tried to conquer environment. To man, the environment has been a challenge, something to alter and change, crush and overcome. He tried to adopt and adjust even partly to the inherent needs of nature. He could have lived in peace without disturbing nature's delicate balance and equilibrium.

Chauhan (1977) mentioned that the environmental problem as we see them today were not always so grave. In fact they illustrate what may be termed as a cumulative result of man's anti-life and adhoc activities over the past. A major chunk of these deeds are attributed to the modern man and his technology.

Mills (1978) is of the opinion that technology also creates environmental problems. Persistent pesticides such as DDT and supersonic air craft are product of modern technological progress whose environmental effects are of great concern. Atomic energy is undoubtedly the product of science and technology whose environmental effect have arosed the greatest anxiety.

Madhab (1982) defined the term environment by saying that the environment is simply, the totality of the world around us, including ourselves and our domesticated animals. It is a foolish mistake to think, as many people seem to that the environment means only rocks,rivers, vegetation, wild animals and industrial pollution the things which have been published. It is everything. The ecological saying that everything is related everything also is the foundation stone of environment studies.

Iyer's and Krishna (1984) comments is worth mentioning in this regard. "The unconscionable industrialization, the unpardonable deforestation and the human extermination of living species betray an exploitative brutality and antisocial appetite for profit and pleasure incompatible with humanism and conservationism. Today a bath in the Yamuna and Ganga is a sin against bodily health, not a salvation for the soul so polluted and noxious are these Holy water Now".

Sharma (1986) defined planet earth is sick, very sick. The symptoms of this planetary disease are all round in our air, water and our food. The most alarming the air, earth and water with dangerous and even lethal materials. This pollution of our environment is for the most part irrecoverable.

Environmental group, called friends of earth (1989) pointed out that the problem is that carbon dioxide-form burning coal and oil, etc. is one of our the biggest waste products. Power stations, cars, industry and agriculture all produce it in massive amounts. For more carbon dioxide is getting into the atmosphere than should naturally be there and result the green house effect increasing the earth is getting hotter. Burning of tropical forest as practiced in developing country it actually adding more to the problem.

Manivaskam (1989) observed "The industrial revolution and our modern civilization turns the air we breath into a waster basket in which dust, noxious fumes, toxic, gases, mist, odour and smoke are thrown.

Ansari (1989) stated that poverty is the fundamental cause which makes people over exploitable natural resources of the country like land, forest and water for meeting their basic needs for employment, for shelther, for fuel and fodder for their cattle.

Karpagam (1991) opined "Environmental economics mainly builds its theoretical foundation on welfare economics. Through environmental pollution society incurs significant cost by reducing the assimilative capacity of environment. These costs are external costs because the individuals and firms that use the waste assimilative capabilities of environment, are not charged for this use. They're in essence of the rest of the society. Such external costs are also called as spill over cost. It is in this sense that pollution becomes an externality".

Nayak (1994) reported a study conducted by him showed that emission from NALCO, Angul have caused pollution of both soil and water of the surroundings areas. The extent of pollution with fluoride (F) decreased with distance from NALCO smelter plant. Fluoride content of leaves of trees, crop plant and paddy straw collected from these areas within 5 kms radius varied from 66 to 330 mg/kg (dry weight basis) compared content of 10 to 26 mg/kg similar samples collected war area.

2.3 Sources of environmental Pollution

Astranin and Blagosklonov (1978) According to them the soil may be polluted when fertilizer and pesticides are in-correctly used and also by the waste of livestock breeding complexes.

Asogwa (1981) regarded chemicals extensive use in agriculture as posing a threat to human environment. Those at risk are mainly workers who are engaged in the application of chemicals.

Pal (1982) evaluated that effect of environmental pollution of agriculture according to his evaluation, of the direct effects of consequence to the environment, one could talk of pollution of water bodies from the run off of water used for irrigation farm and field. This pollution is due to residual agricultural chemicals in the water being drain off which have been known to cause fish kills and other kinds of damage to aquatic life.

Obian (1986) concluded that recycling of farm wastes through biogas plant relieves the farmer of problem of waste disposal and environmental pollution. According to him it also provides some relief for problems caused by high cost of three major inputs. Fertiliser, feed and fuel. By using integrated farming system that optimise the utilisation of farm wastes, the farmer reduces his production cost and increase his productivity.

Gupta (1988) said it is well known that hundreds of millions of living organisms including human and animal population exposed significantly to pesticides each year. Roughly 85 to 90 per cent of pesticides applied to crops never reach target organisms, but are disposed in the environment (air, soil and water) and contaminate both biotic and abiotic systems. Several physio-chemical factors influence the persistence of pesticides.

Wadhawa and Malhotra (1988) indicated pesticides, the synthetic chemicals occupy a unique position among the many chemicals in land, water management result in health hazard due to careless use, misuse and mishandling of pesticides. Finally, there can be acute and chronic toxicity in mammals, livestock and wild life. So to maintain ecological balance, toxicological studies of pesticides must consider the problems relating to injurious effect of these chemicals on man and animals and also on environment.

Sharma (1988) revealed the role of agricultural machinery and pesticides. According to him our highly mechanized agricultural operations dominated by extensive acreage of one particular crop encourages large no. of insects. As an insurance against damage by insects, vast quantities of insecticides are applied with little regard for what happens to the chemicals once it is on the land. The average use of pesticides in India is low (45 gm/hect) as against 14010 gms/hect in Japan. The CPPII, Hyderabad, revealed that the various food items tested contained residue above permissible level (use of pesticides in high localized conditions). In another limited survey, it was found that proper care and attention is not given while using pesticides. In the third world, it is estimated that one person dies every minute due to pesticide poisoning.

Ellers (1989) reported about the over use of fertilizer and manure in West Germany, he stated that the exports harbour no doubts that farmers are the worst polluters of West Germany's water supplies. Some 30,000 tonnes of the highly poisonous pesticides and herbicides are sprayed on to the country's field each year. More toxins come from liquid manure from cattle farms.

Millinship (1989) quoted the leading Soviet Green Professor Alexi Yablakov in his article "Green take root in the Kremlin". According to Alexi Yablakov, the average for the Soviet Union as a whole is two kilos/hectare a year. But there are regions where between 10 to 50 kilos are used. I know of one region where the figure is 200 kilos a year. And there is a strong, direct connection between heavy use of pesticides and ill health, mental and physical.

Khan *et al.* (1990) on an average methane production is estimated to be 200 lits/day for a 500 kg cow, 30 lits/day for buffaloes produce less amount of methane because of poor quality feed and fodder available to them. On an average a buffalo at maintenance level of feeding on wheat straw based ration generate only about 150 liters methane in day.

Khoshoo (1991) The root cause of poverty of India's teeming millions can be traced to land degradation which assumes critical importance on account of the fact that as a result of which their effect on living being is potentiated.

2.4 Awareness about harmful effects of environmental pollution

According to Encyclopedia Britannica (1943-1973) "It is a form of environmental degradation and has implication for health that may be as serious as air or water pollution. It can change man's physiological state by speeding up pulse and respiratory rates and it can impair hearing either permanently or temporarily; millions of industrial workers are threatened with hearing damage".

Dubes (1968) defined today's problems are different and far more intractable. Erosion of the land, the chemical pollution of air and water, the high level of noise light and other stimuli, the pervasive ugliness of industrial civilization, the inescapable pressures resulting from high population densities and mechanized life, all these phenomena have become critical only during recent decades.

Aschabaker (1973) reported pollution and degradation of ecosystem have assumed more importance owing to increased industrialization. Industrial process has been directly or indirectly responsible for release of toxic pollutions in the environment of all pollutants which effect farm animals fluorine causes more severe and wide spread damage.

Perkins (1974) opined air pollution means the presence in outdoor atmosphere of one or more or more contaminants, such as dust, fumes, gas mist, odour, smoke or vapour in quantities, of characteristics and of duration such as to be injurious to human, plant or animal life or to property, or which unreasonably interferes with the comfortable enjoyment of life and property.

Gerasimov (1975) mentioned some pollutants of air by saying that the earth's atmosphere continues to be contaminated with dusts carbon dioxide, sulphurous compounds, lead, nitrogen oxides, soot, pesticides. The carbon dioxide level in the atmosphere are rapidly growing which is likely to lead to great and even catastrophic changes in the earth's climate.

Chauhan (1977) has expressed that it is man's sheer numbers which is the root cause of all pollution problem.

Hodges (1977) classified pollution into natural and artificial pollution. He mentioned some completely artificial pollutant i.e. chlorinated hydrocarbons (DDT and others) lead aerosols and substantially artificial aerosols on oceans and phosphates in

running water. He further mentioned some substantial contributions from natural sources i.e. hydrocarbon in the atmosphere, radiation and sulphur oxides in the atmosphere. Further he has stated that domestic waste in rural areas must also be considered. Generally the waste water are disposed of in the ground through the use of pit privies, cesspool or septic tank. The main concern is to prevent contamination of ground water supplies or at least to prevent contamination of wells from which drinking water is obtained. He has defined one of the most worrisome aspect of the increase in pollution is that human have now become a major factor in several of the greates bio-geochemical cycles and may be causing irreversible change or irreparable harm without realizing it. These biogeochemical cycles are the circulation of various element through the biosphere (the past of the earth characterized by the existence of plant and animal life). The atmosphere, the hydrosphere (the earth ocreans and waters) and the lithosphere (the onseravation of atmosphere nitrogen into organic nitrogen compound) by human through combustion process, fertilizer productions and cultivation of the nitrogen-fixing legumes may equal to the historical nitrogen fixation from natural sources such as terrestrialmarine life and lightening and obtained that "noises that affect a community include construction noises (especially in large cities in which some construction or repairing is usually going on) transportation noises from cars, trucks, motor cycles and air plane. Noise from power lawn mower power saw and noise appliances.

Mills (1978) stated that both air and water pollution are complex in that many substances are discharged to the media and substances interact in complex and incompletely understood ways among themselves and with substances found naturally in media. People have much more flexibility and discretion with respect to water. Water pollution is much more complex than air pollution in the sense that society has much ,ore options about the quality and uses of water bodies than have about air quality.

Mohanty et al. (1978) stated as most of the packaging materials are made up of plastic, polythene, coir, nylon, leather materials, they remain undigested in the ruemenoreticulum of the cow causing serious patho-physiological change and economic loss through fall in production.

Thanase and Sunderason (1980) regarded water pollution as a serious threat to Indian environment and it is due to industrial effluent and municipal sewage.

Crissman *et al.* (1980) opined although most fluoride emission from smelters is airborne, toxic contamination of soil, water and vegetation could occur not only in the industrial vicinity but upto a fairly distant place from the source of emission. Fluoride contamination of forage (pasture, grass timothy alfa-alfa) near an aluminum plant ranged from 14.9 to 22.5 ppm on dry matter basis. It is influenced by rainfall and distance to the source of pollution.

Madhav (1982) stressed that pollution is responsible for mist of the physical problems of the environment and many of the social problem.

Pal (1982) staded "dust storms are a much too familiar recurring feature on the plains of northern India where in the hot summer months, particles of desiccated soil are carried high up in the air by winds and over considerable distances. Some of the best known examples of damage to land are found in north-eastern hill state".

Khanna (1982) mentioned that with increased urbanizations and rapid industrialization, the contamination of air poses a big menace. The emission of gases by the automobiles which are growing in number and burning of coal for fire or in factories for plower generation, use of fire wood, cow dung etc. have contributed greatly to air pollution.

Dugar (1982) in his study on "Ecological and environmental problem in Rajasthan" quoted the preliminary survey which was conducted by the environmental cell of Gandhi Peace foundation over fifteen millions liters of water mixed with harmful dye stuff, chemical, and acids, alkalies, metals, solvents etc. of dyeing and printing industry have already polluted quite a bit of ground water and printing industry have already polluted

quite a bit of ground water and a majority of wells and other water sources inducing the tubewells and hand pumps water of these sources cannot be taken as safe and fit for human consumption.

Jain (1988) reports water technology experts have estimated that large parts of India will go without water by the years 2025 A.D.

Ansari (1989) estimated that nearly 100 million hectares of land, almost one-third of total area have been affected by land degradation caused by soil erosion, salinity, alkalinity and wind erosion.

Pachauri (1989) gave some figure about carbon dioxide emissions produced cumulatively by different groups of countries in the past, he stated that between 1870 and 1986, roughly 65 per cent of the cumulative emissions of carbon dioxide from burning of fossile fuels come from the free market developed countries, while centrally planned economies and developing countries contributed roughly 20 and 15 per cent respectively.

Lag (1990) defined acidification of soil through pollution of atmosphere has been ascribed to deposition of sulphur compound, independent of precipitation. Sulphur contribute as high as 30 per cent in soil acidification.

Singh (1992) observed that the use of thresher create a number of problem (health hazard) in rural village and a large number of people face breathing problem and irritation in throat.

Singh (1992) observed the effect of noise pollution in rural life and found that noise pollution disturbed mental peace, student and patients. This menace has been increased due to technological advancement in the rural area.

Mathur (1993) opined coal mining which covers 3.47 million ha out of 328.8 million ha (0.1%) land area in India cause degradation of 0.38 million ha (0.0006%) land area in country.

Swarup (1995) many of the environmental pollutant undergo transformation to mire hazardous forms to living being. Toxic element such as lead, arsenic, cadmium and fluoride and synthetic chemicals such as DDT and orgno chlorine tend to accumulate in plants and animals affecting the health and physiology of living being. Similarly some of the pollutants are reported to be biomagnified in plant.

2.5. Suggestion of people for control of environmental pollution for sustainable agriculture.

Holloingshead (1953) focus in the study of human communities emerged with the use of the ecological approach.

Howley (1968) broadened the scope of environment by covering both social as well as natural components of environment. According to him, the application of the concepts from plant and animal ecology to human community carried with it, the implication what the community was essentially a natural phenomenon.

Platt and Griffith (1972) stated that modern civilization is already exercising its termediuous potential to alter our environment, too frequently in adverse way's on regional and even global scales. For the continued development and even survival of civilization man must bend every effort to understand and better use his environment.

Palmier (1974) described the development is likely to involve major changes in the pattern of use and management of land and other resources and an increase in the amount of pollutants released into the environment. The problem is to determine what changes and what amounts of increase in pollutant are acceptable, both in particular instances and on a global scale.

Hodges (1977) stated that environmental pollution is the unfavorable alteration of our surroundings through direct or indirect effects of change in energy patterns, radiation levels, chemical and physical construction and abundances of organism. These changes may effect human directly or through their supplies of water and of agricultural other biological products, their physical objects or possessions or their opportunities for recreation and appreciation of nature.

Khozin (1979) is of the opinion that environment is damaged because of irrational use of our planet's resources and organising production is such way. He further, advanced his opinion that protecting nature, making rational use of scientific advancement and technology for the welfare of mankind.

Pal (1982) stated that it is of the most importance that life support systems embracing air, water, and land the tremendous diversity of life, are preserved even though there is need for undertaking development on a vast scale to satisfy the increasing needs of human being. Erosion of land resources, pollution of air, water and even the soil, deforestation on a scale never before witnessed in history and many other activities are taking place which are severely damaging the environment and its resources. Unless development is so planned as to be sustainable the future appears to be very bleak.

Prasad (1989) stated in his article that Indian faces serious problem of environmental pollution. Water pollution from untreated community and industrial wastes flowing into our river and streams, increasing use of fertilizer and pesticides, dumping of organic wastes and inorganic wastes are issues that need to be tackled on priority. Air pollution long regarded as the bane of industrialized nation looms large over our country.

Prasad (1989) postulated that forest play an important role in maintaining environmental stability and in supplying essential requirement of people on a renewable basis. Over the year, the forests have suffered depletion due to relentless pressures arising

from increasing demand for fuel wood, fodder and timber, inadequacy of protection measures, diversion forest land to non-forest uses and the tendency to look upon forest as a revenue earning resource.

Gowda (1992) opined "Development must not be at the cost of nation's life supporting ecosystem comprising soil, water flore, fauna and other natural resources. Environment protection is thus a new dimension of development which can not be overlooked".

Rath and Mohanty (1994) observed that most important suggestion as expressed by the non-school going adolescents in order of rank were teaching about environmental pollution is school maintenance of gap between residential house and cattle shed, enforcement of anto-pollution law, use of natural product, in view of chemicals/pesticides, removal of city slums, concouraging the role of voluntary organisation in checking environmental pollution, banning air horns and loudspeakers. taking ahead role for checking of environmental pollution, construction of drainage channels in village/tows, checking of industrial waste and other debrishes, organisation of environmental protection club in every village lastly through check of automobile emissions. Further, they have stated that "Education is considered as the chief vehicle for maintaining and transmitting the basic values on which the cohesion of our future society depends. Education should also fulfill its role in promoting environmental protection through creating awareness among the adolescents and utilising resource for environmental monitoring. This awareness towards environmental pollution will certainly help to develop comprehensive social and economic objective to ensure the success of environmental programme.

Raoot (1997) use of toxic chemicals and release of concentrated wastes water to the surrounding may cause the pollution. An easier and less costly option of the waste. Water treatment is biological/ bacterial treatment. Suitable bacteria are also given to convert the organic components in the waste water harmless compounds. To ensure this absence of chemicals toxic to the bacteria is essential.

CHAPTER-III
RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

The procedure in selection of village, sampling, empirical measurement of different concepts and variables, devices used for collection of data and statistical analysis of data are described in this chapter under the following heads.

- 3.1 Locale of the Study
- 3.2 Population of the study
- 3.3 Selection of respondents.
- 3.4 Research design.
- 3.5 Operationalization of concepts used in the study.
- 3.6 Measurement techniques.
- 3.7 Construction of interview schedule and data collection.
- 3.8 Statistical methods used for analyzing the data.

3.1 Locale of the study

The present study was conducted purposefully in Khurda district of Orissa State. The selection of district was purposefully because most of the farmers are progressive and adopting intensive method of cultivation and the area is prone to high environmental pollution.

Bhubaneswar block was selected for the study as the villages of this block are subjected to environmental pollution. Four villages were selected by the method of random sampling technique to avoid biasness. The villages were lingipur, Jaganathpur, Kumardiha and Nathpur. The basic information about the villages have been given in the appendix-II.

3.2 Population of the study

A preliminary survey was conducted by the researcher to identify the progressive farmers. These farmers were constituted the population of the present study.

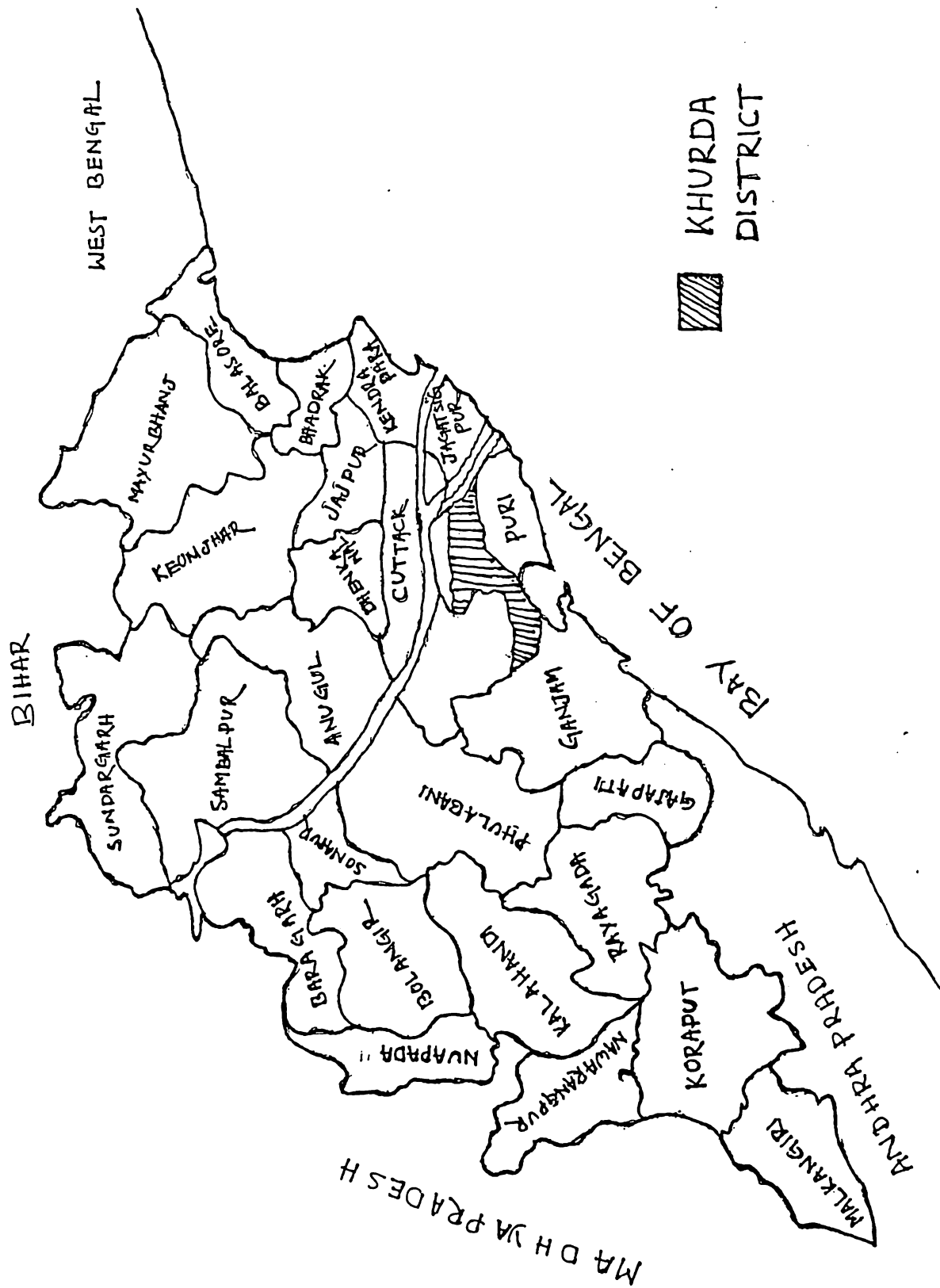


Fig. 1. Map of Orissa showing Khurda District.

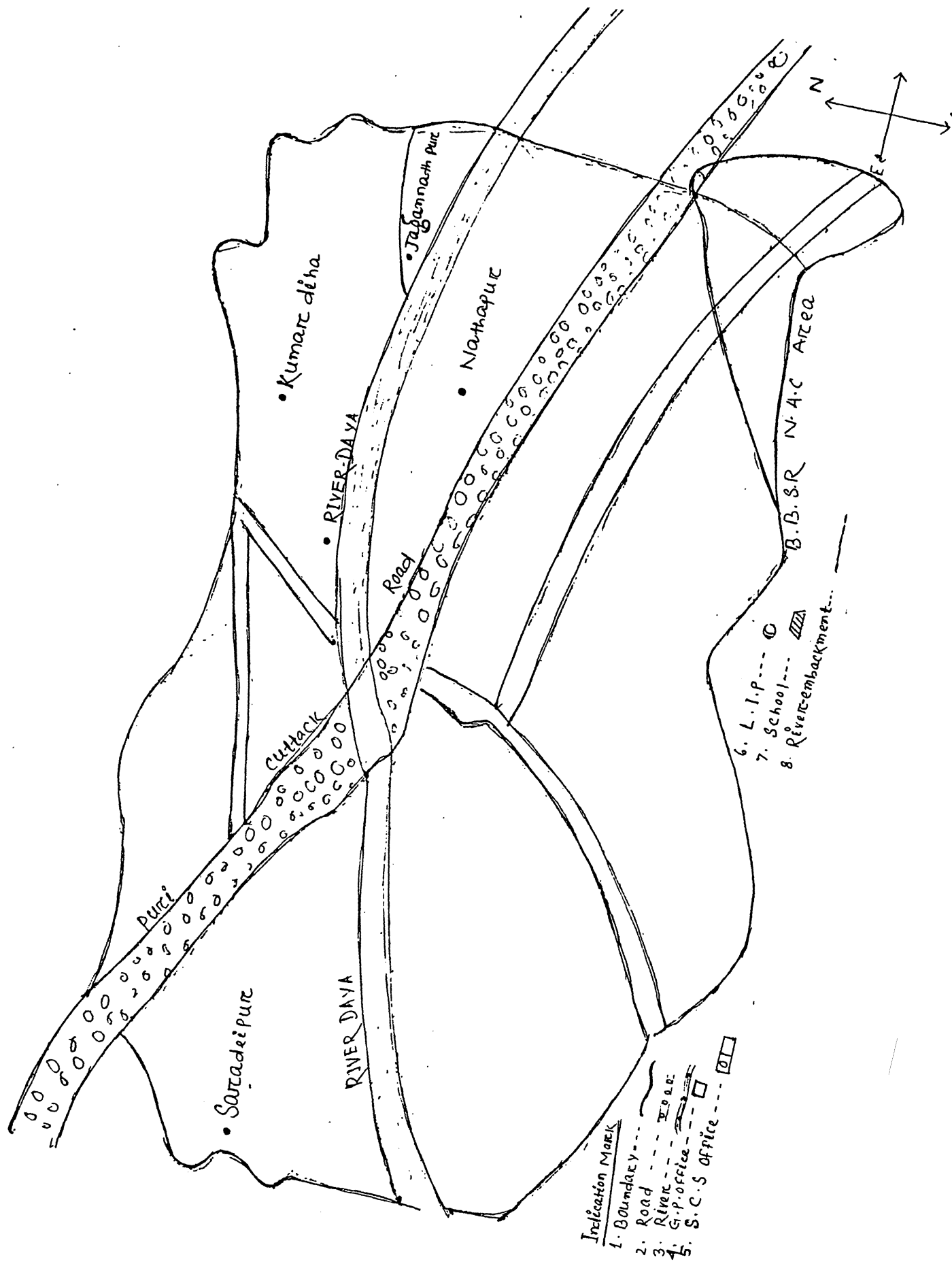


Fig. 2.
Map of Area under study.

3.3 Selection of respondents

Twenty five respondents from each of the four villages were selected by the use of lottery method keeping their agricultural practice in view.

3.4 Research design

Survey method design was adopted for the present study,. According to Mulay and Sabarathanam (1980), the term survey applied to a wide variety of investigation such as classical poverty surveys Gallop Pools in United States of social condition of rural poors or fact-finding study of nutrition etc. The survey is concerned with examining the nature of and relationship among demographic characteristics, social condition and activities and attitude of the people. The surveys are always carried out in a field situation., They could be either descriptive or analytical (diagnostic). It needs a combination of techniques which are standardized and which cover a ,larger representative sample. A good survey design includes information on necessary matching characteristics and a a carefully thought out classification of stimulus and effective variables.

3.5 Operationalization of concepts used in the Study

Kerlinger (1964) pointed out that operational definitions are indispensable ingredient of scientific research because they enable the researcher to measure the variables and they are the bridge between the Theory- hypothesis construction level and the level of observation. The operational definition of some of the concepts used in the study as follows.

Environment

Environment is the totality of world around including plant and domesticated animals. Environment , the action of environing, the state of being environed. The condition under which any person or things lives or is developed. The sum total of influences which modify and determine the development of linkage character.

Environmental Pollution

Environmental pollution is caused when a change in physical, chemical or biological condition in the environment, harmfully effect the quality of human and also other animals and plants, industries and cultural and aesthetic assets.

Awareness

It is the process of being informed about certain objects. In this study it is the degree to which an individual is known about world events on environmental pollution.

Perception

It is the act of knowing things by the senses, or claiming of sensations into recognition of the factors of environmental pollution considered in this research.

Sustainable agriculture

It is a practice of crop production by which all the parameters of agriculture are followed in an integrated manner to meet the changing food, fibre, fodder and fuel needs of a country without detrimental effect on its natural resource base.

3.6 MEASUREMENT TECHNIQUES

3.6.1 Measurement of personal and socio-economic profile

The table 3.1 below given a picture about different personal and socio-economic variables used in the study alongwith their empirical measurement.

Table 3.1 Personal and socio-economic variables used in the study and their empirical measurements.

<u>Personal and socio-economic variables</u>		
<u>Variable No.</u>	<u>Variables</u>	<u>Instruments used</u>
X ₁	Age	Schedule developed for the study
X ₂	Educational Status	-do-
X ₃	Caste	-do-
X ₄	Family Type	-do-
X ₅	Occupation	-do-
X ₆	Annual income	-do-
X ₇	Mass Media Participation	-do-
X ₈	Social Participation	-do-
X ₉	Extension participation	-do-
X ₁₀	Extension contact	-do-

X₁ Age

In the present study age was operationalised as the actual age of the respondent in completed year at the time of the study i.e, December,1997. After observing the distribution of the respondents according to their age, they were catagorised into four categories as follows.

<u>Sl No.</u>	<u>Age Group</u>
1	Upto 40 years
2.	41-50 years
3.	51-60 years
4.	Above 60 years

X₂ Educational status

Educational status refers to the educational attainment of the respondents at the time of the study. The respondents were catagorised into four categories according to their educational status. The scoring pattern for each of the categories were as follows:

Sl. No.	Categories	Score
1.	Illiterate	1
2.	Upto primary	2
3.	Upto Matric	3
4.	Above Matric	4

X₃ Caste:

Caster refers to the social position of the respondent by birth. The respondents were catagorised in to two categories viz., Lower caste and higher caste. The respondents belonging to Brahmin, Kshetriya and Karan by caste were considered as higher caste. The respondents other than the above caste were considered as lower caste in the present study. The scoring pattern for the caste were as follows:

Sl. No.	Categories	Score
1.	Lower Caste	1
2.	Higher Caste	2

X₄ Family type:

Family type in the present study refers to whether the adult member of family were living in jointly or nuclear family and they were catagorised into two categories according two their family type. The scoring pattern were as follows:

Sl.No.	Categories	Score
1.	Nuclear	1
2.	Joint	2

X₅ Occupation:

Occupation in the present study refers to from which source the respondents earned and sustain their livelihood and were catagorised into five categories.

The scoring pattern for each of the categories were as follows:

Sl. No.	Categories	Score
1.	Agril. Labour	1
2.	Agril. & Business	2
3.	Agril. & Service	2
4.	Any other	2
5.	Agril. and allied activities	3

X₆ Annual Income:

Annual income in the present study refers to the total income of the respondents from all sources in a year. They were catagorised into five categories according to their total income in a year. The scoring pattern for each of this categories were as follows:

Sl. No.	Categories	Score
1.	Upto Rs.15,000/-	1
2.	Rs.15,000 to 30,000/-	2
3.	Rs.30,000 to 45,000/-	3
4.	Rs.45,000 to 60,000/-	4
5	Above Rs.60,000/-	5

X7 Mass media participation:

Mass media participation in the present study refers to the frequency of listening and reading habit or the respondent to the difference mass media like newspaper, farm magazine and literature of environment concern, books on agriculture and environment, radio and television. The scoring pattern of listening and reading habit of respondents to mass media were as follows.

Sl. No.	Frequency of reading/ Listening habit	Scoring pattern
1.	Regularly	3
2.	Often	2
3.	Rarely	1
4.	Never	0

Final the total score for mass media participation was computed for each of the respondents by summing up the scores for each of the mass medium. The maximum and minimum possible score for this variable ranges from 15-0. After obtaining the total score, the respondents of each of the farming systems were categorised into three categories by farming systems were categorised into three categories by taking mean and standard deviation as follows.

Sl.No.	Categories	Criteria
1.	High participation	More than mean S.D $\pm$ 1
2	Medium participation	In between mean S.D $\pm$ 1
3.	Low participation	Less than mean S.D-1

X8 Social participation :

Social participation in the present study refers to the active-passive involvement of respondent in different organisation present in their locality and were catagorised into four categories. the scoring pattern for each of the categories were as follows:

Sl.No.	Categories	Score
1.	Not member oaf any organisation.	1
2.	Member of the one organisation	2
3.	Member of more than one organisations	3
4.	office bearer	4

Further, the respondents were catagorised into two categories depending upon their membership in different organisation. The respondents who are not member of any organisation were included under low social participation category which others were included under high social participation category. The frequency distribution for each of the categories were finally computed.

X9 Extension participation:

Extension participation in the present study refers to the frequency of participation of respondents in attending different extension programmes such as short training programmes, training courses, discussion, meetings, field visits, demonstrations, film shows, field days, exhibition and study tours etc. The scoring pattern for the frequency of participation in different extension programmes were as follows:

Sl.No.	Frequency of participation	Score assigned
1.	Regularly	3
2.	Often	2
3.	Rarely	1
4.	Never	0

The total score for each of the respondents was calculated by adding the frequencies of participation over different extension programmes. The minimum-maximum possible score ranged from 0-3. Lastly, the respondents were categorised into three categories for each of the farming systems depending upon their extension participation by taking mean & standard deviation as follows.

Sl.No.	Categories	Criteria
1.	High participation	More than mean +1 S.D
2.	Medium participation	In between mean $\pm$ S.D
3.	Low participation	Less than mean - S.D

X₁₀ Extension Contact :

Extension contact in the present study refers to the frequency of contact of the respondent with the extension personnel like village level Extension Officer, Block Level Extension Officer, District Level Extension Officer and State Level Extension Officers. The weightage given for contacting different extension personnel were as follows.

Sl.No.	Extension Personnel	Score assigned
1.	Village Level Extension Officer	1
2.	Block Level Extension Officer	2
3.	District Level Extension Officer	3
4.	State Level Extension Officer	4

Further, the scoring pattern for frequency of contact with extension personnel were as follows:

Sl. No.	Frequency of Extension contact	Score assigned
1.	Regularly	3
2.	Often	2
3.	Rarely	1
4.	Never	0

Finally, the total score for each of the respondents on their extension contact was computed by multiplying their frequency of contact with the score assigned to different level of extension officers. The minimum-maximum possible score ranges from 0 to 12. the respondents were catagorised into three categories as high, medium and low extension contact by taking mean and standard deviation as follows.

Sl. No.	Categories on extension contact	Criteria
1.	High	More than mean +1 S.D
2.	Medium	in between mean $\pm$ 1 S.D
3.	Low	Less than mean -1 S.D

3.6.2 Perception of farmer about sustainable agriculture

In order to find out the perceptions farmers about sustainable agriculture statements were prepared on each parameters of agriculture. A list of twelve statement on soil and management, ten statement on water management, twelve statement on integrated nutrient management, ten statements on integrated pest management, ten statements on conservation of bio diversity, fourteen statements on post harvest technology, eighteen statements on socio-economic political factors and extension management were prepared. The respondent were asked to indicate their degree of perception about each of the statement.

The response categories along with the scoring patterns were as follows.

Sl.No.	Statements	Degree of perception score
1.	Very important	4
2.	Important	3
3.	Less important	2
4.	Least important	1

After getting the response from the respondents on each parameter of sustainable agriculture the total score as well as mean score of each statement were computed.

Further in order to findout the perception on sustainable agriculture the total score of each of the respondent was computed by totaling all the statement of sustainable agriculture.

Sl. No.	Perception categories	Criteria
1.	High perception	More than +1S.D
2.	Medium perception	In between mean±1S.D
3.	Low perception	Less than mean -1S.D

3.6.3 Degree of awareness about harmful effects of environmental pollution

In order to assess the awareness of farmers about the harmful effects of environmental pollution an extensive list of twenty seven statements were formed in consultation with the experts and students in the related field. The responses of farmers about their awareness on each of the statements was calculated in the following order.

Sl.No.	Category	Score assigned
1.	Not aware	0
2.	Aware	
	(a) Listened	1
	(b) Read	2
	(c) Experienced	3

After getting the responses of the respondents the total awareness score as well as mean awareness score of each statement were computed. Then the respondents were categorised by taking mean & standard deviation into awareness categories.

Sl.No.	Awareness categories	Criteria
1.	High awareness	More than mean 1 S.D
2.	Medium awareness	In between mean 1 S.D
3.	Low awareness	Less than mean 1 S.D

3.6.4 Farmers perception about different sources of pollution

In order to determine the perceptions of farmers about different sources of pollution four broad areas were identified through reviewing related literature. The areas were soil/Land pollution, air pollution, water pollution, and pollution due to intensive agriculture. Further an exhaustive list of statements under each of the broad areas were framed in consultation with experts and specialist in the concerned field. Accordingly seven, five, fifteen, twelve statements were formulated in the areas of soil water, air and on intensive agriculture respectively.

The responses were collected from the farmers on each of the statement in the following order.

Sl.No.	Response categories	Score
1.	Strongly Disagree	0
2.	Disagree	1
3.	Undecided	2
4.	Agreed	3
5.	Strongly agreed	4

After getting the score of each item, total perception score (TPS) as well as mean perception score (MPS) for each sources were computed. Finally they were ranked on the basis of mean perception score for getting clear understanding.

Sl.No.	Perception categories	Criteria
1.	High perception	More than mean +1 S.D
2.	medium perception	In between mean $\pm$ 1 S.D
3.	Low perception	Less than mean -1 S.D

3.6.5 Suggestions of farmer about control of environmental pollution for sustainable agriculture

An exhaustive list of thirty statements with respect to different aspects on environmental pollution & its control measure was prepared in consultation with the experts in the related field. The respondents were asked to indicate the degree of importance to all these statement in a four point seals not important , important, medium import & High important. The scoring pattern were 0, 1, 2, 3 respectively.

After getting the responses from the respondents, the mean score, for each of the statement was calculated for the four villages separately. Finally the mean score for each statement was also computed taking all the farmers together after which ranking was done in order to find out important suggestions on degree of importance.

3.7 Construction of interview schedules and data collection

The interview schedule was prepared keeping all the objectives in mind. In the first part of the interview different personal and socio-economic profile the farmers viz. age, educations, caste, etc. were collected while in the second part the awareness about harmful effects of environmental pollution, perception of farms about sustainable agriculture, perception of farms about different sources of pollution . Suggestions of the farmers in order of degree of importance were calculated.

The data were collected by the researcher himself during Dec 1997 by personal contact with the farmers. A good rapport was built up with the farmers which facilitated the researcher to ask questions freely and discuss any matter pertaining to the study and record information received from the respondents. The schedule was translated to local language in Oriya to facilitate the research for data collection

3.8 Statistical methods used for analyzing the data

The different statistical tests used for analyzing data in the present study were as follows:

3.8.1 Percentage :

Percentages of respondent with respect to different character to facilitate for interpretation and comparison.

3.8.2 Mean score :

The mean score was computed in order to draw the inference pertaining to different characters.

3.8.3 Standard deviation :

The standard deviation was computed to categories the respondents according to their different characters under study.

3.8.4 Ranking :

The rank was assigned to the different dimension of environmental pollution by calculating the mean score. The 1st rank was given to the statement having highest mean score. Similarly, second to the statement having next mean score and so on. It was used in order to rank the different dimensions of environmental pollution as perceived by the farmers of different farming systems.

3.8.5 Kendall co-efficient of concordance :

The Kendall co-efficient of concordance (W) test was used for determining association among the ranking by farmers of different farming systems.

When we have K- sets of ranking, we may determine the association among them by using the Kendall co-efficient of concordance (W). Such a measure may be particularly useful in studies of inter judge or inter test reliability and also has application in studies of clusters of variables (Siegel, 1956).

Suggestions of Farmers for the control of environmental pollution

A list of thirteen statements with respect to different aspects on control of environmental pollution was prepared in consultation with the experts in the related field. The respondents were asked to indicate the degree of importance to allow these statements in a 6 point scale viz., not important, least important, less important, important, more important and most important. The scoring pattern were 0, 1, 2, 3, 4 and 5 respectively.

After getting the response from the respondents, the mean score for each of the statement was calculated for the four farming systems separately. Finally the mean score for each statements was also computed by taking all the farming systems together after which ranking was done in order to find out the important suggestions in order of degree of importance.

CHAPTER-IV
FINDINGS AND DISCUSSION

RESULT AND DISCUSSION

The salient findings have been presented and discussed in this chapter under the following heads.

- 4.1 Socio-economic profile of the farmers under study.
- 4.2 Perception of farmers about sustainable agriculture.
- 4.3 Awareness of the farmers about harmful effects of environmental pollution.
- 4.4 Perceptions of the farmers about different sources of pollution.
- 4.5 Suggestions of farmers about control of environmental pollution for sustainable agriculture.

EXPERIMENTAL RESULTS

The different personal and socio-economic characters which were encoded in order to find out their relationship with the awareness about environmental pollution were age, educational Status, Caste, family type, occupation, annual income, mass media participation, social participation and extension participation contact.

4.1.1 Age

It was revealed from the table-4.1 that twenty percent of the total respondent were less than 40 years of age. Thirty percent, thirty seven percent, thirteen percent of them belonged to the age category of 40 to 50, 51 to 60 and above 60 years. The same table indicates the distribution of respondent in different villages of different age categories.

4.2.2 Educational status

It was revealed from the table-4.1 that nineteen percent of the total respondents belonged to illiterate, thirty nine percent, twenty eight percent, fourteen percent were belonged to the educational status of upto primary, upto matric, above matric respectively. The same table also indicates distribution of respondents of different villages over different educational status.

4.1.3 Caste

It was revealed from table-4.1 that seventy eight percent of the total respondent belonged to High caste categories and twenty two percent belonged to low caste categories. The same table also shows the distribution of respondents of different villages over the different caste categories.

4.1.4 Family type

It was revealed from the table-4.1 that seventy one percent of the respondents belonged to nuclear family type and twenty nine percent of the respondent belonged to joint family type. The same table also indicated the distribution of respondents of different villages over efficient family type either joint or nuclear type.

4.1.5 Occupation

It was observed from the table-4.1 that twenty five percent of the respondent were belonged to agriculture and allied activities, twenty four percent belonged to agriculture and allied activities, thirty two percent of the respondents belonged to agriculture with business and nineteen percent belonged to agriculture with service. The same table also indicated the distribution of respondents of different villages over different occupation categories.

4.1.6 Annual Income

It was revealed from the table-4.1 that fifteen percent of the total respondents belong to the income group of upto 15,000, twenty seven percent of the people belong to the group 15,000- 30,000, thirty three percent of the people belong to 30 - 45,000, twelve percent of the people belonged to income group of 45- 60,000 & thirteen percent belonged to more than 60thousant annual income category .

The same table also indicates distribution of respondents of little villages over different annual in come group.

Table-4.1 Socio-economic profile of farmers.

Socio-economic status categories		Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
		f	%	f	%	f	%	f	%	f	%
A. Age											
(a)	<40	6	24.0	5	20.0	7	28.0	2	8.0	20	20.0
(b)	40-50	5	20.0	9	36.0	9	36.0	7	28.0	30	30.0
(c)	51-60	13	52.0	10	40.0	6	24.0	8	32.0	37	37.0
(d)	Above 60	1	4.0	1	4.0	3	12.0	8	32.0	13	13.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
B. Educational status											
(a)	Illiterate	6	24.0	6	24.0	2	8.0	5	20.0	19	19.0
(b)	Primary	10	40.0	9	36.0	9	36.0	11	44.0	39	39.0
(c)	Upto matric	8	32.0	5	20.0	8	32.0	7	28.0	28	28.0
(d)	> Matric	1	4.0	5	20.0	6	24.0	2	8.0	14	14.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
C. Caste											
(a)	Higher	20	80.0	18	72.0	19	76.0	21	84.0	78	78.0
(b)	Lower	5	20.0	7	28.0	6	24.0	4	16.0	22	22.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
D. Family											
(a)	Nuclear	21	84.0	17	68.0	18	72.0	15	60.0	71	71.0
(b)	Joint	4	16.0	8	32.0	7	28.0	10	40.0	29	29.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
E. Occupation											
(a)	Agriculture	7	28.0	6	24.0	4	16.0	8	32.0	25	25.0
(b)	Agriculture and allied activities	5	20.0	9	36.0	5	20.0	5	20.0	24	24.0
(c)	Agriculture with business	10	40.0	5	20.0	12	48.0	5	20.0	32	32.0
(d)	Agriculture with service	3	12.0	5	20.0	4	16.0	7	28.0	19	19.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0

Socio-economic status categories		Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
		f	%	f	%	f	%	f	%	f	%
F. Annual Income											
(a)	Upto Rs. 15,000/-	2	8.0	6	24.0	5	20.0	2	8.0	15	15.0
(b)	Rs. 15,000/- to Rs. 30,000/-	10	40.0	9	36.0	4	16.0	4	16.0	27	27.0
(c)	Rs. 30,000/- to Rs. 45,000/-	7	28.0	5	20.0	11	44.0	10	40.0	33	33.0
(d)	Rs. 45,000/- to Rs. 60,000/-	5	20.0	2	8.0	1	4.0	4	16.0	12	12.0
(e)	Above Rs. 60,000/-	1	4.0	3	12.0	4	16.0	5	20.0	13	13.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
G. MassMedia Praticipation											
(a)	High	10	40.0	11	44.0	8	32.0	9	36.0	38	38.0
(b)	Medium	12	48.0	12	48.0	15	60.0	13	52.0	52	52.0
(c)	Low	3	12.0	2	8.0	2	8.0	3	12.0	10	10.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
H. Social participation											
(a)	Low	6	24.0	8	32.0	5	20.0	7	28.0	26	26.0
(b)	High	19	76.0	17	68.0	20	80.0	18	72.0	74	74.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
I. Extension participation											
(a)	High	10	40.0	8	32.0	2	8.0	15	60.0	35	35.0
(b)	Medium	9	36.0	12	48.0	18	72.0	7	28.0	46	46.0
(c)	Low	6	24.0	5	20.0	5	20.0	3	12.0	19	19.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0
J. Extension contact											
(a)	High	8	32.0	5	20.0	9	36.0	3	12.0	25	25.0
(b)	Medium	15	60.0	16	64.0	12	48.0	20	80.0	63	63.0
(c)	Low	2	8.0	4	16.0	4	16.0	2	8.0	12	12.0
	Total	25	100.0	25	100.0	25	100.0	25	100.0	100.0	100.0

4.1.7 Mass media Participation

It was revealed from the table-4.1 that thirty eight percent of the total respondents belonged to high group, fifty two percent belonged to medium group, ten percent belonged to low group of mass media participation. The same table also indicates the distribution of respondents of different villages over different groups of mass media participation.

4.1.8 Social participation

It was revealed from the table-4.1 that seventy four percent of the respondents belonged to high group of social participation. Where as twenty six percent of them belonged to low group of social participation. The same table also indicted the distribution of respondents of different villages over different group of social participation.

4.1.9 Extension Participation

It was revealed from the table-4.1 that forty six percent of the people belonged to medium group of extension participation while thirty five percent of and nineteen percent of them belonged to high group and low group of extension participation respectively.

4.1.10 Extension contact

It was revealed from the table-4.1 that twenty five percent of the total respondent belonged to high group of extension contact sixty three percent & twelve percent of the respondents belonged to medium and low group and extension contact respectively.

4.2 Perceptions of farmers about sustainable agriculture

In this section, an attempt has been made to findout the perception of farmers about sustainable agriculture. It was revealed from the table-4.2 that the perception of farmers in land management with respect to "application organic manure" was maximum as indicated by the farmers of village Jaganathpur which got mean score 3.8 and rank 1. Right sowing time increases the grain yield was the highest perception by the farmers of

village Saradeipur. The perception with respect to prevention of land from non farm practices was maximum by the farmers of village Kumardiha, right varieties with good crop rotation by the villagers of Nathapur which got mean score 3.49 & 3.65 ranked 1 respectively.

When all the farmers were taken together the perception for " Prevention of land from non from practices was highest which got mean score 3.42 & ranked 1.

Further, it was observed from the table that the perception was minimum on " crop calendar according to the need of climate and resources available by the farmers of Jaganathpur and Nathapur villages which got mean score 1.2 & 1.42 respectively. When all the farmers were taken together the perception was also low over the same item which got a mean score 1.27 and ranked as XI. The same table indicates the difference in perception about sustainable agriculture as judged by farmers of different villages separately as well as together.

The result of Kendall coefficient of coincidence 'w' indicated that there was no difference with respect perception by the farmers on sustainable agriculture. It might be due to the fact that the farmers know about the different aspect of sustainable agriculture.

The possible reason for getting such type of result that the farmers are aware of the fact that lands are essential for agriculture and its conversion to non farm practices is a loss to agriculture. This might be the possible reason for which the perception about prevention of land from non farm practices got highest mean score as well as rank. Secondly the item " crop calendar according to climate and resource available got the lowest mean score as well as rank of the farmers" It is difficult task to prepare a crop calendar by the individual farmer according to climate and resources available which involves scientific skill and attitude to carry it out. This might be the reason that the perception score come to be lowest by all the farmers.

Water management is an important tool in sustainable agriculture. The table-4.2 revealed that "use of water resource like pisciculture in the bond and plantation crops on the embankments like Banana and coconuts etc. got the highest mean score 3.2, 3.26, 3.39, 3.55 and ranked as 1 by villages of Jaganathpur, Saradeipur, Kumardiha and Nathpur.

Further it was found from the table-4.2 a low perception same was found with respect Drip irrigation in village Jaganathpur, proper design of irrigation sources to prevent salinisation in village Jaganathpur, Kumardiha, Nathpur which got mean score 1.13, 1.27, 1.38 and respectively and got rank X.

When all the farmers were considered together the perception in "use of water resources by adopting pisciculture coconut, and bananas and on the embankment" got the highest mean score 3.35 and ranked as I.

To ensure sustainable agriculture there must be diversification of farm practices with maximum use of available resources to derive sustainable production from it. This might be the reason that all the farmers have shown their high perception with respect to use of water resources in judicious manner.

Salinisation is a natural phenomenon which occurs to the land by constant use of land through intensive agriculture. The farmers are interested to get high production without having understanding about the water soil. It might be reason that the perception score with respect to design of irrigation to prevent salinisation got the lowest score 1.32 & rank X.

In order to find out the perception of the farmers about integrated nutrient management for sustainable agriculture the table no.4.2 revealed that there is high Perception "emphasis in farm yard manure rather than chemical fertilizer" by the farmers of village Jagannath and Nathpur which got mean score 3.76, 3.92 & rank 1. The perception

with respect to " resource generation recycle of ecosystem and growing of high yielding quick growing varieties to utilise the nutrients were high perception by the villagers of Saradeipur and Kumar diha which got score 3.26 & 3.57 respectively and rank-I.

Again taking altogether the perception of farms of the four villages with respect to "Farm yard manure rather than chemical fertilizer" got mean score 3.59 & rank I was high.

Further it was revealed that the lowest perception score was found in adaption of vermiculture which got mean score 1.69 & rank XI.

The farmers have felt that application of chemical fertiliser had lost the fertility of land in contrast organic manure restores the fertility of land without any harm to environment., This why the perception on organic manure was high in nutrient management.

Further though vermiculture is old concept, but it is too difficult to maintain land for vermicultural purpose. The farmers show their hesitation to maintain it in their field as they have no knowledge about the procedure needed for it. This might be the reason that the perception about adoption of vermiculture is low.

The perception about integrated pest management shows high perception with respect to "growing resistant varieties of crop disease and pest by the farmers village Jagannath pur which got mean score 3.8 and rank. I. Avoidance of synthetic pesticide was high perception by the villagers of Saradeipur, Kumardiha, Nathpur which got mean scores 3.51, 3.69, 3.91 respectively and rank I.

The lowest perception score was found in growing of trap crop around the main crop which got mean score 0.87, 0.92, 0.59 & 1.21 respectively and ranked X.

Table-4.2 Perception of farmers about sustainable agriculture.

Statements on different parameters of sustainable agriculture	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
A. Soil & land management										
1. Prevention of land from non farm practices	3.45	IV	3.65	II	3.49	I	3.12	VI	3.42	I
2. Right varieties with good crop rotation	3.5	III	2.99	V	3.44	II	3.65	I	3.39	II
3. Right sowing time maximises the grain yield	3.1	V	3.7	I	3.22	III	3.4	II	3.38	III
4. Application of organic manure	3.8	I	3.16	III	3.1	V	3.29	IV	3.33	IV
5. Hand weeding or intercultureal operation reduces the weed problem	3.6	II	3.1	IV	3.17	IV	3.24	V	3.27	V
6. Use of modern tools according to the land type, cropping pattern.	2.4	VIII	2.21	VIII	2.38	VII	2.49	VIII	2.49	VI
7. Growing of crops on land capability classes	2.5	VII	2.9	VI	2.17	IX	2.38	X	2.48	VII
8. Classification of land on crop productivity basis.	2.8	VI	2.5	VII	2.19	VIII	2.45	IX	2.48	VII
9. Planting methods according to nature and size of the seed to provide better condition for plant health	1.8	IX	2.1	IX	2.5	VI	2.59	VII	2.24	VIII
10. Improvement degraded and eroded soil	1.6	X	1.15	XI	1.45	X	1.56	XI	1.44	IX
11. Control of soil erosion and acidification	1.5	XI	1.12	XII	1.24	XII	3.39	III	1.31	X
12. Crop calendar according to the need climate and resources available	1.2	XII	1.19	X	1.27	XI	1.42	XII	1.27	XI
B. Water management										
1. Judicious use of water resources like pisciculture in the bond and plantation crops on the embankments like Bananas	3.2	I	3.26	I	3.39	I	3.55	I	3.35	I
2. Agroforestry & Agro silviculture on watershed basis.	3.05	III	3.19	II	3.25	III	3.48	II	3.24	II
3. Water harvest on command areas	3.05	III	3.15	III	3.29	II	3.41	III	3.22	III
4. Environmentally sound low cost dams to supply irrigation water.	3.1	II	2.92	IV	3.14	IV	3.29	IV	3.11	IV

Statements on different parameters of sustainable agriculture		Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
		MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
5.	Irrigation scheduling keeping view of fertilizer application.	2.65	V	2.76	V	2.89	V	3.2	V	2.88	V
6.	Crop planning according to the moisture availability.	2.8	IV	2.19	VI	2.49	VI	2.63	VI	2.52	VI
7.	Irrigation scheduling according to the nature of the soil and crop.	2.8	IV	2.15	VII	2.35	VII	2.52	VII	2.45	VII
8.	Proper allocation of funds for drainage system.	1.8	VI	1.18	IX	1.33	IX	1.47	IX	1.44	VIII
9.	Drip irrigation in fruit crops as it supplies uniform water, reduced pumping energy leading to increased productivity checking diseases by runoff water.	0.85	VIII	1.29	VIII	1.56	VIII	1.69	VIII	1.34	IX
10.	Proper design of irrigation resources to prevent salinisation.	1.5	VII	1.13	X	1.27	X	1.38	X	1.32	X
C. Integrated nutrient management											
1.	Emphasis on farm yard manure rather than chemical manure	3.76	I	3.14	IV	3.56	II	3.92	I	3.59	I
2.	Green manuring with (Dhanicha) improves soil health.	3.7	II	3.2	III	3.5	III	3.9	II	3.57	II
3.	Application of Bio fertilizers like neem cake and karang cake to improve soil health	2.8	VI	2.21	IX	2.52	VIII	2.76	IX	3.57	II
4.	Efficient, high yielding quick growing varieties for better utilisation of soil nutrients.	3.4	III	3.25	II	3.57	I	3.72	III	3.48	III
5.	Resource generation and recycling eco system like supply nitrogen the azolla and (B.G.A)	3.05	IV	3.26	I	3.56	II	3.71	IV	3.39	IV
6.	Integrated use of organic manure with other chemical amendments like green leaf manure + Lime improves soil health.	2.95	V	2.69	VI	2.49	IX	3.4	V	2.88	V
7.	Agronomic techniques like spilt application of fertilizer depending on growth stages, placement of fertilisers in correct doses to increase production per unit area.	2.4	VIII	2.62	VII	2.85	V	2.98	VI	2.71	VI

Statements on different parameters of sustainable agriculture		Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
		MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
8.	Use of Bio gas slurry to the soil for increasing productivity.	2.5	VII	2.62	VII	2.79	VI	2.87	VII	2.69	VII
9.	Incorporation of legumes to increased the nitrogen status.	2.4	VIII	2.55	VIII	2.68	VII	2.85	VIII	2.62	VIII
10.	Application of fertilizer based on soil test.	2.5	VII	2.72	V	2.89	IV	2.32	X	2.6	IX
11.	Byproducts of sugar factory improves physical properties of the soil.	1.8	IX	1.98	X	1.53	XI	2.3	XI	1.9	X
12.	Vermiculture (earth worm) farming on possible areas.	1.5	X	1.71	XI	1.87	X	1.69	XII	1.69	XI
D. Integrated pest management											
1.	Avoidance of synthetic pesticides	3.2	II	3.51	I	3.69	I	3.91	I	3.57	I
2.	Growing resistant varieties of crop disease and pest.	3.8	I	3.2	III	3.4	III	3.69	III	3.52	II
3.	Use of botanical pesticides.	3.2	II	3.42	II	3.56	II	3.72	II	3.47	III
4.	Use of chemicals having less residual effect.	2.98	III	3.1	IV	3.15	IV	2.79	VI	3.00	IV
5.	Protection of Beneficial insects like spiders etc.	2.6	V	2.81	V	2.98	VI	3.1	IV	2.87	V
6.	Agronomic manipulation like late & early sowing escapes from disease pest attack.	2.9	IV	2.8	VI	2.4	VIII	2.59	VIII	2.67	VI
7.	Use of appropriate dose of chemicals according to the advice of Agril. officer.	2.3	VI	2.46	VII	2.62	VII	2.85	V	2.55	VII
8.	Altering the farming system reduces pest problems and enriches the soil fertility.	1.8	VII	1.97	VIII	3.12	V	2.62	VII	2.37	VIII
9.	Use of attractants, repellants, sterilants growth regulators, male sterility techniques as per the advice of agriculture officers.	1.2	VIII	1.42	IX	1.59	IX	1.76	IX	1.49	IX
10.	Growing of trap crop around the main crop.	0.87	IX	0.92	X	0.59	X	1.21	X	0.89	X

Statements on different parameters of sustainable agriculture		Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
		MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
E. Conservation Genetic diversity (Biodiversity)											
1.	Use of indigenous technology in soil, water and land management.	3.2	I	3.41	I	3.56	I	3.36	III	3.38	I
2.	Preservation of plant species which helps to control soil erosion and other economic species like chenopodium and vativar grass.	3.1	II	3.16	III	3.45	II	3.59	I	3.3	II
3.	Conservation of plant species having commercial importance like medicine, Agroforestry and alley farming.	2.85	V	2.99	IV	3.12	IV	3.26	IV	3.05	III
4.	Preservation of indigenous plant species which more resistant to disease pest than hybrid varieties.	2.98	IV	3.19	II	2.78	VI	2.52	VIII	2.86	IV
5.	Creation of environment which is aesthetically pleasing.	2.76	VI	2.89	V	2.57	VIII	3.11	V	2.83	V
6.	Conservation of annual plants like Begunia effective control of pests and diseases.	3.00	III	2.86	VI	3.16	III	3.42	II	2.82	VI
7.	Diversification land towards alternate farming system such as mushroom, poultry etc.	2.42	VII	2.62	VII	2.86	V	2.98	VI	2.72	VII
8.	Maintenance of soil fertility and productivity or renewable resources.	2.3	VIII	2.45	VIII	2.65	VII	2.82	VII	2.55	VIII
9.	Identification of plants having higher and lower fertilisers response to maximise the production.	1.75	X	1.96	IX	2.15	IX	2.29	IX	2.03	IX
10.	Establishment of Botanical garden for conservation of Bio-diversity.	1.8	IX	1.76	X	1.59	X	1.12	X	1.56	X
F. Post Harvest Technology											
1.	Use of botanical preservatives like, Neem, Tulsi, Begunia.	3.44	IV	3.72	II	3.89	II	3.99	I	3.76	I
2.	Efficient storage facility.	3.65	I	3.86	I	3.99	I	3.41	VII	3.72	II
3.	Sanitation of store house.	3.45	III	3.24	III	3.62	III	3.87	II	3.54	III
4.	Frequent chacking of store house.	3.60	II	3.21	IV	3.43	V	3.79	III	3.5	IV

Statements on different parameters of sustainable agriculture		Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
		MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
5.	Use of chemical in store house having less residual effect.	3.25	V	3.09	V	3.47	IV	3.78	IV	3.39	V
6.	Prevention of drainage near the store house.	3.08	VII	3.21	IV	3.41	VI	3.56	V	3.31	VI
7.	Adoption of low cost drying method	3.12	VI	2.92	VI	3.29	VII	3.51	VI	3.21	VII
8.	Keeping the store house in a moisture proof condition.	2.09	IX	2.71	VII	2.47	X	3.1	VIII	2.79	VIII
9.	Close down of holes and keeping grains on the wooden thatch of bamboo thatch.	2.09	IX	2.45	IX	2.79	VIII	2.21	X	2.58	IX
10.	Use of metal container for storage of grains.	1.2	XII	1.42	XII	1.63	XII	1.84	XII	2.52	X
11.	Low temperature storage for decreasing decaying fruits.	2.09	IX	2.57	VIII	2.38	XI	2.14	XI	2.48	XI
12.	Provision of complete ventilation in all seasons except rainy season.	2.10	VIII	2.32	X	2.59	IX	2.82	IX	2.45	XII
13.	Use of cemented floor for threshing and better storage of grains.	1.8	X	1.98	XI	1.57	XIII	1.31	XIV	1.66	XIII
14.	Coltar spray in wooden articles and walls of the store house.	1.5	XI	1.24	XIII	1.02	XIV	1.77	XIII	1.38	XIV
G. Socio-Economic Political factors and Extension management											
1.	Practical implementation of technology.	3.75	IV	3.87	II	3.98	II	3.49	V	3.77	I
2.	Construction and design of farm practices on area specific basis.	3.88	I	3.72	IV	3.43	VI	3.97	I	3.75	II
3.	Use of locally available inputs like FYM compost and other resources.	3.67	V	3.82	III	3.99	I	3.51	III	3.74	III
4.	Farm practices according to cultural desire.	3.82	III	3.99	I	3.59	III	3.37	VII	3.69	IV
5.	Extension education for sustainable agricultural practices.	3.84	II	3.69	VI	3.57	IV	3.37	VII	3.61	V
6.	Participatory research and training through the farm scientist with the farmers.	3.84	II	3.71	V	3.45	V	3.23	IX	3.55	VI
7.	Training units for farmers to boost the production ahead in a sustainable manner.	3.00	VIII	3.16	VIII	3.31	VII	3.5	IV	3.24	VII

Statements on different parameters of sustainable agriculture	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
8. Launching of social acceptability interest oriented stabilising programmes.	3.12	VII	3.25	VII	2.82	IX	3.39	VI	3.14	VIII
9. Economic viability which leads to profit and interest of the farmers.	3.00	VIII	3.15	IX	2.74	XI	3.27	VIII	3.04	IX
10. Farm information centre on area basis.	3.25	VI	3.09	XII	2.91	VIII	2.78	XI	3.00	X
11. Technological appropriability according to soil, climate and infrastructures available.	2.95	IX	3.1	XI	2.72	XII	2.49	XIII	2.81	XI
12. Equity in farm investment and required production.	2.85	XI	2.98	XIII	2.75	X	2.61	XII	2.79	XII
13. Video shows, farm magazines, bulletins helps updating the farmers knowledge.	3.25	VI	3.11	X	2.49	XVI	3.69	II	2.88	XIII
14. Economic feasibility as per the capacity of the farmers.	2.94	X	2.75	XV	2.50	XV	2.31	XIV	2.65	XIV
15. Farm advisory system in possible areas.	2.7	XIII	2.92	XIV	2.51	XIV	2.29	XV	2.6	XV
16. Stabilisation of production for sustainability.	2.5	XIV	2.42	XVII	2.69	XIII	2.85	X	2.56	XVI
17. Provision of environmental sound programmes.	2.8	XII	2.62	XVI	2.41	XVII	2.19	XVI	2.5	XVII
18. Temporal stability of a technology on long run basis.	2.3	XV	2.39	XVIII	2.21	XVIII	2.09	XVII	2.29	XVIII

When all the farmers were taken together the perception on avoidance of synthetic pesticides was high which got mean score 3.57 and rank I. Similarly the perception on trap crop was low by all the farmers which got mean score 0.89 and rank X.

The farmers of all village live in a similar condition adjacent to Bhubaneswar city and all are aware about the use of chemical pesticide had lost our environment. They have experienced the environmental pollution caused by the use of pesticide. This might be the reason that the perception on avoidance of chemical fertiliser was high.

Trap crop concept is a new phenomenon to the farmers. They do not know the trap crop of various crops. Moreover it required some land labour and capital which is impossible on the part of farmers. So the mean score achieved in case of trap crop is very low by all the farmers.

In order to find out the conservation bio diversity it was revealed from the table no. 4.2 that the perception on "indigenous technology for soil, water and land management" was high by the villagers of Jagannathpur, Saradeipur and Kumardiha which got the mean score 3.2, 3.41, 3.56 respectively and rank- I. In case of village Nathapur the high perception score obtained in "preservation of plant species which help to control soil erosion and other economic species like vativer and Chenopodium" which got mean score 3.59 and rank-I.

The lowest perception score was found with respect to establishment of Botanical garden for conservation of biodiversity by all the villagers except Jagannathpur which got mean score 1.76, 1.59, 1.12 respectively and ranked as X "identification of the plants having higher & lower fertilizer response to maximise the production" was low by the villagers of Jagannathpur which got mean score 1.75 and ranked-X.

Taking altogether the perception of villagers under study it was revealed that the perception in use of indigenous technology for soil water conservation was high which got mean score 3.38 and rank-I.

Similarly the lowest perception score was obtained with respect to establishment of Botanical garden for preservation of genetic diversity which got rank-X and mean score value 1.56.

The modern technology is high costly and environmentally not sound which need skills to operate it. This may be the reason why the perception on indigenous technology is high.

Botanical gardens are not familiar to the farmers of all four villages. Establishment of Botanical garden for conservation of genetic diversity seemed a costly method for them. This is why the perception score obtained as 1.56 is very low and ranked X.

It was revealed from the table 4.2 that the perception on efficient storage facility was high by the farmers of Jagannathpur, Kumardiha and Saradeipur which got mean score 3.65, 3.86 & 3.99 respectively and ranked I. In village Nathpur the perception with respect to use of Botanical preservatives like, neem, Tulsi and Beguna is high which got mean score 3.99 and ranked as 1.

Similarly the low perception score found with respect to "use of metal container for storage of grains" coltar spray in the wooden articles by the farmers of Jagannathpur, Saradeipur, Kumardiha respectively which got the mean score 1.2, 1.24, 1.02, 1.31 respectively and ranked as XII, XIII, XIV, XIV, "coltar spray in wooden articles" and "use of cemented floor for threshing and better storage" got the lowest perception score by the villagers of Nathpur having mean score of 1.31 and rank XIV.

When all the farmers were taken into consideration the high perception score was obtained with respect to the "use of Botanical pesticide" which got mean score 3.76 and rank 1 and low perception score was found in case use of coltar in wooden articles which got mean score 1.38 and ranked XIV.

Efficient storage facility is the key to good preservation and good economy. The farmers have felt the need of efficient storage facility for which there was high perception on this aspect.

The farmers are very much reluctant to use chemicals in the store house for which they do not use it for preserving the grains. It might be the reason that there is low perception about spraying coltar in store house articles.

In order to findout the perception of the farmers about socio-economic political factors and extension management the farmers were asked to response on various statements. It was revealed from the table that the perception on " construction & design of farm practices on area specific basis was high by the farmers of Jagannathpur, Nathpur which got the mean score 3.88, 3.97 and ranked as I. The perceptions of Nathpur on use of locally available inputs like FYM compost and other resources and farm practices according to the cultural desire and use of localy available inputs like FYM were high by the villagers of Saradeipur and Kumardehia which got M.S 3.99 in each case and rank I.

Further from the table it was revealed that the perception with respect to " Temporal stability of an technology on long term basis was low by the famers of Jagannathpur, Saradeipur, Kumardiha and Nathpur which got M.S. 2.3,2.39, 2.21 & 2.09 and rank as XV, XVIII, XVIII, XVII respectively.

When all the farmers were considered on the aspect of socio-economic political factors and extension management for sustainable agriculture high perception was found on practical implementation of an technology which got mean score 3.77 and rank I. Low perception was found in respect to temporal stability of an technology on long term basis which got mean score 2.99 XVIII.

Most of the farmers are progressive. They are well known with production stabilization rather than profit maxitization for future. It might be the reason that the perception on "farm pactices on area & climate specific basis for sustainable" was high. The farmers were very much interested to use indigenous technology. They were not in a position to take any technology which is not practicable in the local situation. This is the

reason that the perception on temporal stability technology on long term basis is low. Here the non significant 'w' value was obtained which indicated that the rank, given by the farmers was more or less similar.

Again an attempt was made for findout the degree of perception of farmers towards sustainable agriculture. It was observed from the table that in case of village Jagannathpur.

Table-4.3 Perception categories on sustainable agriculture.

Perception Categories	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	f	%	f	%	f	%	f	%	f	%
High	8	32.0	6	24.0	10	40.0	17	28.0	31	31.0
Medium	12	48.0	11	44.0	12	48.0	14	56.0	49	49.0
Low	5	20.0	8	32.0	3	12.0	4	16.0	20	20.0

Thirty, two percent, forty eight percent and twenty percent in the perception category high, medium and low respectively. In case of village Saradeipur 24 percent in the group of high, forty four percent and thirty two percent were in the group of medium and low perception categories.

The farmers of village Kumardiha have shown 40percent perception in high category forty eight percent and twelve percent in category of medium and Low perception category. In case of village Nathour twenty eight percent were found in the group of high perception category. Fifty six percent and sixteen percent were found in the group of medium and low perception category respectively.

Finaly when all the farmers were taken it was revealed that a majority of total respondents i.e. 49 percent were belonged to medium perception category while thirty one percent and twenty percent of them belonged high and low perception categories respectively.

4.3 AWARENESS OFF FARMERS ABOUT HARMFUL EFFECTS OF ENVIRONMENTAL POLLUTION

In this section an attempt was made to findout the awareness about the harmful effects of environmental Pollution. It was revealed from the table that "reduction of soil fertility due to application of chemical fertiliser" loss of wild animals and plants gets the highest awareness score 2.8 and 2.7 be the farmers of Jagannathpur and Nathpur ranked as I. The same table shows reduction of life span due to air, water and land pollution which is ranked as I having the score value 2.7 by the farmers of villages Nathpur, "climatic change occurs due to environmental pollution got highest score by the villagers Kumardiha ranked as 1.

When all the farmers were taken together awareness an climatic change occurs due to environmental pollution got the mean score 2.62 and rank 1.

Further it was observed from the same table 4.3 that the awareness was minimum on " Retardant plant growth due to air pollution" which got mean score 1.18, 0.20, 0.16 & 0.22 respectively when all the farmers were taken together the awareness was also low over the same item. which got mean score 0.19 and rank XXV. The same table indicts the difference in awareness as about the harmful effects of environmental pollution by farmers of difference villages separately as well as together.

The result of Kendall co-efficient of concordance (w) indicated that there was with difference with respect to glumness that the harmful effects of environmental pollution. It might be due to the fact that all the farmers are from score urban villages and know about the different effects environmental pollution.

4.4 Awareness about harmful effects of environmental pollution.

Statements regarding harmful effects of environmental pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
1. Climatic changes occur due to environmental pollution.	2.6	II	2.4	IV	2.8	I	2.7	I	2.62	I
2. Reduction of soil fertility due to application of chemical fertiliser.	2.8	I	2.6	II	2.10	VI	2.7	I	2.55	II
3. There is loss of wild plants and animals due to loss of bio-diversity.	2.8	I	2.10	VIII	2.6	II	2.7	I	2.55	II
4. The Global environmental crisis has been contributed to pervasive poverty (pollution of poverty)	2.48	IV	2.46	III	2.45	III	2.52	III	2.47	III
5. The longevity of life span is reduced due to pollution of air, water & soil.	2.5	III	2.7	I	2.10	VI	2.4	V	2.42	IV
6. Indigenous communities suffer a lot due to loss of forest & environment.	2.40	V	2.38	V	2.42	IV	2.42	IV	2.4	V
7. Death of aquatic animal is due to use pesticides, industrial wastage & swage.	2.2	VI	2.00	XI	2.4	V	2.6	II	2.3	VI
8. Disease in quatic animals due to water pollution.	2.1	VII	2.3	VI	2.00	IX	2.4	V	2.2	VII
9. Food poisoning due to excessive use pesticide.	2.10	VII	2.12	VII	2.09	VII	2.14	VI	2.11	VIII
10. Pollution makeks individual life unpleasant.	2.05	VIII	2.07	IX	2.09	VII	2.06	VII	2.06	IX
11. Noise pollution disturbs the patient, student and mental peace.	2.00	IX	2.02	X	2.04	VIII	2.01	VIII	2.01	X
12. There is loss of habitat due to drustic loss of forest & environment.	1.78	X	1.76	XII	1.80	X	1.77	IX	1.77	XI
12. Air pollution produces eye and respiratory irritation to animal.	1.70	XI	1.68	XIII	1.72	XI	1.74	X	1.71	XII
13. Water pollution causes diorhea and other diseases of humanbeing.	1.68	XII	1.66	XIV	1.70	XII	1.67	XI	1.67	XIII
14. Air pollution causes respiratory diseases such bronchits, Asthma.	1.58	XIII	1.68	XIII	1.48	XIV	1.52	XII	1.58	XIV

Statements regarding harmful effects of environmental pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
15. Pollution causes irritation and discomfort..	1.38	XIV	1.29	XVII	1.36	XV	1.46	XIII	1.37	XV
16. Water pollution of swege & toxic chemical causes human and animal health hazards.	1.30	XV	1.32	XVI	1.28	XVI	1.34	XIV	1.31	XVI
17. Damage to plant is possible due to automobile exhaust.	1.2	XVI	1.4	XV	1.6	XIII	1.00	XVIII	1.3	XVII
18. Rise in temperture affects the people in coastal areas.	1.20	XVI	1.22	XVIII	1.18	XVII	1.21	XV	1.21	XVIII
19. Health hazard occurs in animal due to use of pesticide.	1.08	XVII	1.10	XIX	1.12	XVIII	1.06	XVI	1.09	XIX
20. Pollution causes heart diseases.	1.05	XVIII	0.98	XX	1.00	XIX	1.02	XVII	1.01	XX
21. Impact of urbanisation creates land shortage and housing problem.	0.98	XIX	0.96	XXI	0.97	XX	0.95	XIX	0.96	XXI
22. Abnormal of calcsification of teeth or flurosos occur in human and animals.	0.70	XX	0.68	XXII	0.69	XXII	0.72	XX	0.69	XXII
23. Development of sterility in animal & human due to application of pesticide.	0.68	XXI	0.66	XXIII	0.70	XXI	0.72	XX	0.69	XXII
24. Energy conversion activities makes our planet uninhabitable.	0.58	XXII	0.56	XXIV	0.57	XXIII	0.60	XXI	0.57	XXIII
25. Health hazard to animal occurs by eating non-bio degradable article.	0.38	XXIII	0.36	XXV	0.34	XXIV	0.4	XXII	0.37	XXIV
26. Retandout of growth of plant is occured due to air pollution.	0.18	XXIV	0.20	XXVI	0.16	XXV	0.22	XXIII	0.19	XXV
Total	43.47		42.66		42.66		44.05		42.93	

W = 0.63^{NS}

N.B. - MS = Mean awareness Score

The possible reason for getting such type of result that the farmers nearby Bhubaneswar are subjected due frequent climatic changes they have experienced. This might be the possible reason for which the awareness is maximum with respect to climatic changes due to environmental pollution. Secondly the item damage to plant due to automobile pollution got the lowest mean score awareness as ranked by the farmers of different villages that most of the farmers do not know the effects of air pollution on plant.

Table-4.5 Awareness categories about harmful effects of environmental pollution.

AwarenessC ategories	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	f	%	f	%	f	%	f	%	f	%
High	8	32.0	5	20.0	6	24.0	3	20.0	22	22.0
Medium	12	48.0	11	44.0	15	60.0	18	72.0	56	56.0
Low	5	20.0	9	36.0	4	16.0	14	8	22	22.0

Again, an attempt was made to find out the extent (degree) of awareness of farmers of different villages about the harmful effects. It was revealed from the table 4.5 that out of total farmers in village Jagannathpur 48 percent were found to be in medium category 32 percent of them belonged to high and 20 percent belonged to low awareness category. In village Saradeipur it was observed that 44 percent, 20 percent, 36 percent were belonged to medium, high & Low awareness category respectively.

In village 'Kumardiha' 60 percent were found to be in medium awareness category followed by 24 percent & 16 percent in high and Low awareness category 20 percent, 72 percent, 8 percent farmers of village Nathpur were found to be in medium low awareness categories respectively. Finally when all the farmers were taken together it was observed that majority of them i.e. 56 percent farmers belonged to medium awareness category while 22 percent belonged to high and low awareness category respectively.

4.4 PERCEPTION OF FARMERS ABOUT DIFFERENT SOURCES OF ENVIRONMENTAL POLLUTION

In order to find out the perception of farmers about different sources of pollution the respondents were asked to show their perception on four aspects of pollution VIZ. Water Pollution, soil/land pollution, air pollution and pollution due to intensive agriculture.

In case of water pollution, the farmers of village Jagannathpur Saradeipur and Nathpur have high degree of perception about " Industrial effluents pollute the water which about mean score 2.60 and rank I. The perception about water pollution is highest with respect to the same item as judged by the farmers village Saradeipur Nathpur. They got mean score 2.62, 2.61, excess use of chemical fertiliser pollutes the water were mostly known by the farmers of village Kumardiha When all the farmers were taken together it was found that industrial effluents pollutes the water was mostly known by the farmers which got mean score 2.6 and rank I.

Further it was revealed from the table that the excreta of man and animal causes water pollution was least known by the farmers of the four villages which got a mean score 1.4 and got rank VII. The other items occupied in between which could be revealed from the table 4.6.

As population increases industries and apartments are being constructed near the villages aside to Bhubaneswar. So industrial water along with drain water is released to rivers and make the water pollute. Further a low perception was observed with respect to Pollution of water by excreta of man and animal. It might be due to the fact that the farmers are progressive and they use separate places for motion. They rarely release excreta into water and rivers for which a low awareness was observed with respect to this item.

Table-4.6 Farmers perception about different sources of pollution.

Statements regarding different sources of pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
A. Water Pollution										
1. Industrial effluents pollute the water.	2.60	I	2.62	I	2.58	II	2.61	I	2.6	I
2. Water in polluted by excess use of chemical fertiliser.	2.5	II	2.58	II	2.60	I	2.20	III	2.47	II
3. Water is polluted by use of pesticide.	2.40	III	2.42	III	2.38	III	2.44	II	2.41	III
4. Food processing plants also pollutes the water.	1.60	V	1.62	V	1.58	IV	1.64	IV	1.61	IV
5. Release of garbage to ponds and rivers and oceans pollute the water.	1.7	IV	1.8	IV	1.10	VII	1.6	V	1.55	V
6. The dectergents used for cleaning polluted the water.	1.52	VI	1.48	VI	1.54	V	1.49	VI	1.51	VI
7. The excreta of man and animals causes water pollution.	1.40	VII	1.42	VII	1.38	VI	1.41	VII	1.4	VII
Total	13.72		13.93		13.16		13.27		13.51	

$W = 0.527^{NS}$

N.B. - MS = Mean awareness Score

Statements regarding sources of pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
B. Soil / land pollution										
1. Excess use of nitrogen fertilizer in crop pollutes the soil.	2.8	I	2.6	I	2.9	I	2.75	I	2.76	I
2. Excess use of phasphotic fertilizer causes pollution in soil.	2.5	II	2.4	II	2.6	II	2.3	II	2.57	II
3. Nuncipal waste pollute the soil.	2.10	III	2.12	III	2.08	III	2.2	III	2.1	III
4. Industrial carbon water pollutes the soil.	1.68	IV	1.67	IV	1.70	IV	1.72	IV	1.69	IV
5. Excess use of compost pollutes the soil.	1.45	V	1.46	V	1.44	V	1.48	V	1.45	V
6. Shulpher in inorganic form pollute the soil	1.25	VI	1.23	VI	1.26	VI	1.22	VI	1.24	VI
7. Animal waste pollute the soil.	1.20	VII	1.21	VII	1.18	VII	1.21	VII	1.20	VII
8. Soil borne pathogen like virus bacteria pollute the soil.	0.80	VIII	0.85	VIII	0.79	VIII	0.84	VIII	0.81	VIII
9. Use of pesticide pollutes the soil.	0.78	IX	0.74	IX	0.70	IX	0.72	IX	0.74	IX
Total	14.58		14.22		14.67		14.44		14.58	

$W = 0.489^{NS}$

N.B. - MS = Mean awareness Score

Statements regarding sources of pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
C. Air pollution										
1. Automobile emission pollutes the air.	2.8	I	2.6	I	2.4	I	2.5	II	2.57	I
2. Respiration of man, animal releases carbon dioxide causes in air, pollution.	2.5	II	2.4	II	2.2	III	2.5	II	2.4	II
3. Industrial waste and emission pollute the air.	2.30	III	2.28	III	2.32	II	2.29	III	2.29	III
4. Deposition of garbages & burning them pollute the air.	2.10	IV	2.12	IV	2.11	IV	2.78	I	2.27	IV
5. Crop residues pollute the air.	1.80	V	1.81	V	1.82	V	1.79	IV	1.8	V
6. Animal waste pollute the air.	1.70	VI	1.72	VI	1.68	VI	1.73	V	1.7	VI
7. Decomposed fruits and vegetables pollute the air.	1.60	VII	1.61	VII	1.62	VII	1.58	VI	1.6	VII
8. Use of pesticide and fungicide in crops pollutes the air.	1.25	VIII	1.24	VIII	1.22	VIII	1.26	VII	1.24	VIII
9. Use of machinery like power thresher causes air pollution.	0.65	IX	0.67	IX	0.69	IX	0.70	VIII	0.68	IX
10. Forest fires causes air pollution	0.40	X	0.42	X	0.41	X	0.38	IX	0.40	X
11. Air as carriers of spores bacteria causes air pollution.	0.32	XI	0.31	XII	0.28	XII	0.33	X	0.31	XI
12. Noise caused by loud speaker causes air pollution.	0.30	XII	0.32	XI	0.34	XI	0.28	XI	0.31	XI
13. Noise of automobile causes air pollution.	0.20	XIII	0.21	XIII	0.24	XIII	0.18	XIII	0.2	XII
14. Noise produced by industrial plants causes the air pollution.	0.18	XIV	0.16	XIV	0.19	XIV	0.20	XII	0.18	XIII
15. Industrial emission of Gas produces air pollution.	0.16	XV	0.15	XV	0.17	XV	0.18	XIII	0.16	XIV
Total	19.00		19.00		17.70		18.60		19.00	

W = 0.75^{NS}

N.B. - MS = Mean awareness Score

Statements regarding sources of pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
D. Pollution due to intensive Agriculture										
1. Use of pesticides in crop & pest pollution in the surrounding.	1.8	I	1.25	I	1.08	I	1.9	I	1.50	I
2. Repeated use of chemical fertiliser like N & P causes air pollution.	0.58	II	0.56	II	0.57	II	0.55	II	0.56	II
3. Repeated application of fertilizer in crop field pollutes the water.	0.48	III	0.47	III	0.46	III	0.49	III	0.47	III
4. Repeated application of chemical fertilisers leads to pollution of soil and there by reduce microorganic activity and production.	0.32	IV	0.31	IV	0.34	IV	0.33	IV	0.32	IV
5. Use of pesticide pollutes the water.	0.32	IV	0.31	IV	0.33	V	0.28	VI	0.31	V
6. Burning crop by product causes air pollution and health hazard of man & animal.	0.30	V	0.28	V	0.31	VI	0.32	V	0.30	VI
7. Indiscriminate application of fertilizer causes soil, water, air pollution.	0.16	VI	0.18	VI	0.17	VII	0.15	VII	0.16	VII
8. Indiscriminate use of pesticide pollute the food leading to residual toxicity.	0.15	VII	0.16	VII	0.17	VII	0.14	VIII	0.15	VIII
9. Repeated use of pesticide causes pest resistance & pest surgece.	0.14	VIII	0.15	VIII	0.16	VIII	0.13	IX	0.14	IX
Total	4.32		3.60		3.60		4.23		6.45	

$$W = 0.87^{NS}$$

N.B. - MS = Mean awareness Score

Further, non significant value indicate there was no difference with respect to different sources of pollution of the four villages. It might a fact that the farmers live in similar rural situation for which such type of result was obtained.

Further in order to find out the perceptions the farmers were asked questions about the soil/land pollution. A high degree of response was observed in respect to "excess use of nitrogenous fertiliser in crops pollute the soil" which got mean score 2.8 in village Jagannathpur and same excess use of nitrogenous fertiliser in crops pollute the soil had higher response of perception which got mean score 2.6, 2.9, 2.75 respectively and which also got rank I by the villagers Saradeipur, Kumardiha and Nathpur.

Again taking together the perception of four villagers, it was revealed that excess use of nitrogenous fertiliser in crops pollute the soil got mean score of 2.76 and also got rank I.

Further it was revealed that a lowest perception score was found in respect to "use of pesticide pollute the soil in almost all farmers which got mean score 0.78, 0.74, 0.70, 0.72 in village Jagannathpur, Saradeipur, Kumardiha, Nathpur respectively which got rank IX.

Further, it was observed taking all mean awareness score that least awareness was found in respect to use of pesticide pollute the soil, such got 0.74 and got rank IX. The other items of soil pollution occupied the intermediate position that could be revealed from table 4.6.

To get higher returns in crop production farmers of all four villages have higher degree perception, about role of nitrogenous fertiliser in crop production. So high perception is obtained in this field. Pesticide is applied to the plant surface and rarely in the soil to control the disease. So the farmers have least awareness about soil pollution by excess application of pesticide.

Here the a non significant 'W' value indicated that there was no difference in ranking the different statements by farmers of different villages.

In order to find out awareness of respondents about air pollution as one of source of environmental pollution, farmers were asked about statements of air pollution. It was observed from the table 4.6 that incase of village Jagannathpur the "Automobile emission pollutes the air which has high perception score 2.8 and also such type of perception found in village Saradeipur & Kumardiha which got mean score 2.6 & 2.4 respectively. But in case of village Nathpur high degree of awareness was found in deposition of garbage and burning them cause air pollution which got mean score 2.78 and rank I.

Taking altogether the mean awareness score of all four villages, it was revealed from table that automobile emission has higher degree of peception score among people of four villages which got score 2.57 and ranked 1.

Further, it was revealed that from the all four villages about industrial emission causes air pollution which got mean score 0.16 which got rank XIV.

People belonged to rural areas and almost all respondents are residing in a similar condition in rural villages. Their habitation is not linked with industries so a low perception is found.

In order to findout the perception about intensive agriculture as a source of environmental pollution a number of questions were asked to the respondents and the perception score obtained in different parameters of intensive agriculture.

It was revealed from the table 4.6 use of pesticide in crop cases pollution in the surrounding was the highest perception among the farmers of all villages which got values 1.8, 1.25, 1.08, 1.9 and ranked as I respectively.

The farmers are exposed various chemicals as the villages are situated in near the capital city. They use chemicals to get high and disease free production. They have experienced the consequences of chemicals. So the result obtained similar in all the villages.

Further the table reveals that a least perception was found in " Repeated use and pesticide cause pest resistance which got score 0.14 and ranked IX.

As the farmers are progressive they use high quantity of pesticide but they are least known about its effects on targeted species so the perception score is very less i.e. 0.14 and got the rank IX.

Here also non significant 'W' value was obtained which indicated that the ranks given by the farmers of different villages were more or less similar.

Table-4.7 Extent of Perception towards sources of pollution.

Extent of perception	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	f	%	f	%	f	%	f	%	f	%
High	6	24.0	4	16.0	7	28.0	3	12.0	20	20.0
Medium	12	48.0	14	56.0	15	60.0	16	60.0	57	57.0
Low	7	28.0	7	28.0	3	12.0	6	20.0	23	23.0

Again an attempt was made to find the extent of perception towards same of pollution. It was observed from the table-4.7 that in case of village Jagannathpur Extent of perception which was found forty eight percent found in category of medium reception category and twenty four percent and twenty eight percent in of total belonged to high low perception categories respectively.

In village Saradeipur it was observed that 56percent and 16percent, 28percent were found to be in medium, high and small perception group respectively. In case of village Kumardiha 28%, 60percent, 12percent were belonged to high medium and low perception group, 12%, 64%, 24% were found in category of high, medium & low perception respectively in Nathapur . Finally when all the farmers of four villages were taken together it was revealed that a majority of total respondents is 57percent were belonged to medium perception category while 20percent and 23percent were belonged to high and low perception categories respectively.

Table-4.8 Suggestion of the farmers about control of environmental pollution for sustainable Agriculture.

Suggestions regarding control of environmental pollution	Jagannathpur		Saradeipur		Kumardiha		Nathpur		Total	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
1. Promotion of Education and motivation	2.90	II	2.88	II	2.79	II	2.95	I	2.88	I
2. Large scale plantation of trees around the habitation.	2.80	III	2.85	III	2.82	I	2.90	II	2.84	II
3. Use of bio-fertilizer instead of chemical fertiliser.	2.75	IV	2.80	IV	2.72	IV	2.85	III	2.78	III
4. Incentives for environment protection.	2.75	IV	2.78	V	2.74	III	2.80	IV	2.77	IV
5. Enforcement of act and rules against violation.	2.98	I	2.90	I	2.40	X	2.7	VI	2.74	V
6. Technological control of automobile pollution.	2.70	V	2.6	VIII	2.68	V	2.75	V	2.68	VI
7. Use of compost in judicious manner.	2.49	IX	2.70	VII	2.50	VII	2.65	VII	2.58	VII
8. Use of bio pesticide for controlling the pest.	2.6	VII	2.5	IX	2.49	VIII	2.25	VIII	2.46	VIII
9. Scientific control of effluents from food processing industries.	2.45	X	2.75	VI	2.00	XIII	2.24	IX	2.36	IX
10. Teaching the people about pollution hazard.	2.5	VIII	2.4	X	2.52	VI	1.90	XIII	2.33	X
11. Adoption of Gobar Gas plant in agriculture	2.35	XIII	1.9	XII	2.45	IX	2.18	X	2.22	XI
12. Implementing water shed in undeveloped area.	2.40	XI	2.1	XI	2.2	XII	2.05	XI	2.19	XII
13. Sanitation around the living.	2.69	VI	1.74	XIII	2.00	VI	1.80	XV	2.05	XIII
14. Taking of soil conservation measure.	2.39	XII	1.74	XIII	2.00	XIV	2.00	XII	2.03	XIV
15. Adoption of integrated pest management instead of using only pesticides.	1.68	XV	1.67	XIV	2.35	XI	1.76	XVI	1.86	XV
16. Reducing waste and recycling the biproduct.	1.8	XIV	1.6	XV	2.00	XVI	1.86	XIV	1.81	XVI
17. Encouraging agroforestry farming system.	1.5	XVI	1.5	XVI	1.7	XVII	1.80	XV	1.62	XVII
18. Adoption of vermiculture.	0.68	XVII	0.80	XVII	1.2	XVIII	1.1	XVII	0.94	XVIII

4.5 SUGGESTION/OPINIONS OF THE FARMERS FOR CONTROL OF ENVIRONMENTAL POLLUTION FOR SUSTAINABLE AGRICULTURE

In this section an attempt was made to sort out the suggestions of farmers for control of environmental pollution. Table -4.8 indicates the suggestion opinion of farmers for control of environmental pollution for sustainable agriculture.

From the table it was revealed that the farmers of the village Jagannathpurt gave more emphasis on "enforcement of act and rules against violation " and less emphasis on "adoption of vermiculture" which got rank I and XVII respectively. The other suggestions according to preferences were "promotion of education and motivation, large scale plantation of trees around the habitation, use of bio-fertilizer instead of chemical fertilizer and incentives for environment protection, technological control of automobile pollution, sanitation around the living, use of bio-pesticide for controlling the pest, teaching the people about pollution hazard , use of compost in judicious manner, scientific control of effluents from food processing industries, implemneting water shed in undeveloped area, taking of soil conservation measure, adoption of gobar gas plant, reducing waste and recycling the biproduct, adoption of integrated pest management instead of using only pesticides,encouraging agroforestry got the ranks II,III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI respectively.

In order to find out the sum total suggestions of the farmers about control of the environmental pollution for sustainable agriculture, it was found from the concerning table that the farmers were very much aware about the "promotion of education and motivation" which got rank. I. And also it was revealed from the table thgat the farmers were very less aware about " adoption of vermiculture" which got rankl XVIII. The other factors as per awareness sequence were, large scale plantation of trees around the

habitation, use of bio-fertilizer instead of chemical fertiliser, incentives for environment protection, enforcement of act and rules against violation, technological control of automobile pollution, use of compost in judicious manner, use of bio-pesticide for controlling the pest, scientific control of effluents from food, processing industries, teaching the people about pollution hazard, adoption of gober gas plant in agriculture, implementing water shed in undeveloped area, sanitation around the living, taking of soil conservation measure, adoption of integrated pest management instead of using only pesticide, reducing waste and recycling the byproduct, encouraging agroforestry farming system which got the ranks II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII respectively. The other suggestions by the farmers were prevention of deforestation, discouraging shifting cultivation, preventing grazing of animals from forests and considerations of farmers views regarding control of environmental pollution for an ever green agriculture called as sustainable agriculture.

CHAPTER-V
SUMMARY AND CONCLUSION

SUMMARY, SUGGESTION AND CONCLUSION

As agriculture fulfills the basic needs of people, a lot of emphasis has been made to commercialise agriculture production . The much acclaimed green revolution based on high yielding seeds, costly chemical inputs and assured supply of water , was still considered a vital farming strategy to feed on ever growing population of this country. But over the past five years with the disturbing indications of stagnant trends in food grain production, there is a feeling that diminishing return has taken over the green revolution. Scientists are of the view that an environmentally friendly and sustainable green revolution need to be ushered to accelerate the farm growth in the country. There's a need to move away from the green revolution model towards ecologically and socially forms of farming. An effort has been made to commercialise agriculture through the introduction of high yielding variety seeds, Chemical fertiliser, pesticides irrigation and mechanisation. These inputs are used without taking their side effects into account. These efforts aimed to increase in production and yield on one hand. It damages the environment and increases inequality in the society and other. Due to intensive farming the soil gets polluted and ground water infected with pollutants such as nitrates and phosphates. In the long run, farmers found their lands becoming barren after few years and there are frequent crop losses" Traditional agriculture"through the locally available seeds, organic fertilizers and the traditional Agricultural implements does not harm the environment and maintain the environmental balance but gives very low yield.

The declining trend in the carrying capacity of land other natural sources has drawn the attention of environmental agricultural and social scientists in the recent times to look for an alternating approach and environmental pollution control for sustainable agriculture of the agriculture.

Control of environmental pollution by ecofriendly farming or natural farming has emerged the only answer to bring sustainability to agriculture. A big boost to natural farming comes from the findings of a research farm in U.K. where farm Scientists have

proved that chemical inputs of land can be greatly reduced without economic penalties. The less intensive farming environmental programme aimed to reduce the environmental loss and improve the environmental safety of farming of aerable crops. We look at farming practices how they can be manipulated to minimise pest, disease and weeds.

The organic food market in U.K. has grown from 8 million in 1985 to 80 million in 1990. This market was produced at 240 million 1994. Coffee farmers in Mexico by avoiding chemical inputs can sell their beans 25-35% higher than non-organic beans. Consumers in many developed countries willingly pay a premium price farmed vegetables, fruits and other farm produce. A recent report published in National academy of sciences quotes a study where organic farming without fertilizers and pesticides for more than 15 years has produced yield of corn and soya bean 30 -40% higher than the average. In India also particularly in metropolitant cities like Bombay, Organic farmed vegetables and fruits are available in the market and the farmers are getting much higher price for their produce.

Many farmers who have taken the organic framing have realised a crop yield higher than those in the farms subjected to intensive, high tech farming.

The success of sustainable agriculture can be achieved by control of environmental pollution, crop diversification, maintaining genetic diversity, integrated pest management, integrated nutrient management, sustainable water management, post harvest technology and sound extension programmes.

Therefore the present investigation is an attempt made to find out that the perception of farmers about control of environmental pollution for sustainable agriculture. The specific objectives were as follows.

1. To study the socio-economic profile of the farmers.
2. To find the perception of farmers about sustainable agriculture.
3. To find the degree of awareness about the harmful effects of environmental pollution.
4. To find out the perception about sources of environmental pollution.
5. The suggestions of farmers to control the environment for sustainable agriculture.

The study was conducted purposefully selected Khurda district of Orissa. Out of nine blocks, Bhubaneswar block was selected purposefully as the farmers are very much progressive and nearby villages are subjected to pollution problems. Further 4 villages were selected randomly. Twenty five farmers of each villager were selected by lottery method from each of the 4 selected villages. So altogether 100 farmers were considered as the sample respondent of the study.

In order to find out the perception of farmers about sustainable agriculture different statements were framed on the parameters on it. Thus twelve ten, twelve, ten, ten fourteen and eighteen statements, were developed in consultation with the scientist, experts in the field of soil and land management, water management integrated nutrient management, integrated pest management, conservation of genetic diversity, post harvest, technology and socio-economical political factors and extension management respectively. The respondents were asked to indicate their response in a 4 point scale. Finally total score and mean score were computed and statements were ranked for each of the villages separately and together.

In order to find out the awareness of farmers about harmful effects of environmental pollution, statements, were developed in the concerned field. The awareness was measured in a 4 point scale. Finally total awareness score and mean score were computed after which they were ranked.

They different source of pollution viz. water pollution, soil pollution , air pollution and pollution due to intensive agriculture were studied in detail in order to find out the perception about different sources. Statements were developed in a similar fashion on each of sources which were then ranked after computing the mean perception score.

Attempt was also made to list out the different suggestions of the farmers to the control of environmental pollution for sustainable agriculture different possible suggestions were listed out and also open choice was given to the respondents to include more suggestions. Each of the suggestions were judged by the respondents by giving their response in a 4 point scale. Finally the statements, where ranked after calculating mean score of the statements.

The data were collected by using a structured and pre-tested interview schedule during December,1997. The test status viz. mean, standard deviation, and Kendall co-efficient of coincidence (w) were used to analyse, interpret and drawing inference.

The salient finds of the study were as follows.

- 5.1 It was revealed from the study that, out of several parameters on sustainable agriculture " prevention of land from non-farm practices was mostly agreed by the farmers which got rank. Lowest perception obtained in " crop calander according to climate and resources available" which ranked XI. by all the farmers under the study are as. The other are as on soil and land management in order of preference were right values with good crop rotation. Right sowing time maximises the grain yield. Application of organic manure hand weeding to reduce the weed problem, growing of crops on land capacity classes. use of modern tools according soil, and cropping pollution classification of land on crop productivity basis, planting methods accordingly to nature and size of seed to provide better condition for plant health which got ranks II, III, IV, V, VI, VII, VIII, IX, X, XI.

- 5.2** Judicious use of water resources like pisciculture in the pond and plantation crops on the embankment, proper design of irrigation resources to prevent salinisation were highest and lowest preference by the farmers which got rank I & X respectively on water management.
- 5.3** It was revealed from the title about integrated nutrient management that emphasis on farm yard manure and vermi Culture farming in possible area got the score 1 & II respectively as per the preference of the farmers. The other factors in order of importance were green manuring with Dhanicha improves the soil health, efficient high quick growing varieties for better utilisation of soil nutrients Resource generation and recycling eco system like supply of nitrogen with B.G.A., azolla, integrated use of organic and chemical manures, agronomic techniques, use of bio gas slurry to increase productivity, incorporation of legumes to increase the nitrogenous status, application of fertiliser based on soil test, use of byproducts of sugar factory to improve soil health which got rank. II, III, IV, V, VI, VII, VIII, IX, X respectively.
- 5.4** Avoidance of synthetic pesticide and growing of trap crop around the main crop field got the highest and lowest perception score by the farmers and ranks No.I & X respectively. The other statements preferred in order of importance were growing of resistant varieties of crop disease and pest use of botanical pesticide, use of chemicals having less residual effect, protection of beneficial insects like spider etc. Agronomic manipulations, like late and early sowing escapes from disease and pest attack, use of appropriate doses of chemicals according to the advice of Agril. Officer, altering the farming system reduce, pest problem and enriches the soil fertility, use of attractants repellents, sterilants growth regulators, male sterile techniques as per the advice of Agriculture Officers which got the rank II,III,IV,V,VI,VII,VIII,IX, respectively.

- 5.5 From the table it was also revealed that the farmers gave emphasis on use of indigenous technology in soil, water and land management which got the rank the lowest preference was on identification of plants higher and lower fertilizer response to maximize the production having the rank X, preservation of plant species which helps to control soil erosion and other economic species like chenopodium and vativar grass conservation of plant species having commercial importance like medicine, agroforestry and alley farming , preservation of indigenous plant species which are more resistant to disease pest than hybrid varieties, creation of environment which is aesthetically pleasing, conservation of annual plants like Begunia effective control of pests and diseases, diversification land towards alternate farming system such as mushroom, poultry, maintainance of soil fertility and productivity on renewable resources, identification of plants higher and lower fertiliser response to maximise the production establishment of Botanical garden for conservation of Bio diversity got the ranks II,III, IV,V, VI,VII,VIII respectively in order of their choice and preference.
- 5.6 Out of several factors on post harvest technology the farmers of the area showed their highest a lowest preference to use of botanical preservatives like, Neem, Tulsi, Begunia and coltar spray in wooden articles and walls of the store got the rank I & X respectively. The other statements in order of importance were efficient storage facility, sanitation of store house, frequent checking of store house, use of chemicals in store house having less residual effect, prevention of drainage near the store house, Adoption of low cost drying, method keeping the store house in moisture proof condition, close down the holes and keeping the grains on the wooden thatch or bamboo thatch use of metal container for storage of grains low temp. storage for decreasing decay of fruits, provision of complete ventilation in all seasons rainy seasons, sensory, use of cemented floor for threshing and better storage of grains respectively which got ranks II,III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII.

5.7 The socio-economic Political factors and extension management revealed that the preference of the farmers with respect to practical implementation of technology and temporal stability of an technology on long run basis got the ranks of I & XVIII respectively.

The other factors in order of importance were participatory research & training through the farm . Scientist with the farmers, use of locally available inputs like FYM compost & other resources, farm practices according to cultural desire, extension education for sustainable agricultural practices, participatory research & training through the farm scientist with the farmers, training units for farmers to boost the production ahead in a sustainable manner, video shows, farm magazines, bulletins helps updating the farmers knowledge, economic viability which leads to profit & interest of the farmers, farm information centre on area basis, Technological appropriability according to soil, climate & infrastructure available, construction & design of farm practices on area specific basis, economic feasibility as per the capacity of the farmers, farm advisory system in possible areas, stabilization of production for sustainability, provision of environmental sound programmes, temporal stability of an technology on long run basis got the ranks II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII respectively.

5.8 In order to find out the awareness of the farmers about the harmful effects of environmental pollution, it was found from the table that " the farmers were very much aware about the climatic change due to environmental pollution " which got rank I and the lowest awareness about "Retardant of plant growth due to air pollution ranked as XXV. The other factors as per awareness sequence were reduction of soil fertility due to application of chemical fertilizer, loss wild plants and animals due to loss of environment. The global environmental pollution has been contributed to pervasive poverty. The the longevity life span has reduced due to pollution of air, water & soil, indogenous communities suffers a lot due to loss

of forest & environment, death of aquatic animals is due to use of pesticides, industrial wastage & sewage, disease in aquatic animals due to water pollution, food poisoning due to excessive use of pesticide, pollution makes individual life unpleasant, noise pollution disturbs the patient, student and mental peace, there is loss of habitat due to drastic loss of forest & environment, air pollution produces eye and respiratory irritation to animal, water pollution causes diarrhoea and other diseases of human being, air pollution causes respiratory diseases such as bronchitis, Asthma, etc. pollution causes irritation & discomfort, water pollution of sewage toxic chemical causes human and animal health hazard. damage to plant due to automobile exhaust, rise in temperature affects the people in coastal areas, Health hazard occurs animal due to use of pesticide, pollution causes heart disease, impact of urbanization creates-land-shortage & environmental problems, Abnormal calcification of teeth or fluorosis occur in human and animals, development of sterility in animal & human due to application of pesticide, energy conversion activities make our planet uninhabitable, health hazard occurs to animal due to eating non bio degradable article, retardant of plant growth due to air pollution which got the ranks II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX, XX, XXI, XXII, XXIII, XXIV, XXV respectively.

5.9 As regards extent of awareness of the farmers about the harmful effects of environmental pollution, it was observed that 22% of the farmers belonged to high & low and 56% belong to the medium awareness categories.

5.10 The discussion is broadly on four dimensions of environmental pollution. They were water pollution, soil and Land pollution, air pollution & pollution due to intensive agriculture. It was revealed that the perception of the farmers maximum on "industrial effluents pollute the water which got rank I the other areas on decreasing order of awareness were water" is polluted due to excess use of chemical fertiliser water is polluted due to use of pesticides, water is polluted due

to food processing plant . release of garbages to pond and rivers and oceans pollute the water, detergents used for cleaning pollute the water, the excreta of man and animal causes water pollution which got rank II, III, IV, V, VI, and VII respectively.

5.11 Out of several factors on soil & land management it was found that "excess of use nitrogenous fertiliser in crops pollute the soil which got rank I . The factors where lowest awareness was observed was " use of pesticides pollute the soil. The other factors were excess use of phosphatic fertiliser, causes pollution in the soil, municipal waste pollute the soil, industrial carbon water pollute the soil, excess use of compost pollute the soil ,sulphur in inorganic form pollute the soil use of pesticides pollute the soil animal waste pollute the soil, soil borne pathogen like virus, bacteria, pollute the soil which got rank II,III, IV, V, VI, VII, VIII, ix respectively.

5.12 In case of perception of farmers about air pollution it was revealed that the perception was maximum with respect to "emission of automobiles pollute the air which got rank I by the farmers of all villages. A lowest awareness was observed in respect to industrial gas pollute the air. The dimensions got intermediate position with respect to their awareness.

5.13 Out of several factors on intensive agriculture highest perception was found with respect to "use of pesticide in crop & pest causes pollution in the surrounding" which got the rank I & lowest perception with respect to burning of crop by product causes air pollution & health hazard to man & animal.

5.14 The different suggestions/opinions of farmers about control of environmental pollution for sustainable agriculture were "promotion of education & motivation, large scale plantation of the trees around the habitaion , use of bio fertiliser instead of chemical

fertiliser, incentives for environmental protection, enforcement of laws against violation, technological control of automobile pollution . Use of compost in judicious manner, use of bio pesticide for controlling the pest, scientific control of effluents from the industry, teaching the people about pollution hazard, adoption of gobar gas plant in agriculture, implementing watershed in undeveloped areas, sanitation around the living, taking soil conservation measure, adoption of integrated pest management , reducing the waste and recycle of the byproduct,encouraging agroforestry farming system, adoption & vermi culture which got rank I, II, iii, IV, v, vi,vii, viii, ix, x, xi, xii, xiii, xiv, xv, xvi, xvii, xviii, xix . The other open ended suggestions were preventing of deforestation, discouraging shifting cultivation preventing grazing of animals from the forest and consideration farmers's views for environmental protection etc.

SUGGESTIONS FOR FUTURE RESEARCH

The suggestions for future research over and above this investigation are as follows:

1. Due to time and other limitations, the study was confined to only one district of the state. Therefore, similar type of studies of wider coverage need to be under taken by the future researcher in order to draw some valid conclusion.
2. The schedule developed for measuring the awareness and perceptions on different environmental pollution should be standardised by the future researcher for development of a standard scale for measurement of above variables.
3. The control of environmental pollution involves not only scientific interference but depends on also the social religions & cultural factors, which should be identified and documented for a pollution free nation.
4. Though the concept sustainable agriculture is not new, much works are to be conducted on the parameters of it. Sustainable agriculture models should be developed to bring live hood security and at the same time balancing the exploitation of natural resources and maintenance of environment.

CONCLUSION

Our research efforts in the year to come will focus not only to increase the productivity of agro-eco.system but also to ensure sustainability involving stability and equitability of the agricultural production system and environmental security through pollution control .The study revealed that economic considerations and population pressures have transformed agriculture ecosystem from what may be called as "domesticated " ecosystem in relative harmony with the environment to increasingly "fabricated" ecosystem which resemble urban & industrial production system in their energy & material demands & waste production. The farmers are aware aboutvery much interested to carryout the agriculture for sustainability to achieve the livelihood with a balance between exploitation of natural resources & maintenance of environment.

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APPENDICES

APPENDIX - I

INTERVIEW SCHEDULE

SOCIO-ECONOMIC PROFILE OF THE FARMERS

- | | |
|-----------------------------|-------------------|
| 1. Name of the farmer | 3. Village |
| 2. Father's name | 4. Block |
| | 5. District |

1. Age years (as on
December, 1997)

2. Educational status

(a) Illiterate

(b) Upto Primary
.....

(c) Upto Matriculation
.....

(d) Above Matriculation
.....

3. Caste

(a) Higher

Caste.....

(b) Lower

Caste.....

4. Family

(a) Type

(a) Nuclear

(b) Joint

(b) Size
.....

.....

(b) Female

(a) Male nos.

5. Occupation

(a) Agril. Labourer
.....

(c) Agril. & business

(b) Agril. & allied activities
.....

(c) Agril. & business

(d) Agril. & Service

(e) Any other

6. Annual Income from all sources

- (a) Upto Rs.15000/-
- (b) Rs.15000/- to 30,000/-
- (c) Rs.30,000/- to 60,000/-
- (d) Rs.45,000/- to 60,000/-
- (e) Above Rs.60,000/-

7. Mass Media Participation-

Media

Frequency of Reading/Listening habit

Regular Often Rarely Never

- a) News paper
- (b) Farm Magazine and Literature of Environmental concern.
- (c) Books on Agriculture and Environment
- (d) Radio
- (e) Television

8. Social Participation-

- (a) Not member of any organisation
- (b) Member of one organisation
- (c) Member of more than one organisation
- (d) Office bearers

9. Extension Participation

Sl. No.	Programme	Frequency of participation			
		Regularly	often	Rarely	Never
1	Short Training Programme	--	--	--	--
2	Training courses	--	--	--	--
3	Discussion meeting	--	--	--	--
4	Field visit	--	--	--	--
5	Demonstration	--	--	--	--
6	Film show	--	--	--	--
7	Field days	--	--	--	--
8	Exhibitions	--	--	--	--
9	Study tours	--	--	--	--
10	Any other	--	--	--	--

10. Extension Contact

Sl. No.	Programme	Frequency of contact			
		Regularly	often	Rarely	Never
1	Village level Extension Officer.	--	--	--	--
2	Block level Extension Officer	--	--	--	--
3	District level Extension Officer.	--	--	--	--
4	Extension Officer of Volunteer Organisation Officer	--	--	--	--
5	State Level Extension Officer	--	--	--	--

12. Perceptions of farmers about sustainable Agriculture.

Sl. No.	Statement	Degree of Perception			
	Is it important that sustainability of Agriculture depends upon ?				
A.	Soil and land management	Vimp.	Imp.	Less Imp.	Least Imp.
1	Classification of land on crop productivity basis.	--	--	--	--
2	Prevention of land from non farm practices.	--	--	--	--
3	Improvement degraded and eroded soil.	--	--	--	--
4	Control of soil erosion and acidification.	--	--	--	--
5	Application of organic manure.	--	--	--	--
6	Growing of crops on land capability classes.	--	--	--	--
7	Use of modern tools according to the land type, cropping pattern.	--	--	--	--
8	Right varieties with good crop rotation.	--	--	--	--
9	Crop calender according to the need climate and resources available.	--	--	--	--
10	Right sowing the maximises the grain yield.	--	--	--	--
11	Planting methods according to nature and size of the seed to provide better condition for plant health.	--	--	--	--
12	Hand weeding or intercultural operation reduces the weed problem.	--	--	--	--

B	Water management				
1	Judicious use of water resources like pisciculture in the bond and plantation crops in the embankments like Banana, Coconut, etc.	--	--	--	--
2	Irrigation scheduling according to the nature of the soil and crop.	--	--	--	--
3	Proper design of irrigation resources to prevent salinasation.	--	--	--	--
4	Proper allocation of funds for drainage system.	--	--	--	--
5	Environmentally sound low cost dams to supply irrigation water.	--	--	--	--
6	Crop planning according to the moisture availability	--	--	--	--
7	Drip irrigation in fruit crops as it supplies uniform water, reduced pumping energy leading to increased productivity chaking diseases by run off water.	--	--	--	--
8	Irrigation scheduling keeping view of fertilizer application.	--	--	--	--
9	Water harvest on command areas.	--	--	--	--
10	Agroforestry & Agro silviculture on watershed basis	--	--	--	--

C.	Integrated nutrient management				
1	Emphasis on farm yard manure rather than chemical manure.	--	--	--	--
2	Green manuring with (Dhanicha) improves soil health.	--	--	--	--
3	Resource generation and recycling eco system like supply nitrogen (the azolla and B.G.A.)	--	--	--	--
4	Bio fertilizers like Neem cake and karang cake to improve soil health.	--	--	--	--
5	Use of Bio gas slurry to increase the soil productivity.	--	--	--	--
6	Incorporating of legumes to increase the nitrogen status.	--	--	--	--
7	Efficient, high yielding quick growing varieties for better utilisation of soil nutrients.	--	--	--	--
8	Integrated use of organic manure with other chemical amendments like green leaf manure + lime improves soil health.	--	--	--	--
9	Byproducts of sugar factory improves physical properties of the soil.	--	--	--	--
10	Application of fertilizer based on soil test.	--	--	--	--
11	Agronomic techniques like spilt application of fertilizer depending on growth stages, placement of fertilisers in correct does to increase production per unit are.	--	--	--	--
12	Vermiculture (earth warm) farming on possible areas.	--	--	--	--

D.	integrated pest management				
I	Growing resistant crop varieties of disease and pest.	--	--	--	--
ii	Use of botanical pesticides.	--	--	--	--
iii	Agronomic manipulation like late & early sowing escapes from disease pest attack.	--	--	--	--
iv	Avoidance of synthetic pesticides.	--	--	--	--
v	Protection of beneficial in sects like spiders etc.	--	--	--	--
vi	Use of attractants, repellants, sterilants growth regulators, male steri techniques as per the advice of agriculture officers.	--	--	--	--
vii	Use of appropriate dose of chemicals according to the advice of Agril. officer.	--	--	--	--
viii	altering the farming system reduces pest problems and enriches the soil fertility.	--	--	--	--
ix	Use of chemicals having less residual effect.	--	--	--	--
x	Growing of trap crop around the main crop.	--	--	--	--

E.	Conservation Genetic diversity (Biodiversity)				
1	Conservation of annual plants like Begunia for effective control of pests and diseases.	--	--	--	--
2	Identification of plants having higher and lower fertilisers response to maximise the production.	--	--	--	--
3	Conservation of plant species having commercial importance like medicine, Agroforestry and alley farming.	--	--	--	--
4	Preservation of plant species which helps to control soil erosion and other economic species like chenopodium and vativar grass.	--	--	--	--
5	Preservation of indigenous plant species which more resistant to disease pest than hybrid varieties.	--	--	--	--
6	Use of indigenous technology in soil, water and land management.	--	--	--	--
7	Establishment of Botanical garden for conservation of Bio-diversity.	--	--	--	--
8	Diversification land towards alternate farming system such as mushroom, poultry.	--	--	--	--
9	Maintenance of soil fertility and productivity on renewable resources.	--	--	--	--
10	Creation of environment which is aesthetically pleasing.	--	--	--	--

F.	Post harvest technology				
1	Adoption of low cost drying method.	--	--	--	--
2	Efficient storage facility.	--	--	--	--
3	Use of botanical preservatives like, Neem, Tulsi, Begunia.	--	--	--	--
4	Low temperature storage for decreasing decay of fruits.	--	--	--	--
5	Sanitation of store house.	--	--	--	--
6	Prevention of drainage near the store house.	--	--	--	--
7	Keeping the store house in a moisture proof condition.	--	--	--	--
8	Use of metal contain for storage of grains.	--	--	--	--
9	Use of cemented floor for threshing and better storage of grains.	--	--	--	--
10	Coltar spray in wooden articles and walls of the store.	--	--	--	--
11	Provision of complete ventilation in all seasons except rainy season.	--	--	--	--
12	Close down of holes and keeping grains on the wooden thatch or bamboo thatch.	--	--	--	--
13	Frequent chacking of store house.	--	--	--	--
14	Use of chemical in store house having less residual effect.	--	--	--	--

G.	Socio-economic political factors and Extension Management				
1	Construction and design of farm practices on area specific basis.	--	--	--	--
2	Participatory research and training through the farm scientist with the farmers.	--	--	--	--
3	Use of locally available inputs like FYM compost and other resources.	--	--	--	--
4	Technological appropriability according to soil, climate and infrastructures available.	--	--	--	--
5	Economic feasibility as per the capacity of the farmers.	--	--	--	--
6	Economic viability which leads to profit and interest of the farmers.	--	--	--	--
7	Provision of environmental sound programmes.	--	--	--	--
8	Temporal stability of an technology on long run basis.	--	--	--	--
9	Launching of social acceptability interest oriented stabilising programmes.	--	--	--	--
10	Practical implementation of technology.	--	--	--	--
11	Farm practices according to cultural desire.	--	--	--	--
12	Equity in farm investment and required production.	--	--	--	--
13	Stabilisation of production for sustainability.	--	--	--	--
14	Extension education for sustainable agricultural practices.	--	--	--	--

15	Vedio shows, farm magazines, bulletins helps updating the farmers knowledge.	--	--	--	--
16	Farm advisory system in possible areas.	--	--	--	--
17	Training units for farmers to boost the production ahead in a sustainable manner.	--	--	--	--
18	Farm information centre on area basis.	--	--	--	--
13	Degree of awareness about the harmful effects of environmental pollution.				
1	Air pollution causes respiratory diseases such bronchitis, Asthma.	--	--	--	--
2	Pollution causes irritation and discomfort.	--	--	--	--
3	Pollution causes heart diseases.	--	--	--	--
4	Pollution makes individual life unpleasant.	--	--	--	--
5	Noise pollution disturbs the patient, student and mental peace.	--	--	--	--
6	Water pollution causes diorhoea and other diseases in human being.	--	--	--	--
7	Food poisoning due to excessive use pesticides.	--	--	--	--
8	Air pollution produces eye and respiratory irritation to animal.	--	--	--	--
9	Health hazard occurs in animal due to use of pesticide.	--	--	--	--
10	Abnormal of calcification or teeth flurosis occur in human and animals.	--	--	--	--

11	Water pollution of sewage & toxic chemical causes human and animal health hazards.	--	--	--	--
12	Disease in aquatic animal due to water pollution.	--	--	--	--
13	Death of aquatic animal is due to use pesticides, industrial wastage & sewage.	--	--	--	--
4	Development of sterility in animal & human due to application of pesticide.	--	--	--	--
5	Health hazard to animal occurs by eating non-bio degradable article.	--	--	--	--
5	Retardant of growth of plant is occurs due to air pollution.	--	--	--	--
7	Damage to plant is possible due to automobile exhaust.	--	--	--	--
8	Reduction of soil fertility due to application of chemical fertiliser.	--	--	--	--
9	The longevity of life span is reduced due to pollution of air, water & soil.	--	--	--	--
10	Climatic changes occur due to all these pollution.	--	--	--	--
11	There is loss of wild plants and animals due to loss of biodiversity.	--	--	--	--
12	There is loss of habitat due to drastic loss of forest & environment.	--	--	--	--
13	Indigenous communities suffers a lot due to loss of forest & environment.	--	--	--	--
14	Rise in temperature affects the people in coastal areas.	--	--	--	--
15	Energy conversion activities make our planet uninhabitable.	--	--	--	--

26	The Global environmental crisis has been contributed to pervasive poverty (pollution of poverty)	--	--	--	--
27	Impact of urbanization creates land shortage housing problem, creates all economic problem.	--	--	--	--
28	Textile industries creates health problem.	--	--	--	--
14.	Farmers perception about different sources of pollution.	--	--	--	--
A.	Water Pollution				
1	Water is polluted by excess use of chemical fertiliser.	--	--	--	--
2	Water is polluted by use of pesticide.	--	--	--	--
3	Release of garbage to ponds and rivers, and oceans pollute the water.	--	--	--	--
4	Industrial effluents pollute the water.	--	--	--	--
5	The excreta of man and animal causes water pollution.	--	--	--	--
6	The detergents used for cleaning polluted the water.	--	--	--	--
7	Food processing plants also pollutes the water.	--	--	--	--
B.	Soil/land pollution				
1	Excess use of nitrogen fertilizer in crop pollutes the soil.	--	--	--	--
2	Excess use of phosphatic fertilizer causes pollution in soil.	--	--	--	--
3	Sulphur in organic form pollute the soil.	--	--	--	--
4	Use of pesticide pollutes the soil.	--	--	--	--
5	Industrial carbon water.	--	--	--	--
6	Municipal waste pollutes the soil.	--	--	--	--

7	Excess use of compost pollutes the soil	--	--	--	--
8	Animal waste pollutes the soil.	--	--	--	--
9	Soil borne pathogen virus bacteria pollute the soil.	--	--	--	--
C.	Air pollution				
1	Respiration of man, animal releases carbon dioxide causes in air pollution.	--	--	--	--
2	Emission of automobiles cause pollution of air.	--	--	--	--
3	deposition of garbages & burning them pollute the air.	--	--	--	--
4	Decomposed fruits and vegetables pollute the air.	--	--	--	--
5	Animal waste pollute the air.	--	--	--	--
6	Crop residues pollute the air.	--	--	--	--
7	Industrial waste and emission pollute the air.	--	--	--	--
8	Use of pesticide and fungicide in crops pollutes the air.	--	--	--	--
15	Use of machinery like power thresher causes air pollution.	--	--	--	--
16	Forest fires causes air pollution.	--	--	--	--
17	Air as carriers of spores bacteria causes air pollution.	--	--	--	--
18	Noises of automobiles cause air pollution.	--	--	--	--
19	Noise caused by loud speaker causes air pollution.	--	--	--	--
20	Noise produced by industrial plants causes the air pollution.	--	--	--	--
21	Industrial emission of Gas causes air pollution.	--	--	--	--

D	Agriculture (Intensive cultivation) Do you know that.				
1	Repeated use of chemical fertiliser like N & P causes air pollution.	--	--	--	--
2	Repeated application of fertilizer in crop field pollutes the water.	--	--	--	--
3	Repeated application of chemical fertilisers leads to pollution of soil and there by reduce micro-organic activity and production.	--	--	--	--
4	Use of pesticides in crop & pest causes pollution in the surrounding.	--	--	--	--
5	Use of pesticide pollutes the water.	--	--	--	--
6	Indiscriminate application of fertilizer causes soil, water, air pollution.	--	--	--	--
7	Indiscriminate use of pesticide pollute the food leading to residual toxicity.	--	--	--	--
8	Repeated use of pesticide causes pest resistance & pest surge.	--	--	--	--
9	Burning crop by product causes air pollution and health hazard of man & animal.	--	--	--	--
10	Indiscriminate application of pesticide reduces the natural enemies of pest.	--	--	--	--
11	Indiscriminate application of pesticide kills the beneficial organism.	--	--	--	--
12	Power thresher used for harvesting causes breathing problem and irritation.	--	--	--	--

15. Suggestion of the farmers about controls of environment for sustainable Agriculture.

	Opinion/suggestion				
1	Large scale plantation of trees around the habitation.	--	--	--	--
2	Teaching the people about pollution hazard.	--	--	--	--
3	Use of bio pesticide for contoling the pest.	--	--	--	--
4	Adoption of integrated pest management instead of using pesticide only.	--	--	--	--
5	Use of bio-fertilizer instead of chemical fertiliser.	--	--	--	--
6	Reducing waste and recycling the byproduct.	--	--	--	--
7	Encouraging agroforestry farming system.	--	--	--	--
8	Adoption of vermiculture in agriculture.	--	--	--	--
9	Enforcement of laws for environmental protection.	--	--	--	--
10	Technological control of automobile pollution.	--	--	--	--
11	Incentives of environment protection.	--	--	--	--
12	Sanitation around the living.	--	--	--	--
13	Use of compost in judicious manner.	--	--	--	--
14	Scientific control of effluents from food processing industries.	--	--	--	--
15	Implementing water shed in undeveloped area.	--	--	--	--
16	Taking of soil conservation measure.	--	--	--	--
17	Adoption of Gobar Gas Plant in agriculture.	--	--	--	--
19	Promotion of Education and motivation.	--	--	--	--
20		--	--	--	--

APPENDIX - II
BASIC INFORMATION ABOUT THE AREA UNDER STUDY

- (1) Name of the State - Orissa
(2) Name of the district - Khurda
(3) Name of the block - Bhubaneswar
(4) Name of the villages.

Sl. No.		Jagannathpur	Saradeipur	Kumardiha	Nathpur
A	Population	440	517	747	679
1	Male	215	242	362	385
2	Female	225	275	385	382
B	Area (hectare)				
	Geographical area	72.6	204.25	263.4	186.20
1	Irrigated	20	42	105	48
2	Non irrigated	44	158	155	136
C	Land classification				
1	High land	4	16	48	16
2	Medium land	25	85	79	105
3	Low land	35	99	133	60
D	Categories of farm families				
1	Agricultural labourers.	15	20	22	23
2	Marginal farmers	30	41	42	22
3	Small farmers	25	22	35	62
4	Big farmers	21	24	15	13