MANAGEMENT OF INDIGENOUS TRADITIONAL KNOWLEDGE IN AGRICULTURE

ABSTRACT

THESIS

SUBMITTED FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy

IN

MANAGEMENT

BY

UMME HANI

Under the Supervision of

PROF. SHAMIM AHMAD

DEPARTMENT OF AGRICULTURAL ECONOMICS & BUSINESS MANAGEMENT
FACULTY OF AGRICULTURAL SCIENCES
ALIGHARH MUSLIM UNIVERSITY
ALIGHARH (INDIA)

2011
ABSTRACT

Knowledge is indispensable for the understanding and promotion of technical, economic and social change in societies. The unwritten knowledge/wisdom continually used and developed by generations, coming out of experience through tradition, heritage, culture or family or social setup is called traditional knowledge. Indigenous knowledge is the sum total of the knowledge and skills which people specific to geographical area and culture possess, and which enable them to attain the best out of their natural environment. An old African proverb states “when a knowledgeable old person dies, a whole library disappears.”

The terms Indigenous knowledge and Traditional knowledge are frequently used in the same context to distinguish the knowledge of traditional and indigenous communities from other types of knowledge, such as the knowledge of scientific and industrial communities. Traditional knowledge is a broader category that includes indigenous knowledge as a type of traditional knowledge held by indigenous communities (Mugabe 1999). While “traditional knowledge” and “indigenous knowledge” are not synonymous, they share many attributes, such as being unwritten, customary, pragmatic, experiential, and holistic. Here also both the terms have been used interchangeably.

Traditional farmers in India developed agricultural practices to successfully grow crops and raise animals in the highly diversified agro-ecological conditions with the help of locally available raw materials. The resource poor farmers with the help of highly efficient techniques that depend on locally available, low cost inputs get their lively hood.

The role of Traditional knowledge in healthcare is indisputable. Because of better cultural acceptability, better compatibility with the human body and lesser side effects the recognition of traditional medicine is now a days getting popularity.

The contribution of indigenous and local communities to the conservation and sustainable use of biological diversity is indisputable. The
growing interest in the potential contribution of indigenous knowledge to sustainable development is becoming manifest.

In spite of the growing awareness among the intellectuals about the value of traditional knowledge regarding agriculture, health care, handicrafts etc, a little effort has been made to identify, document, validate and protect this knowledge. There is a great threat that this knowledge will be completely lost or be misappropriated by the time we really understand the worth of this valuable knowledge system.

It is anticipated that indigenous peoples’ traditional knowledge may be important sources of new technology for the future.

The thesis has been organized in the following order. Chapter one describes the introduction about traditional knowledge. It’s various uses and its importance, Some agricultural and traditional medicinal data are also used. The Objective of the study has been stated.

The present need of the study is

**Problem statements and Objectives**

1. To look into the contribution of TK in day to day life.
   
   Q.1 How does TK help in enriching agriculture, medicines?
   
   Q.2. What is its role in conserving bio-diversity and sustainable development?

2. To look into the issues of TK holders.

   Q.3. How do we handle issues related to the questions of their rights nationally as well as internationally?
   
   Q.4. How do we ensure that the traditional knowledge holders could get benefit from the cultural capital that they have sustained, harnessed and developed.

   The second chapter deals with the review of literature. A brief overview of the traditional agricultural sector in India is presented in chapter three.
Traditional agriculture, is a sustainable indigenous farming practice, that results out of the coevolution of local social and environmental systems and that exhibit a high level of ecological rationale expressed through the intensive use of local knowledge and natural resources, including the management of agrobiodiversity in the form of diversified agricultural systems.

Having a varied favourable agro-climatic condition India is a major producer of horticultural crops such as fruits, vegetables, root tuber, ornamental aromatic plants medicinal herbs, spices and plantation crops like coconut, arecanut, cashew and cocoa. Its loudable achievements can be termed as more than 30.5% GDP of agriculture has been contributed by Horticulture.

The technological modernization in Agriculture is highly successful at meeting its primary objective of increasing crop yields and augmenting aggregate food supplies, in order to answer the problem of feeding the increasing world's population, yet, despite its success at increasing aggregate food supply, as a development approach it has not necessarily translated into benefits for the lower strata of the rural poor in terms of greater food security or greater economic opportunity and well-being.

Studies of impact have shown that the better-off strata of rural society have gained access to better incomes generated by the introduction of technology whereas the poorest strata have tended to lose access to income that was available before its introduction. However, most farmers have not willingly adopted this, rather it has been forced on them by a package of government policies, subsidies and selective price incentives.

The structure and performance of herbal medicinal system is used in chapter four.

Medicine is the field where Indigenous Knowledge is taught both in informal as well as formal subject in educational institutions. India has many Ayurveda, Unani, Siddha & Homoeopathy medical colleges and several university departments. All herbal drug based systems come under the control of Indian System of Medicine and Homoeopathy (ISM&H).
Chapter five deals with the legal status of traditional knowledge. The study aims at exploring the potentials and finding the means and ways of promoting the traditional knowledge by developing effective policy recommendations for the achievement of benefit sharing of the traditional knowledge holders of India in particular and the world population in general.

The sixth chapter deals with the research methodology. The broad aspects of research methodology are briefly given below:

**Nature of the Study**

The nature of this study is characterized by the following features:

1. Descriptive Research.
2. Applied Research
3. Empirical research
4. Exploratory research

As the major purpose of this research is the description of the state of affairs as it exists. This research has been put into the descriptive research category. It aims at obtaining the information on people's attitudes towards the acknowledgement of the contribution of traditional knowledge. The management of traditional knowledge is socially oriented and leads to the improvement of quality of life and supplies better amenities to mankind in keeping with the growing and varied requirements of the society.

As the research aims at finding a solution for an immediate problem facing a society it has been categorised under the heading of Applied research.

Most of the times relying on experience and observations has been preffered over relying solely on theory, or research has been done without giving due regards for the system and theory. It is data based research, coming up with conclusions which is capable of being verified by observations and especially when the available information is insufficient, the empirical study is the only way to get it.
The approach of the study is exploratory in the sense that it is mostly directed towards the development of hypothesis rather than their testing. This approach is generally followed for new areas of investigations where the problem itself may not be very clear and is needed to be diagnosed. The domain of the research is also required to be reasonably wide but properly specified.

As the research is concerned with qualitative phenomenon, i.e., phenomenon relating to or involving quality or kind is has been categorized as a qualitative research. This research aims at discovering the mindset of general public regarding traditional knowledge, using in depth interviews for the purpose. Applying qualitative research is relatively a difficult job and needs some more experience and observations.

This approach can further be specified as inferential approach, as this research forms a data base from which characteristics or relationships of population has been inferred. This means survey research where a sample of population is questioned to determine its characteristics, and is then inferred that the population has the same characteristics.

An advantage of this approach is that it brings the researcher and the respondent face to face and their cooperative efforts help to build up a better research database. Personal contact enables the researcher to use his intelligence to elicit precise information from them and analyze the data in the light of his experience. In fact it establishes a liaison between the research laboratories and field situations and stimulates research both ways.

Covering the whole area being enriched with the contribution of traditional knowledge was not possible in the study due to time and cost constraints. The study has been divided in two parts.

Firstly a step has been taken towards achieving the goal of finding out the important areas where the contribution of Traditional Knowledge is very high or the areas highly enriched with traditional knowledge by conducting a survey at Aligarh district of UP. This study aimed to use primary cross-sectional data to identify the areas in which the use of traditional knowledge is very high. And also the areas in which the contribution of ITK is high in
enriching the fields. Using stratified random sampling, 180 participants were selected to take part in this study, and data were collected through a structured questionnaire by interviewing the selected participants.

For the purpose of drawing conclusions and testing of hypothesis, the following methods were used in the process of data analysis:

1. percentage calculation for different parameters
2. Rank coefficient using the ranks and multiplying them with the appropriate weightage-coefficients rank wise
3. Rating scores for Likert scale analysis by multiplying the frequencies with the appropriate weightage-coefficients
4. T test for significance test

As a result of the analysis it has been found that unanimously irrespective of age, profession and location the respondents acknowledged the use of traditional knowledge, though their preference in the level of use varied. Most of the respondents went in favor of three areas where the use of traditional knowledge is very high. These are Agriculture, Herbal Medicine and Handicraft.

Chapter seven and eighth deals with quantitative and qualitative analysis of the primary data collected.

When asked about the enrichment of these areas their result went to Agriculture the most.

As the whole world is being considered as a global village i.e., the borders of the countries are about to deplete and knowledge is easily transferred into a marketable commodity; there is a growing realization that the traditional wisdom representing our cultural identities is being lost. Easy accessibility of ITK leads it to be susceptible to misappropriation. In recent past a lot of cases of bio-piracy has been noticed.

The issue of Traditional Knowledge has become contentious with the emergence of new intellectual property rights (IPR) and the conflicts between the provisions of Trade-Related Aspects of Intellectual Property Rights
(TRIPS) agreement, the UN Convention on Biological Diversity (CBD) and the FAO International Treaty on Plant Genetic Resources (ITPGRFA).

In order to sustainably use the components of biological diversity Article 10(c) of Convention on Biological diversity states, “Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements”

Finally the ninth chapter concludes the thesis and gives some relevant suggestions.
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ALIGARH (INDIA)
2011
Dedicated
To
Abbu & Saarim
CERTIFICATE

This is to certify that the thesis entitled "Management of Indigenous Traditional Knowledge in Agriculture" has been completed by Mrs. Umme Hani under my supervision. I have allowed her to submit it in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

To the best of my knowledge the thesis work is original and done by the candidate herself.

Prof. Shamim Ahmad
(Supervisor & Chairman)
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My Husband Mr. Saad Md Ali duly deserves my heartful thanks for his co-operation, coordination and encouragement during the critical juncture of this work. I am also thankful to other research scholars who remained close to me.

With best regards, I feel short of words to express my deep feelings to my loving Abbu, Ammi & in-laws, and my uncle Prof. Liaqat Ali, my aunty Prof. Naima Gulrez. Special credit to my son Sarim who constantly missed my presence in those moments when he needed me most.

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UMME HANI
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The Researcher has finally suggested some suggestions for the adoption of a new technology which would be environment friendly economically viable, and socially acceptable.

Aligarh

October 2011

(UMME HANI)
CHAPTER – 1

Introduction
CHAPTER - 1

INTRODUCTION

Background

Knowledge is indispensable for the understanding and promotion of technical, economic and social change in societies. It is the possession of acquired information that can be put to work. By the Oxford English Dictionary Knowledge is defined as expertise, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject, what is known in a particular field or in total; facts and information or awareness or familiarity gained by experience of a fact or situation. The great Greek Philosopher Plato defines knowledge as “justified true belief”.

The unwritten knowledge/wisdom continually used and developed by generations, coming out of experience through tradition, heritage, culture or family or social setup is called traditional knowledge. Indigenous knowledge is the sum total of the knowledge and skills which people specific to geographical area and culture possess, and which enable them to attain the best out of their natural environment. Most of this knowledge and skills have been passed down from earlier generations, each new generation adapt and add to this body of knowledge in an adjustment to changing circumstances and environmental conditions and pass on the body of knowledge to the next generation, in order to provide them with survival strategies. An old African proverb states “when a knowledgeable old person dies, a whole library disappears.” It is the basis for local-level decision-making in agriculture, health care, food preparation, education, natural resource management, and a host of other activities in rural communities. There has been proliferation of terms such as: traditional knowledge (TK), indigenous technical knowledge (ITK), and indigenous knowledge system (IKS).

The terms Indigenous knowledge and Traditional knowledge are frequently used in the same context to distinguish the knowledge of traditional and indigenous communities from other types of knowledge, such as the knowledge of scientific and industrial communities. Traditional knowledge is a
broader category that includes indigenous knowledge as a type of traditional knowledge held by indigenous communities (Mugabe 1999). While “traditional knowledge” and “indigenous knowledge” are not synonymous, they share many attributes, such as being unwritten, customary, pragmatic, experiential, and holistic. Here also both the terms have been used interchangeably.

Traditional Knowledge is now growingly recognized in developing as well as developed countries due to its important role played in economic, social, and cultural development since time immemorial, and as a result of increasing awareness of the value of biodiversity, environmental crisis and sustainable development.

The Indian Agricultural sector provides employment to about 65% of the labour force, accounts for 27% of the GDP, contributes 21% of total exports, & provides raw materials to several industries. The live stock sector contributes an estimated 8.4% to the country’s GDP and 35.85% of the agricultural output. Contributions of indigenous and other traditional knowledge to the global crop production system have well been documented.

It is estimated, for example, that the economy of the United States of America has annual sales at least US$ 50 million from genes of 15 major crops that were first cultivated and enhanced by traditional peoples.

Traditional farmers in India developed agricultural practices to successfully grow crops and raise animals in the highly diversified agro-ecological conditions with the help of locally available raw materials. The resource poor farmers with the help of highly efficient techniques that depend on locally available, low cost inputs get their lively hood.

The role of Traditional knowledge in healthcare is indisputable. Because of better cultural acceptability, better compatibility with the human body and

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2 See, for example, Kloppenburg, First the Seed: The Political Economy of Plant Biotechnology 1492-2000 (Cambridge University Press, Cambridge, 1988)
lesser side effects the recognition of traditional medicine is now a days getting popularity. WHO defines traditional medicine as: the health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being.  

The global market for traditional therapies stands at US$ 60 billion a year and is steadily growing. The WHO estimates that 60-90% of the people in developing countries such as India Ethiopia, Benin, Rwanda, Tanzania & Uganda use them while in the developed countries like the USA, Canada, Australia, France, Germany and Belgium, at least 40–70% of the population use an alternate system of medicine some time or other, either singly or concurrently with modern medicines.

According to RAFI (1997:P4), 80% of the people of the whole world rely on indigenous knowledge for their medical needs. About 25% of modern medicines are descended from plants first used traditionally. In wealthy countries, growing numbers of patients rely on alternative medicine for preventive or palliative care. In France, 75% of the population has used complementary medicine at least once; in Germany, 77% of pain clinics provide acupuncture; and in the United Kingdom, expenditure on complementary or alternative medicine stands at US$ 2300 million per year.

The growing interest in the potential contribution of indigenous knowledge to sustainable development is becoming manifest. "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Now a days research has given valuable insights into how people use their traditional knowledge to change and to improve, for example, natural

4  a b c United Nations World Health Organization Fact sheet no. 134, revised May, 2003 - Traditional Medicine
5  Traditional medicines and medicinal plants, and their protection modalities from an Intellectual Property Rights perspectiveM. D. Nair* A-11, Sagarika, 15, 3rd Seaward Road, Valmiki Nagar, Chennai 600041, India, q NIAB 2005 ISSN 1479-2621 Plant Genetic Resources 3(2); 314–319 DOI: 10.1079/PGR2005080
resource management. However, the contribution of indigenous and local communities to the conservation and sustainable use of biological diversity goes far beyond their role as natural resource managers.

The World Commission on Environment and Development, also known as the Bruntland Commission, completed in 1987 was arguably the beginning of a wider acceptance of non-scientific (in the Western sense) knowledge as having a role to play in the conservation of global biodiversity and environmental sustainability (Colorado 1996).  

Biodiversity is the variability within and between living organisms and ecological systems of which they are a part, including genetic, species and ecosystem diversity.  

India is one of the 12-mega biodiversity countries of the world. With only 2.4% of the land area, India already accounts for 7-8% of the recorded species of the world. Approximately 90,000 species of animals are known from India of which Fish account for 2,546 species; Amphibia, 210 species; Reptilia, 428 species; Birds, 2,000 species and subspecies; Mammals, 397 species and subspecies; the rest being represented by other faunal elements. Of these, 75 'species of Mammals, 59 species of Birds, 19 species of Reptiles, 3 species of Amphibians and a large number of Lepidoptera and Coleoptera are listed as endangered.  

Over 46,000 species of plants have been recorded in the country so far by the Botanical Survey of India.

As bio-diversity is not equally distributed all over the world some countries having rich recorded diversified species are called as mega biodiversity countries which account for harbouring 60 to 70% recorded biodiversity, are named as Brazil, Colombia, Ecuador, Peru, Mexico, Madagascar, Zaire, Australia, China, India, Indonesia and Malaysia.

As the countries became conscious of the intrinsic value and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components,

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8 Secretariat of the Convention on Biological diversity, 2001; Wilson, 1988
9 http://zsi.gov.in/(accessed on 01.04.10)
and that states are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner and attack the causes of significant reduction or loss of biological diversity at source, and the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity will strengthen friendly relations among States and contribute to peace for humankind, desiring to enhance and complement existing international arrangements for the conservation of biological diversity and sustainable use of its components, and determined to conserve and sustainably use biological diversity for the benefit of present and future generations.  

In order to sustainably use the components of biological diversity Article10(c) of Convention on Biological diversity states, "Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements".  

The United Nations General Assembly (UN GA) has proclaimed the year 2010 as "the International Year of Biodiversity (IYB)". The Mission of IYB 2010 is to: enhance public awareness on the importance of conserving biodiversity and its underlying threats; celebrate and promote successes and accomplishments in saving biodiversity by communities and governments; encourage individuals, organizations and governments to take immediate steps needed to halt the loss of biodiversity; and promote innovative solutions to reduce the threats to biodiversity. The Ministry of Environment & Forests (MOEF), Government of India has developed a plan of action for celebrating the IYB 2010. Under the guidance of the plan of action of MOEF, an Executive Committee for carrying out the plan of action for celebrating the IYB 2010 has been constituted by NBA. 

10 cbd-en.pdf
11 cbd_en.pdf
The handicraft sector has a twin quality of foreign exchange earning as well as labour absorption capacity. Having high value added quality, a very small increase in investment results in an extraordinarily high increase in profits or outcomes. The employment generation capacity of this sector is also noticeably high, second to agriculture. Much of our current developments and innovations in Handicraft area are linked to traditional knowledge, often from indigenous communities that live close to nature and the promotion of such enterprises in developing economies like India is of paramount importance since it brings about a great distribution of income and wealth, economic self-dependence, entrepreneurial development employment and a host of other positive, economic uplifting factors.

In spite of the growing awareness among the intellectuals about the value of traditional knowledge regarding agriculture, health care, handicrafts etc, a little effort has been made to identify, document, validate and protect this knowledge. There is a great threat that this knowledge will be completely lost or be misappropriated by the time we really understand the worth of this valuable knowledge system.

Thurston (1990) indicated that traditional agricultural practices must be understood and conserved before they are lost with rapid advancement of modern agriculture.\(^\text{13}\)

According to Gupta(1990), to understand scientific rationale, to accelerate technological change, to enable better understanding of technology development and newer concepts, to increase awareness among younger generations to revive and restore pride among the farmers themselves, there is a need to document traditional knowledge.\(^\text{14}\)

**Justification for the topic**

It is anticipated that indigenous peoples' traditional knowledge may be important sources of new technology for the future.

\(^\text{13}\) Thurston I D (1990) – Plant disease management practices of traditional farmers. Plant Disease 7: 96-102

Each time someone claims a bit of India as their own and these times of patent war, we are fighting claims to about 40 products all over the world, the country goes into a tail-spin. Anger, confusion, Desperate and determination to fight it out (one more time) do urgent rounds of government offices, agricultural bodies and NGOs. Perhaps rightly so, since Basmati, Neem and Haldi have never been too far from an Indian’s life and the idea that someone in east may acquire the right to own trade and market it is more than a bit jolting.  

**Problem statements and Objectives**

1. To look into the contribution of TK in day to day life.  
   Q.1. How does TK help in enriching agriculture, medicines?  
   Q.2. What is its role in conserving bio-diversity and sustainable development?  

2. To look into the issues of TK holders.  
   Q.3. How do we handle issues related to the questions of their rights nationally as well as internationally?  
   Q.4. How do we ensure that the traditional knowledge holders could get benefit from the cultural capital that they have sustained, harnessed and developed.

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CHAPTER – 2

Review of Literature
CHAPTER - 2

REVIEW OF LITERATURE

The study requires a depth knowledge and understanding on prevailing use of traditional knowledge in agriculture and medicinal use of herbs, shrubs and their protection in terms of government laws and regulation. There is not sufficient documentation of literature or research work done to provide secondary data. Few books, journals, articles, websites have been read the prominent among them were.

The book, “Agricultural Diversification and Smallholders in South Asia” edited by P.K. Joshi, Ashok Gulati & Ralph Cummings Jr. (2007) unfolds the rapidly changing new lifestyles, tastes, and dietary patterns of urban as well as rural consumers of South Asian countries like India, Bangladesh, Nepal, Pakistan, Sri Lanka etc that how they are shifting from staple food grains to high-value- commodities such as fruits, vegetables, milk, meat, eggs and fish.

The book analysis the situation and facilitates inclusiveness of small holders through incentives, evolving institutions and developing infrastructure by experts from various countries.

The book knowledge Management Tool for business development, by Dr. B. Reddy (2007), guides how to capture and use knowledge for business development and create competitive advantage through cross functional areas. The book taking into analysis, the traditional farmers and their problems to enter into New age markets has deliberated, “the immense potential of Indian agriculture is waiting to be unleashed. The endemic constraints that shackle this sector are well known-fragmented farms, weak infrastructure, numerous inter mediaries, excessive dependence on the monsoon and others. These pose their own challenges to improving productivity of land and quality of crops. The unfortunate result is inconsistent quality and competitive prices, making it difficult for the farmer to sell his produce in the world market.”

It suggests how the company’s ‘e-Choupal’ initiative is enabling Indian agriculture significantly enhance its competitiveness by empowering Indian
farmers through the power of the Internet. Farmers use this technology infrastructure to access on-line information from ITC'S farmer-friendly website.

The book “Economic studies of Indigenous and Traditional knowledge” edited by “Nirmal Sengupta, (2007) deals with traditional and indigenous knowledge of common men and women of India. Different chapters, by different authors show the significance of traditional knowledge in different areas like forest farming, animal and husbandry, distortions in the relationship between man and nature and building the bridge between them, fisheries product and distribution, housing, irrigation, economy of homestead garden, medicinal knowledge, drinking water collection.

It also has been brought under notice that these knowledge are being utilized in the modern world in wide variety of ways so global interest for this increasing. Its commercial potential are to be recognised in order to reduce poverty

The book “Biodiversity and traditional knowledge” edited by ‘Sarah A Larid’, (2006) guides how to arrive at equitable biodiversity research and prospecting partnerships. The book deals with biodiversity research relations that who has rights to access, publication and authorship of knowledge?, who determines those rights, and based on what criteria?, what are the implications of publishing, in terms of validating or commodifying cultural knowledge, and what effect do these have on commodity internal and external dynamics and well-being?

Drawing on experience and lessons learned from around the world, it provides case studies, analysis and recommendations in a range of areas like institutional policies, community that together form new framework for creating equity in these partnerships research agreements, the design of more effective commercial partnerships and bio-diversity prospecting contracts, the drafting & implementation of national access and benefit-sharing laws and institution al tools for the distribution of financial benefits.

gives a practical introduction to sustainable agriculture. This book examines in a very good manner, the problem and deficiencies inherent in our present agricultural system to which it terms as industrial agriculture and suggest an alternative sustainable agricultural practice that takes into consideration, the needs of future generation also, for this it has prescribed an eight comprehensive steps.

Sandhya Wakdikar (2004) in his paper “Global Health Care Challenges_Can India take the lead?” attempts to assess the potential of medicinal plants and analyses prospects of modern medicines and health care products derived from plants origin. She concisely touches upon India’s comparative R&D strength, human resources skills, strength of pharmaceutical manufacturing base and traditional market potential. She suggested the measures and incentives to continue utilizing, developing and conserving those resources for sustainable growth of biopharmaceuticals. This paper is also written on the basis of secondary information and focuses on strengths of medicinal plants and its potential in near future. It will be helpful for policy makers and industrialists etc.

Syed Ahmed Hussain et al. (2003) in his study “Contemporary role & future prospects of medicinal plants in the health care system & pharmaceutical industries of Pakistan” has focused on the role and future prospects of medicinal plants in the herbal medicinal industries. In this study he discussed that historical Middle–Eastern traditional medicine had functioned by the combination of hakims and herbal drug dealers. This is a comparative study and is useful for the practitioners and the dealers of herbal medicines.

The report “The WHO strategies for traditional medicine” (2001) has undertaken the task to understand the traditional medicines definition, situation with regard to the use of traditional medicine, the role of traditional medicine in the health care, areas of uses and the problems of traditional medicines. The difficulties, challenges, policies & regulations are crucial to defining the role of TM / CM in national health care system. In this study main focus has been on
the policy making, herbal medicine safety, efficacy and quality of these medicines to promote it.

Kotwal/ Banarjee's Biodiversity conservation in managed and forests and protected areas (1998).

This book is an outcome of selected papers contributed by many authors, organized in a national workshop by Indian Institute of Forest Management titled, “Biodiversity conservation in managed and Forests and protected areas” from Nov 29 to Dec 01, 1995 which discussed about many issues related to the subject.

Dr. Mohd. Iqtedar Hussain Farooqui (1989) the author of “Plants of the Quran” has discussed the plants and its products mentioned in the holy Quran. Those have been described with respect to their botanical identification, chemical composition, medicinal properties and uses. It has facilitated understanding fully several events described in the Quranic verses. In this study, the descriptions of sidratul muntaha, kafur of paradise, Zaqqum of hell, Mannasalva for Bani Israil are very revealing and throw new light not only on the plants but also on the events associated with them. It has unique combination of plants and Islamic references and it is useful to Islamic thinkers and related practitioners.

James A. Murari (1984) in his book “The Plants & Drugs of Sind” has discussed the details of plants and drugs in particular and the flora in general. There is a descriptive index of the flora, the drugs & Asian economic products used by practitioners and others in the province and neighboring countries. It is also useful for the modern medicines practitioners and pharmaceutical industries. This book is an asset for the practitioners, especially those involved in the Ayurvedic medicinal system.

Rustam Jee Naserwan Jee Khory (1981), in his book “Materia Medica of India & their therapeutics” attempts to discuss the organic drugs which are from the vegetable kingdom (origin). This book indicates plants historical nature. The
drugs belonging to this kingdom are treated in this work according to the system of natural order and practices of various systems made.

The work of A. C. Dey (1980) entitled "Indian Medicinal Plants used on Ayurvedic Preparations" has covered various literature of ancient & modern era. This study has made it possible to collect nearly 500 yoga's preparations, embodying 200 plant species. All the descriptions of medicinal plants have been given by name, botanical description, description of the parts used, quality of good materials and active principle etc. in a plant. Active principle in a plant varies according to variety, physiological forms, quality factors, parts of plant collected along with a method of processing. These entire things are very important for getting a good quality plant drug. This is the best compilation out of such books.

K.M. Nandkarni's (1908), "Indian Plants & Drugs" book attempts to understand 200 drugs, the majority of which are of vegetable origin. In this book author has clarified the sections of herbs and their use in medicine list of Indian plants. The drugs from which mother tinctures and extracts etc. are prepared according to the homeopathic system of medicine are narrated. There are tables of weight and measures which have been given on a new basis by their respective comparative equivalents. These measures and weights are useful to dealers in agriculturist, forest producers, exporters, importers and businesses dealing in raw products, drugs, species etc. This book is of purely medicinal nature.

White Law Ainslie (1826) the author of "Materia Indica" discussed about Indian medicines which are almost exclusively employed by the hindu & other oriental nations, and these are in the form of arts, manufactures and vegetables and which are cultivated as food. This book is materia medica of Medicinal plants.

This book is an assemblage of 20 research articles of eminent scholars in India having rich teaching experiences. These articles focus on law relating to intellectual property rights such as copy right patent, trademarks industrial
designs, geographical indication etc. Some articles in this book have been
discussed in the light of new economic policy and intellectual property/ regime.
Some articles such as product patent regime: challenges and opportunities,
protection of traditional knowledge a case for concern has been specifically
gone through by the researcher.

This book analyses certain recent developments in the field of
intellectual property protection. More specifically two main lines of enquiry are
pursued. Firstly this book examines the rapid by evolving international legal and
institutional framework for intellectual property rights and for sustainable
development. Secondly it examines some of the challenges that have surfaced
in India as the courting has grappled with the need to implement its
international commitments through the adoption of new legislature instruments
and major amendments to existing legislature in particular of the Patents Act
1970.

From the review of literature it has been observed by the researcher that
through there are vast literature available on the traditional agricultural and
herbal medicinal area, still there is a huge shortage of literature in the field of
grass root traditional knowledge. There are yet to be documented. As a matter
of fact, traditional knowledge is available, in two different types. The systematic
documented traditional practices is in a better position but the undocumented,
un organized, passed orally, culturally are being depleted with the passage of
every second along with a death of an old knowledgeable traditional rural
person so it is high time to document, government organizations, NGOs etc. an
effort has been made by the researcher in the study to document some of the
traditional agricultural practices, tools etc. the thesis bears the novelty of
touching upon all the traditional agricultural aspects.
CHAPTER – 3

Status of Traditional Agriculture
CHAPTER - 3

STATUS OF TRADITIONAL KNOWLEDGE IN AGRICULTURE

Traditional agriculture, is a sustainable indigenous farming practice, that results out of the coevolution of local social and environmental systems and that exhibit a high level of ecological rationale expressed through the intensive use of local knowledge and natural resources, including the management of agrobiodiversity in the form of diversified agricultural systems.

In the case of the developing world Africa and Latin America are also rich in traditional knowledge but they are to be found by and large only as oral traditions. Asia in general and India in particular have a distinction that traditional knowledge is found not just as oral tradition but also as classical literature that is written down with its own theoretical framework and with a clear exposition of the basic principles of world views.\(^1\)

The basic spatial pattern of population and land use in tropical Asia, existed for a long time over 5000 years depending on the geography and climate of a location. The roots of India lie in age old traditional agricultural occupation. Agriculture is not only the source of income, but also farming for India is a source of culture as well as identity. About 65-70% of the population is dependent on agriculture for their lively hood. The sector provides employment to 58.4% of the country’s work force and is the single largest private sector.

Agro-ecological characteristics of India

The vast agricultural diversity of India is the result of many climates and varieties of soils. The diverse climatic and ecological zones of India provide a congenial setting for the evolution of a wide range of ecosystems. From the tropical Western Ghats to the temperate Himalayas, and from the fertile coastal regions to the cold deserts of Ladakh, India supports a strikingly

\(^1\) Building of Traditional Agricultural Knowledge and Wisdom for Sustainable Agriculture Today - By V. Balasubramanian http://www.wiki.indianfolklore.org/index.php?title=Lecture_11._Building_of_Traditional_Agricultural_Knowledge_and_Wisdom_for_Sustainable_Agriculture_Today_-_By_A_V.Balasubramanian
rich floral and faunal diversity. Agricultural biodiversity consists not only of crops, such as wheat, rice, rajma and bananas, but also of immense variation within each of these crops.

The following agro-ecological zones are defined on the basis of climate, soils, crops and stock animals (Randhawa 1986).²

**The temperate Himalayan zone**

(a) The Eastern Himalayan region, including upper Assam, Sikkim, Bhutan and Nepal. Heavy rainfall is noticed. Tea growing and cultivation of rice in certain areas are found. Forests cover a considerable size.

(b) The Western Himalayan region, including Kumaon, Garhwal, Himachal Pradesh and Jammu and Kashmir. Comparably dry weather is found. Winter & rainfall in northern parts is seen. Climate is of Mediterranean type. It is a good fruit growing area: apples, pears, almonds, cherries, apricots and peaches are grown. Furthermore potatoes, wheat, maize and rice are sown. Goats and sheep are found considerably.

**The dry northern wheat zone**: Punjab, Haryana, western Uttar Pradesh, western Madhya Pradesh and parts of Rajasthan. Annual rainfall between 200 –760 mm. Alluvial soils are found. Wheat, barley, gram, maize and cotton are grown. Cattle, buffaloes and camels are also reared.

**The eastern rice region**: Assam, West Bengal, Bihar, Orissa, eastern Madhya Pradesh and Utta Pradesh and parts of Andhra Pradesh. Soil is Alluvial. Annual rainfall is over 1,500 mm. Rice, jute, sugar cane and tea are grown. Buffalos and cows are main cattle found.

**The Malabar coconut zone**: Kerala, Karnataka and adjoining areas. Soil is Laterite and black cotton. Annual rainfall is over 2,280 mm. Coffee, rubber, coconut, pepper and cardamom, rice are grown.

**The southern millet zone**: southern Uttar Pradesh, central Madhya Pradesh, western Andhra Pradesh, western Tamil Nadu, eastern Maharashtra and

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parts of Karnataka. Soil is Partly black cotton and partly laterite. Rainfall ranges in between 500-1,000 mm. Sorghum, millet, cotton and groundnut are grown. Sheep is the main livestock.

**Agricultural Production in India:**

Agriculture is the mainstay of the Indian economy. Agriculture and allied sectors contribute nearly 22% of Gross Domestic product (GDP of India). The agricultural output as nearly 60% of area sown is dependent on rainfall. The total area coverage under food grains in 2007-2008 has been reported as 124.10 million hectares. Where, the area under rice is estimated at 437.71 lakh hectares however, the area coverage under wheat is at 181.53 lakhs. The total area coverage under coarse cereals during 2007-08 is estimated at 287.15 lakh. This sector provides for about 10% of the total export earnings and provides raw materials to a large number of industries.  

Having a varied favourable agro-climatic condition India is a major producer of horticultural crops such as fruits, vegetables, root tuber, ornamental aromatic plants medicinal herbs, spices and plantation crops like coconut, arecanut, cashew and cocoa. Its laudable achievements can be termed as more than 30.5% GDP of agriculture has been contributed by Horticulture.

The gross cropped area of Horticulture is 10% and that gives a production of 16.75 million tons. Being a second largest producer of the world, the gross cropped area of Fruits and vegetables, are 4.81 mha and 6.3 mha, followed by a production of 49.36mt, 93.00mt respectively. Our share in world fruits and vegetable production is 10% & 13.28% respectively.

Though flower cultivation has been practiced in India since times immemorial, due to its aesthetic value it has blossomed into a viable business only in recent years. The demand for flower now a days is growing in the form of cut flowers, bouquets and arrangements for gifts, as well as decoration of both home and work place apart from being used for holy purposes.

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3. India 2009
4. India 2009
India has made noticeable advancement in the production of flowers. Floriculture is estimated to cover an area of 1.4 lakh ha. with a production of 6,70,000 mt of loose flowers and 13009.3 million cut flowers.\(^5\)

India stands first in producing, consuming and exporting spices and spice products. The total production of spices was 4.3 million metric tonnes and the area covered was 2.56 million hectares. India is the largest producer and consumer of cashew nuts, and the third largest producer of coconut and leads to 90 coconut producing countries of the world. It occupies a number one position in arecanut production. The gross cropped area of Cashew nuts and vanilla is 0.24 mha and 27,811 hectares respectively. The total outputs of these two products are 0.57mt and 101 metric tonnes respectively.\(^6\)

The technological modernization in Agriculture is highly successful at meeting its primary objective of increasing crop yields and augmenting aggregate food supplies, in order to answer the problem of feeding the increasing world’s population, yet, despite its success at increasing aggregate food supply, as a development approach it has not necessarily translated into benefits for the lower strata of the rural poor in terms of greater food security or greater economic opportunity and well-being.

Studies of impact have shown that the better-off strata of rural society have gained access to better incomes generated by the introduction of technology whereas the poorest strata have tended to lose access to income that was available before its introduction. However, most farmers have not willingly adopted this, rather it has been forced on them by a package of government policies, subsidies and selective price incentives.

**Unfavourable effects of new technology**

Land degradation caused by:

Water logging and scarcity of water: High requirement of water resulted in pumping out of more water from under ground than the natural drainage

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5 India 2009  
6 India 2009
potential of the eco system. This is a form of water abuse rather than water use. As a result land gets waterlogged.

Salinization of the soil: The problem of salinity arises through intensive irrigation in arid regions of scarce rainfall. The earth contains a large amount of unleached salts. Pouring irrigation water into such soils brings those salts to the surface and leaves behind a residue when the water evaporates.

Destruction of soil fertility: As a result of replacing pulses by wheat and rice the nitrogen fixing capacity of crops was lost, so more fertilizers were needed. The high yield crops gobble up nutrients like nitrogen, phosphorous, iron and manganese, making the soil anemic.

Micronutrient deficiency: The nutrient cycle, in which nutrients are produced by the soil through plants, and returned to the soil as organic matter is thus replaced by linear non-renewable flows of phosphorous and potash derived from geological deposits, and nitrogen derived from petroleum' (p.104)\(^7\). This led to a western NPK-mentality, with high gifts of these three minerals. As a result deficiency of micronutrients as zinc, iron, copper, manganese and magnesium arose.

Soil toxicity, by high use of pesticides and chemical fertilizers: Soil toxicity arose through irrigation and high chemical fertilizer input, for example fluorine -, boron -, selenium and aluminium toxicity. It is 'posing a threat to crop production as well as animal health'. (p.116)\(^8\)

Biomass reduction used for fodder and organic manure: 'The indigenous cropping systems are based on internal organic inputs.' (p.72)\(^9\). So they used straw from the harvested crops and other, though westerns considered wastes, to feed the farm animals, and/or to increase soil fertility. Also the animals provided organic manure. The new varieties were however selected by producing little straw, because otherwise as a result of high

\(^7\) Vandana Shiva ‘The violence of the Green Revolution– Third world agriculture, ecology and politics’, written in 1991
fertilizer input they would lodge and the crop would be lost. So the straw production was much lower, with negative effects on soil fertility through lower input of biomass. This process also occurred because millet and course-grain were replaced by wheat and grain.

Loss of Bio-Diversity: mixtures and rotation of diverse crops like wheat, maize, millets, pulses and oil seeds were replaced by monocultures of wheat and rice as a result and the introduced wheat and rice varieties were reproduced over large-scale. Because of the large crop production of a very narrow genetic base, compared to the high genetic variability in the populations of traditional wheat or rice plants, genetic erosion took place.

Drop of water table: Higher need for water was caused by ‘the shift from water prudent crops such as millets and oilseeds to monocultures and multicropping and by ‘the replacement of old varieties of wheat with new varieties of wheat and rice’ So intensive irrigation was required mainly by building large dams and applying surface irrigation. The water table is dropping dramatically, as much as 3 feet every year.

Vicious cycle of Debt: As the techniques are highly capital intensive, farmers have to borrow cash, but they are already so deep in debt that conventional banks often turn them away which leads them to go to "unofficial" lenders — local businessmen who charge at least double the banks' interest rate.

Rising Unemployment: With the modern agricultural practice the demand for capital intensive tools were required which replaced labour intensive tools, thus level of unemployment was raised.

“After the green revolution, it was realized that high input Agriculture, could benefit only about 30% resource-rich farmers, leaving out the remaining 70% resource-poor farmers. If these poor farmers are to raise their living standards, they will need more efficient techniques that will only require locally
available, low-cost inputs. I believe our ancient knowledge can help these poor farmers, especially those who depend on rain fall alone.\(^{10}\)

Vandana Shiva in her book defines the modern development as a strategy with the help of capital and technology, to combat scarcity and dominate nature to generate material abundance. In this vision ‘technology is a superior substitute for nature, and hence a means of producing growth, unconstrained by nature’s limits’ (p.15).\(^{11}\)

‘This vision was based not on cooperation with nature, but on its conquest. It was based not on the intensification of nature’s processes, but on the intensification of credit and purchased inputs like chemical fertilizers and pesticides. It was based not on self-reliance, but dependency. It was based not on diversity but uniformity.’ (p.29)

‘The seed / chemical package sets up its own interactions with soils and water systems, which are, however, not taken into account in the assessment of yields.’ (p.69) As a result western expert ‘mistakenly believed that their technologies could substitute land, and chemicals could replace the organic fertility of the soils’ (p.104).

American advisors and experts came with the aim to shift India’s agricultural research and policy ‘from an indigenous and ecological model to an exogenous, and high input one, finding, of course partners in sections of the elite, because the new model suited their political priorities and interests’ (p.29).\(^{12}\)

One of the most dramatic macro level consequences of modernization in the agriculture has been the loss of wage labour opportunities for poor rural women as due to the introduction of technology machine replaced them by performing the tasks they traditionally perform. For example The introduction of rice mills throughout Asia has replaced women labourers who were

\(^{10}\) "Utilizing Traditional Knowledge in Agriculture" Y.L.Nene, Asian Agri-History Foundation, 47, Icrisat Colony, 1, Brigadier Sayeed Road, Secunderabad-500009, Andhra Pradesh.


formerly involved with the winnowing, threshing and hand pounding of rice redundant. Manual dehusking of rice is the most important source of female wage employment in rural areas, modern hullers made them out of work.

Studies on the impact of the Green Revolution have shown that technological change can generate major social benefits but at the same time generate significant costs. High yields are not intrinsic to the seeds, but are a function of the availability of required inputs, which in return have ecologically destructive impacts.

In a praise to the indigenous traditional agriculture, a report was presented long years back in 1893, by Dr John Augustus Voelcker, the Consulting Chemist to the Royal Agricultural Society of England, sent by the British government to study Indian agriculture in 1889, which has been considered as a book of the utmost value to all students of agriculture in India, by the Report of the Royal Commission on Agriculture (1928).

Dr Voelcker has reported as, "I explain that I do not share (...) Indian Agriculture being, as a whole, primitive and backward, but I believe that in many parts there is little or nothing than can be improved, whilst where agriculture is manifestly inferior, it is more generally the result of the absence of facilities which exist in the better districts than form inherent bad systems of cultivation (. . .) I make bold to say that it is a much easier task to propose improvements in English agriculture than to make really valuable suggestions for that of India (. . .) the conviction has forced itself upon me that, taking everything together and more especially considering the conditions under which Indian crops are grown, they are wonderfully good. At his best the Indian raiyat or cultivator is quite as good as, and in some respects, the superior of, the average British farmer, while at his worst it can only be said that this state is brought about largely by an absence of facilities for improvement which is probably unequalled in any other country . . . I have remarked in earlier chapters about the general excellence of the cultivation; the crops grown here are numerous and varied, much more indeed than in England. That the cultivation should often be magnificent is not to be
wondered at when it is remembered that many of the crops have been known to the raiyats for several centuries, rice is a prominent instance in point."

Dr. Voelcker in his report expresses, "To take the ordinary acts of husbandry, nowhere would one find better instances of keeping land scrupulously clean from weeds, of ingenuity in device of water-raising appliances, of knowledge of soils and their capabilities as well as of the exact time to sow and to reap, as one would in Indian agriculture, and this not at its best along, but at its ordinary level. It is wonderful, too, how much is known of rotation, the system of mixed crops and of fallowing. Certain it is that I, at least, have never seen a more perfect picture of careful cultivation, combined with hard labour, perseverance and fertility of resource, than I have seen at many of the halting places in my tour. Such are the gardens of Mahi, the fields of Nadiad and many others."\(^{13}\)

Nature has always been very vibrant, giving and resilient. Religion protects and nurtures nature. If we take a look at Hinduism, we worship the sun, wind, land, trees, plants, and water which is the very base of human survival. Likewise, respect and conservation of wildlife—garuda, lion, peacock, and snake—are part of our cultural ethos from time immemorial. The scripture Vishnu Samhitâ in Sanskrit language contains some direct instructions dealing with biodiversity conservation. Bio-Diversity was a central principle of the indigenous breeding strategies. 'Diversity contributed to ecological stability, and hence to ecosystem productivity. The less the diversity and the more the uniformity in an ecosystem, the higher is its vulnerability to instability, breakdown and collapse.' (p.78)

'The crop and varietal diversity of indigenous agriculture was replaced by a narrow genetic base and monocultures. The focus was on internationally grains, and a strategy of eliminating mixed and rotational cropping, and divers varieties by varietal simplicity.' (p.45) As a result of the formal mixed cropping and using many varieties the growth of pests was controlled. 'Indigenous varieties, or land races are resistant to locally occurring pests and diseases. Even if certain diseases occur, some of the strains maybe susceptible, while

\(^{13}\) Report of the Royal Commission on Agriculture (1928)
others will have the resistance to survive. (...) Cropping systems based on diversity thus have a built-in protection' (p.93). The new technology however resulted in high replacement rates of the new varieties in wheat, because after one or two years the varieties gets overtaken by pests. 'The vulnerability of rice to new pests and diseases due to monocropping and a narrow genetic base is also very high. (...) Most of the high yielding varieties released so far are susceptible to major pests with a crop loss of 30 to 100 %...' (p.89)

**Cropping Systems in Traditional Agriculture**

The basic resources of agriculture are sunlight, soil, water, plants, animals and human beings. In tropics due to availability of sunlight throughout the year more than two crops can be easily raised provided that other resources are available. Growing of more than two corps in the same field in sequence in a year is called multiple cropping. In many instances, the seeds/plants of second crop are sown/planted before the harvest of the first crop. Similarly the seeds/plants of third crop are sown/planted before the harvest of second crop. Growing of more than two such crops in the same field in a year is called relay cropping. Raising two or more crops in the same field in the same season particularly under rainfed agriculture is a common practice. If the seeds are mixed sown it is called mixed cropping. If the seeds are raised in alternate or paired rows or different proportions of rows it is called inter cropping. A combination of these different cropping method is called crop-cafeteria, where in every available space is used for growing corps in the same field over time. In the case of plantation crops, three or more crops are raised simultaneously in a mixed pattern in the different heights and canopy to take advantage of the sunlight. Growing together of coconut, arecanut, pepper, banana, coco, pine-apple, fodder grains etc. are a common practice. This is called multistoried cropping or multi-tier cropping.

In the western India cotton is grown along with rahar or castor as cotton gets benefit by little shade, such as is afforded by rahar or castor.

Cost Effective: Less investments are required to prepare bio-pesticides. For eg. To control bacterial leaf spot, leaf folder and leaf blight in

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14 Crop Production and Management, Y.B. Morachan, chapter-13
paddy the cost of chemical treatment for one acre using monocrotophos, endosulphar, ekalux, malathion and bavistin is Rs 1,575 where as the cost of control using bio-pesticides is Rs950.\(^5\)

**Traditional Agricultural Practices for Plant Disease Management**

The practices for disease management used by traditional farmers are mostly cultural practices. Most of these practices are highly sustainable. It improves soil quality, manages weeds, lowers soil temperatures, conserves moisture etc. There are underlying some practices to manage pest

1. **Fallow:** Generally in order to control soil borne diseases in plants, fallowing is followed. Plant diseases are managed by both dry as well as flood fallowing. It has been practised for thousands of years. Fallowing has been practiced for thousands of years. A sabbatical year was mandated in ancient Jewish religious law; in that for one year farmers were not allowed to plant crops. Exodus 23:10-11 reads: "For six years you shall sow your land and gather in its yield; but the seventh year you shall let it rest and lie fallow." The ancient Romans, Chinese, Incas, Mayas, Arabs, and many other peoples historically used fallowing to a greater or lesser degree as one of their major agricultural practices.\(^6\) This process is effective as well for desease born in plant itself. As in the absence of host plants these pests can be minimized.

2. **Burning:** Fire and heat are often used as plant disease management practices. The high temperature produced by burning eliminates of many pathogen.

3. **Mulching:** Any covering placed over the soil surface in order to modify soil physical properties, reduce soil erosion and degradation and create favorable environments for root development and nutrient uptake is called as mulching. For this purpose green manures, natural vegetation are used as mulches.

\(^{15}\) "Traditional Agricultural Practice- Testing and Validation". By R.Sridevi and Subhashini Sridhar, Centre For Indian Knowledge systems,

\(^{16}\) [http://www.tropag-fieldtrip.cornell.edu/tradag/pfallow.html](http://www.tropag-fieldtrip.cornell.edu/tradag/pfallow.html) retrieved on 12.10.11
4. Crop Rotation: Crop rotations are found in traditional plant disease management practices. Rotations are probably the best documented traditional disease management practice. It is often used as plant disease management that the pests of a crop, which would have multiplied if the same crop had been grown on the same field, die out for the want of the host plant in the immediate neighborhood.

5. Traditional farmers in many areas of Costa Rica grow beans (*Phaseolus vulgaris*) using a slash/mulch system. The procedure consists of broadcasting bean seeds into carefully selected weeds, then cutting and chopping the weeds with a machete so the broadcasted bean seeds are covered with a mulch of weeds. A semi-determinate type of bean, between a bush and a climbing bean, is planted. The beans grow through the mulch and eventually cover it. This combination of mulch and bean plants effectively prevents weed growth and appears to conserve soil moisture. In addition, the mulch prevents soil splashing, which was found to be the most important source of inoculum of *Thanatephorus cucumeris* causing a severe bean disease called web blight. The disease is effectively managed by traditional farmers who use the traditional practice even in areas where climate is optimal for web blight development. Web blight of beans is caused by the fungus *Thanatephorus cucumeris* (anamorph - - *Rhizoctonia solani*). In the humid lowlands of the tropics, web blight is possibly the single most destructive disease of beans.\footnote{http://www.tropag-fieldtrip.cornell.edu/tradag/ptapado.html retrieved on 12.10.11}
Table A

Indigenous practices of soil and water conservation techniques found in India.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Indigenous practices</th>
<th>Crops/plants grown</th>
<th>purpose/benefit</th>
<th>state where followed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vegetative fencing/barrier</td>
<td>kiluvi (Blasmodendron verii) and Agave</td>
<td>Reduce water run off and velocity and to increase in filtration opportunity time</td>
<td>Karnataka</td>
</tr>
<tr>
<td>2</td>
<td>Mixed intercropping as vegetative barrier</td>
<td>Groundnut, pigeonpea and pluses</td>
<td>Run off management</td>
<td>Andhra Pradesh</td>
</tr>
<tr>
<td>3</td>
<td>Relay cropping</td>
<td>onion-rabi sorghum or chick pea</td>
<td>reduction in run off and better utilization of soil moisture.</td>
<td>Karnataka</td>
</tr>
<tr>
<td>4</td>
<td>Spur structure</td>
<td></td>
<td>protection of crop land from erosion by diverting the run off.</td>
<td>Jharkhand</td>
</tr>
<tr>
<td>5</td>
<td>Mixed cropping (Mishrabele paddati)</td>
<td>Onion+chilli+cotton</td>
<td>reduction in run off and better utilization of soil moisture.</td>
<td>Karnataka</td>
</tr>
<tr>
<td>6</td>
<td>Pre-emergence soil stirring</td>
<td></td>
<td>Removal of weeds, loosen the soil for conserving moistures.</td>
<td>Uttar Pradesh</td>
</tr>
<tr>
<td>7</td>
<td>Compartmenetal Bunding; Loosed Boulder Checks; Peripheral Stone Bunding; Strenghtning Bunds By Growing Local Grasses And Field bunding</td>
<td></td>
<td>Soil conservation and runoff management.</td>
<td>Andhra Pradesh, Orissa, Maharashtra</td>
</tr>
<tr>
<td>8</td>
<td>Bunds protected with vegetal cover</td>
<td></td>
<td>Protection and strengthening of earthen bunds and to reduce soil erosion and run off losses</td>
<td>Gujarat</td>
</tr>
<tr>
<td>9</td>
<td>Bandh system of cultivation</td>
<td></td>
<td>Harvest run off assured rabi crops in rain fed areas;</td>
<td>Madhya Pradesh</td>
</tr>
<tr>
<td>10</td>
<td>Live bunding</td>
<td>by raising cactus</td>
<td>reduce run off and check soil erosion.</td>
<td>Uttar Pradesh</td>
</tr>
<tr>
<td>11</td>
<td>Cross ploughing</td>
<td></td>
<td>check run off and soil loss</td>
<td>Uttar Pradesh</td>
</tr>
<tr>
<td>12</td>
<td>Mixed cropping</td>
<td></td>
<td>Run off management and better utilization of soil moisture</td>
<td>Uttar Pradesh</td>
</tr>
<tr>
<td></td>
<td>Practice Description</td>
<td>Benefit</td>
<td>Location(s)</td>
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<td>--------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>13</td>
<td>Green capping</td>
<td>Reduce soil erosion and velocity of run off and to increase time of concentration.</td>
<td>Madhya Pradesh</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Stabilization of field boundary bund; plantation of grasses on field bound; stabilization of field boundary bund with <em>vitex negundo</em> (Nirgundi) with <em>Agave</em> spp.</td>
<td>Reduce run off and soil loss.</td>
<td>Maharashtra</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Peripheral bunding; use of stone and bags; vegetative barrier across gullies</td>
<td>Gully control and run off management.</td>
<td>Andhra Pradesh, Karnataka</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Nala plugging</td>
<td>Control of flow of water in nalas (gullies area, carrying water) to minimize further development of gully and lateral recharge of water.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Conservation furrows with traditional plough (<em>Oodu ulavu</em>), Interropping; wider row spacing, deep interculturing; Tank silt application Groundnut+pigeon pea</td>
<td>in situ moisture conservation.</td>
<td>Karnataka, Orissa, Andhra Pradesh</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Wide row spacing</td>
<td>sustain crop production during deficit rainfall by moisture conservation, weed control and increase aeration.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Repeated tillage during monsoon season</td>
<td>soil moisture conservation for sowing of winter crops.</td>
<td>Haryana</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Crop residue in the field</td>
<td>prevent sheet erosion and increase in situ moisture conservation.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Application of groundnut shells by mulching and incorporation; ploughing across the slopes; planting of potato across the slope; strengthening of bund; Leveling the plots by local leveler; Furrow opening in standing crops with local implement hoe (Dawara); Haveli/Bharel system by impounding rain water in Kharif and taking rabi crops on conserved moisture; Mulching during rabi in sugar cane fields; off season tillage; Mulching with sal leaf in turmeric;</td>
<td>Moisture conservation.</td>
<td>Andhra Pradesh, Karnataka, Orissa, Maharashtra, Gujarat, Madhya Pradesh, Uttar Pradesh, Haryana</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Benefits</td>
<td>State</td>
<td></td>
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<td>------------------------------------------------------------------------------</td>
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<tr>
<td>22</td>
<td>Formation of broad bed and furrow with indigenous plough (kodai Ulavu)</td>
<td>Harvest rainwater and dispose of excess water.</td>
<td>Karnataka</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Ploughing/deep ploughing</td>
<td>Harvest early showers.</td>
<td>Maharashtra</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Field boundry bund</td>
<td>Harvest rainwater and conserve soil.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Percolation pond/tank (khet talawadi)</td>
<td>Harvest run-off water of individual field</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Small check dams</td>
<td>Harvest run off water for drinking and irrigation purpose.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Small Masonry irrigation tank</td>
<td>Store run off water for irrigation.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Recharging of wells through farm pond</td>
<td>Harvest run off water and to recharge ground water.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Nala check with soil filled in cement bags</td>
<td>Water harvesting for irrigation</td>
<td>Karnataka</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Opening up set furrow, sowing across the slope</td>
<td>Harvesting rainwater in soil profile.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Nadi farming system</td>
<td>Collect run off during Kharif season for pre-sowing irrigation (Palewa) of rabi crops.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Compartmental bunding</td>
<td>Retention of rain water for run off modulation</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Inter culturing (Hoeing) and earthenening in standing crop</td>
<td>Harvesting rain water and to provide soil mulch and for easy penetration of page of groundnut in the soil</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Inter cropping coriander with bengal gram, cotton with black gram</td>
<td>Protective irrigation</td>
<td>Karnataka</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Earthen check dams</td>
<td>for irrigation.</td>
<td>Madhya Pradesh</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Talab /Pond making</td>
<td>Runoff conservation for irrigation, domestic and allid use.</td>
<td>Madhya Pradesh</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sand mulching, cultivation;</td>
<td>Soil and moisture</td>
<td>Andhra</td>
<td></td>
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</tr>
<tr>
<td>29</td>
<td>Stone bunding; Murram Bunding and conservation of bench terrace; Deep ploughing and gravel sand mulching; Retention of pebbles on the soil surface and retention of sunflower stalks; plantings of sweet potato along the ridges; Bunding/Bandhan making/pal making and strip cropping; Stone cum earthen bunding; stone cum vegetative bunding and stone bunding; Grass plantation of field boundaries; strengthening bunds by growing local grasses; Cover cropping surplus water weir at the outlet of the field; Cris cross ploughing; Earthen bunds (Kuchha Pala)</td>
<td>conservation.</td>
<td>Pradesh, Karnataka, Orissa, Madhya Pradesh, Jharkhand, Uttar Pradesh, Gujarat</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Stabilized grassed waterways</td>
<td>soil, plant nutrients, water conservation, and land degradation control.</td>
<td>Jharkhand</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Line sowing behind the plough</td>
<td>soil and water conservation and better utilization of soil moisture and reduction in cost of inter cultural operation.</td>
<td>Orissa</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Vegetative barrier supported with small section bund</td>
<td>Soil moisture conservation and to avoid encroachment by wild animals.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Small cross sections earthen bund across slope</td>
<td>Reducing slope length and to increase of infiltration opportunity time for in-situ moisture conservation and minimizing erosion.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Summer ploughing</td>
<td>Conservation of early showers from tillage to harvest, facilitating timely seeding and weed and insect control.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Contour cultivation (operation across slope)</td>
<td>Eliminating slope length, creating barriers for water flow, enhancing soil moisture status.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Ridge and furrow planting</td>
<td>conservation of rain</td>
<td>Uttar Pradesh</td>
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<tr>
<td>45</td>
<td>Negative barriers (Munj and Khus) on field boundaries</td>
<td>Soil moisture conservation and save the crop from wild animals. Uttar Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Conservation furrow (Gurr)</td>
<td>Reduction of run off and soil moisture conservation. Uttar Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Mixed cropping</td>
<td>Pearl millet + green gm (4 kg/ha +5 kg/ha), pigeon pea + black gm (3 to 9 kg/ha +5 -6 kg/ha); pigeon pea + cluster bean (4 kg/ha + 6kg/ha) and chick pea + mustard (60-65 kg/ha + 3 to 3.5 kg/ha) soil moisture conservation, increase of productivity of soil and ensure the production of at least one crop. Uttar Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Loose stone surplus bund</td>
<td>Prevent loss of fertile soil and riling of cultivated land Andhra Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Brush wood structure across the bund</td>
<td>check soil loss. Orissa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Application of tanks silt</td>
<td>Improvement of nutrient, status of soil, improvement in soil moisture holding capacity of amended soil and enhancement in water storage capacity of tank. Madhya Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Green manuring with sun hemp; Sesbania and cow pea</td>
<td>Improve organic matter for soil fertility improvement, weed control, soil and water conservation Madhya Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Growing of vegetative barrier on field boundaries</td>
<td>Saccharum munja Check soil loss by wind erosion. Haryana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Using Role to predict the rain fall amount for ploughing the field,</td>
<td>Rain water management Andhra Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Moving the ant with their eggs; Bathing of house sparrow in the dust and putting down the ear by ass during foraging</td>
<td>Forecasting rain Uttar Pradesh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Run off collection pits for augmentation of ground</td>
<td>Well recharging Gujarat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Activity Description</td>
<td>Benefit</td>
<td>Location</td>
<td></td>
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<td>--------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>56</td>
<td>Precocation well/wide diameter dug out well</td>
<td>Intercepting, collection of percolating water.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Collection of sub-surface run off water and recycling in Diara land</td>
<td>Mitigate drought.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Rain Water harvesting from roof top and road surfaces</td>
<td>Recharge the well.</td>
<td>Haryana</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Farm pond to store water in the pond</td>
<td>Ground water recharge and/or supplemental irrigation.</td>
<td>Andhra Pradesh</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Dug Wells</td>
<td>Domestic and agricultural</td>
<td>Madhya Pradesh</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Green manuring</td>
<td>Increase soil fertility</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Construction of ditches and percolation pits</td>
<td>Ground water recharging, to increase the ground water level.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Bund farming of pulse crops in Kharif under rain fed situation</td>
<td>Pigeon Pea, (Black gram)</td>
<td>Orissa</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Crop stubbles/residue management</td>
<td>Improve organic matter in soil and to improve water holding capacity of soil.</td>
<td>Madhya Pradesh</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Inter row cropping</td>
<td>Increase the moisture use efficiency, risk coverage due to failure of any of the comparative crop and to utilize the moisture availability period specially on medium deep soil.</td>
<td>Madhya Pradesh</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Mixed cropping</td>
<td>Better utilization of soil moisture and reducing the risk of crop failure</td>
<td>Haryana</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Deep ploughing</td>
<td>Break down the hard pan and improve water infiltration.</td>
<td>Gujarat</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Rain water harvesting in kund/tank</td>
<td>Drinking and establishment of trees.</td>
<td>Haryana</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>Farm Ponds</td>
<td>Water harvesting and recycling and for fish production</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Planting trees</td>
<td>Reduce salinity of soil.</td>
<td>Uttar Pradesh</td>
<td></td>
</tr>
</tbody>
</table>
During the past decade a rapidly growing set of evidence indicates a strong relationship between indigenous knowledge and sustainable development. "Serious investigation of indigenous ethno biological/ethno ecological knowledge is rare, but recent studies...show that indigenous knowledge of ecological zones, natural resources, agriculture, aquaculture, forest and game management, to be far more sophisticated than previously assumed. Furthermore, this knowledge offers new models for development that are both ecologically and socially sound" (Posey 1985:139-140). In traditional agriculture, human needs are allowed to be met, but human greed is condemned. Agriculture is the area where humans and the divine co-operate with each other to sustain the Creation. A hymn in the Rig-Veda says: “don’t play the game of dice; get involved in agriculture. You will acquire plenty and prosperity. This will bring you fame and recognition. Thereby you will lead a happy life.” The Bhagavad Gita, another honoured text based on the Vedas says: “If you respect and co-operate with the Gods, they will also respect and co-operate with you. By this mutual respect and co-operation you derive prosperity – both material and spiritual.”

One of the salient features of traditional farming systems throughout the developing world is their high degree of biodiversity

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Indigenous practices and components used</th>
<th>Used against</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mix dried neem (Azadirachta indica) leaves (2-5%) with rice, wheat and other grains</td>
<td>Storage pest</td>
<td>Cereals and pulses</td>
</tr>
<tr>
<td>2</td>
<td>Dry leaf powder of Senwar (Begunia), wild sage (Lippia geminata Kunth), Bael (Aegle marmelos), Wild), basil (Ocimum americanum) @ 1 : 100 part</td>
<td>Storage pest</td>
<td>Paddy</td>
</tr>
</tbody>
</table>

Table B

Indigenous practices of using herbs in order to control pest and diseases.

18 Posey, Darrell Addison 1985a Management of Tropical Forest Ecosystems: The Case of the Kayapo Indians of the Brazilian Amazon, Agroforestry Systems 3 (2): 139-158.
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Neem kernel 5 kg in 100-1 water, keep it for 8 hrs. Add 100 ml teepol or 100 gm soap and spray @ 500-1 water /ha</td>
<td>Green plant hopper</td>
<td>Rice</td>
</tr>
<tr>
<td>4</td>
<td>Garlic 1 Kg + Dried Tobacco Leaf 200 kg + Washing soap 200 gm in 5 liter water @ 150 liter water /Acre</td>
<td>Gandhi Bug.</td>
<td>Rice</td>
</tr>
<tr>
<td>5</td>
<td>Dipping of gunny bag in the oil of white batch (Acorus calcamus) 0.1% with water for 5 minute then dry the bag and use</td>
<td>Storage pest</td>
<td>Vigna radiata</td>
</tr>
<tr>
<td>6</td>
<td>Spray of 3% neem oil</td>
<td>Yellow mosaic disease</td>
<td>Urd (Gigan mungo)</td>
</tr>
<tr>
<td>7</td>
<td>Application of neem cake</td>
<td>Ste borers and white ants</td>
<td>Rice and sugar cane fields</td>
</tr>
<tr>
<td>8</td>
<td>Oil application of Madar (Calotropis procera) leaf powder</td>
<td>Plant hoppers and whorl maggots</td>
<td>Rice and maize</td>
</tr>
<tr>
<td>9</td>
<td>Soil application of Madar (Calotropis procera) leaf powder</td>
<td>Nematodes</td>
<td>Pigeon pea</td>
</tr>
<tr>
<td>10</td>
<td>Application of Argemone sp, Acacia sp &amp; Calotropis sp leaf powder</td>
<td>Root knot nematode</td>
<td>Pigeon pea, chick pea and vegetables</td>
</tr>
<tr>
<td>11</td>
<td>Kernel extract of Karanj <em>Pongamia glabra</em>, Mahua (Madhuca longifolia), Bada Kulanjan (alpinia indica), Castor (Ricinus communis) and white kaner Nerium indicum) root and tract @ 1.5%</td>
<td>Insect pest of citrus group</td>
<td>Citrus</td>
</tr>
<tr>
<td>12</td>
<td>Neem seed kernel powder 1 kg in 5-1 water</td>
<td>Citrus leaf miner</td>
<td>Citrus</td>
</tr>
<tr>
<td>13</td>
<td>Kernel of yellow Kaner (Nerium indicum) 15-30 gm + soap 15-30 gm + water 101</td>
<td>White fly, thrips and caterpillars.</td>
<td>Vegetables</td>
</tr>
<tr>
<td>14</td>
<td>Neem leaf 1 kg in 10-liter water and keeping 4 days in shed</td>
<td>Pest in kitchen garden</td>
<td>Vegetables</td>
</tr>
<tr>
<td>15</td>
<td>Tobacco leaf of Calotropis leaf 1.5 kg + water 3-1, followed by boiling and cooling. Mix in 15-1 water and use</td>
<td>Different pests</td>
<td>Vegetables and crops</td>
</tr>
<tr>
<td>16</td>
<td>Placing of Naphthalene bolls monthly basis in upper 3 leaf sheath of coconut</td>
<td>Black headed caterpillar.</td>
<td>Coconut</td>
</tr>
<tr>
<td>17</td>
<td>Leaf extract of bael (Aegle)</td>
<td>Blight disease</td>
<td>Tomato and onion.</td>
</tr>
</tbody>
</table>
Leaf paste of *Toona hexandra* (Wallich ex Roxb) is used storing the grains for long duration

### Table C

**Materials recommended by Surapala to control tree disorders, and their currently known properties**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant species</strong></td>
<td></td>
</tr>
<tr>
<td><em>Asorus calamus</em> L.</td>
<td>Antibacterial</td>
</tr>
<tr>
<td><em>Aegk marmelos</em> (L.) Corr. (panchamula)</td>
<td>Antifungal; antibacterial; nematicidal; anthelmintic</td>
</tr>
<tr>
<td><em>Eras stca alba</em> (L.) Rabenh./Sinapts alba L. (white mustard)</td>
<td>Insect antixenosis; antifungal; acaricidal; nematicidal; glucosinolate sinalbin &quot;anti-insect&quot; and &quot;anti-nematode&quot;; allyl isothiocyanate antifungal</td>
</tr>
<tr>
<td><em>Ckwdmdrum phlomidis</em>—L. f. (panchamula)</td>
<td>Molluscicidal; antifungal; antiviral; antifeedant; leaf (neoclerodane diterpenes) antibacterial, antifungal and molluscicidal. Induces systemically acquired resistance (SAR) against viral diseases acquired resistance (SAR) against viral diseases</td>
</tr>
<tr>
<td><strong>Plant species</strong></td>
<td></td>
</tr>
<tr>
<td><em>Curcuma longa</em> Koenig non L./C. <em>domestica</em> Val. (turmeric)</td>
<td>Antioxidative curcuminoids; antimicrobial</td>
</tr>
<tr>
<td><em>E-embelia ribes</em> Burm. F.</td>
<td>Anthelmintic; antibacterial; kisecticidal (embelinbenzoquinone)</td>
</tr>
<tr>
<td><em>Emblica officinalis</em> Gaertn. (triphala) *</td>
<td>Anthelmintic with other two species of triphala</td>
</tr>
<tr>
<td><em>fenula asafoetida</em> L.</td>
<td>Antimicrobial (contains resin 40—60%; volatile oil -10-17%)</td>
</tr>
<tr>
<td><em>Picas benghaknsis</em> L. (banyan)</td>
<td>Latex with good sealing properties; tannin</td>
</tr>
<tr>
<td><em>Picas glomerate</em> Roxb.</td>
<td>Latex; bark 14% tannin; some <em>Fiats sp.</em> are antibacterial</td>
</tr>
<tr>
<td><em>Gfyiynhi</em>a glabra* L. (liquorice)</td>
<td>Antimicrobial saponins; glycyrrhizin in underground parts</td>
</tr>
<tr>
<td><em>Gmelina arborea</em> L. (panchamula)</td>
<td>Bark and roots contain alkaloids; resinous substances present</td>
</tr>
<tr>
<td><em>Madhuca indica</em> J. F. Gmel. (madhukd)</td>
<td>Oil cake insecticidal and pisckidal; contains saponin (mowrin); flowers antibacterial</td>
</tr>
<tr>
<td><em>Oroxylum indicum</em> (L.)</td>
<td>Antiseptic; bark contains alkaloids, tannins and</td>
</tr>
<tr>
<td>Plant</td>
<td>Properties</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Vent. (panchamula)</strong></td>
<td>glucoside tetuine</td>
</tr>
<tr>
<td><strong>Piper nigrum L.</strong> (black pepper)</td>
<td>Oleoresin antibacterial/antifungal; alkaloid piperin is insecticidal</td>
</tr>
<tr>
<td><strong>Semecarpus anacardium L.f.</strong> (bhallataka; marking nut)</td>
<td>Antiseptic; insecticidal; termite repellent; antifungal; antibacterial; fruits anthelmintic</td>
</tr>
<tr>
<td><strong>Sesamum indicum L.</strong></td>
<td>Insecticidal and repellent; oil synergistic to pyrethrums; antioxidative lignins in seed; 17% protein; 800 mg per 100 g calcium, phosphorus, and potassium; 14% iron (ash) - highest</td>
</tr>
<tr>
<td><strong>^olanum indicum</strong> (sesame)</td>
<td>Fruits/leaves antifungal/antibacterial; glyco-alkaloid solasonine present</td>
</tr>
<tr>
<td><strong>Stereospermum suaveolens</strong></td>
<td>Antifungal; antibacterial; bark also has same properties</td>
</tr>
<tr>
<td><strong>Terminaka bellirica</strong></td>
<td>Anthelmintic properties</td>
</tr>
<tr>
<td><strong>T. cebula Retz.</strong></td>
<td>Antimicrobial properties</td>
</tr>
</tbody>
</table>

**Animal products and other materials**

<table>
<thead>
<tr>
<th>Animal product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal fat</td>
<td>Saponification after release of fatty acids; anti-microbial antimicrobial</td>
</tr>
<tr>
<td>Ash</td>
<td>Particles hygroscopic; absorb moisture from insect eggs and spores; interfere with insect feeding; ash potassium interacts with surface fats potassium interacts with surface fats</td>
</tr>
<tr>
<td>Brick powder</td>
<td>Action similar to that of ash particles except that these particles are inert</td>
</tr>
<tr>
<td>Buffalo horn</td>
<td>Contains keratin, a protein that contains 24% cystine, a sulphur-containing amino acid; used for smoking (fumigation) trees</td>
</tr>
<tr>
<td>Cow dung</td>
<td>With urine it is antiseptic; rich in bacteria that compete with pathogens; good medium for biocontrol agents; beneficial to %obium and A%obacter</td>
</tr>
<tr>
<td>Cow horn</td>
<td>Same as buffalo horn</td>
</tr>
<tr>
<td>Crab shells</td>
<td>Rich source of chitin from which chitosan, a polymer, is made; induces systemic resistance in plants; used in smoking tree wounds</td>
</tr>
<tr>
<td>Fish meal</td>
<td>Rich in protein; releases amino acids including praline</td>
</tr>
<tr>
<td>Flesh</td>
<td>Same as fish meal; serves as an excellent medium for bacteria that may antagonize plant pathogens; attached connective tissue rich in proline</td>
</tr>
<tr>
<td>Ghee</td>
<td>Same as animal fat</td>
</tr>
<tr>
<td>Hemp fibre</td>
<td>Used for making smoke</td>
</tr>
<tr>
<td>Hog fat</td>
<td>Same as animal fat</td>
</tr>
<tr>
<td>Honey</td>
<td>Antimicrobial; protects wounds in plants /animals; proline present; honeybee peptide apidaecin is antibacterial</td>
</tr>
<tr>
<td>Material</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Horse hair</td>
<td>High amounts of keratin; used in fumigation</td>
</tr>
<tr>
<td>Liquid manure (kunapa)</td>
<td>Effects would include: healthy crop/tree; crop tolerance to abiotic stresses such as frost, heat etc. as well as to insect pests and diseases; high yields; high quality produce</td>
</tr>
<tr>
<td>Lotus mud •</td>
<td>Stickiness due to a high viscosity exo-polysaccharide, comparable to xanthan, produced by <em>Asgbacter vinelandii</em> present in rhizosphere of rhizomes</td>
</tr>
<tr>
<td>Marrow</td>
<td>Fats and blood; rich in phosphorus</td>
</tr>
<tr>
<td>Milk</td>
<td>Glutamate, leucine and proline make up 40% of the total amino acids in the milk of all animals; mass rearing of <em>Trichogramma</em>; sticker-spreader; induces systemic resistance in chilli against leaf-curl</td>
</tr>
<tr>
<td>Proline (present in some of the above materials)</td>
<td>Induces systemic resistance in plants; stimulates production of antimicrobial phenolics; high endogenous proline increases contents of cytokins and axons; protects against stresses — salts, drought etc.; proline-rich peptides antimicrobial; an important ingredient of parasitic diets; provides power for insect flight metabolites</td>
</tr>
</tbody>
</table>

**Table D**

**Traditional pest management practices and crop protection method as per the principles of Vrukshayurved**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| Mechanical method             | • Hand Picking the larvae and grubs  
• Warding off birds using effigies or by making noises using drums  
• Removing Eggs from the tips of the leaves by pinching off the terminal portions  
• Controlling pest by dusting ash on the plants  
• etc |
| Agronomical methods           | • Intercropping  
• Trap cropping  
• Border cropping  
• Crop rotation  
• Fumigation  
• Use of light traps  
• Use of bird perches |
| Biological method             | • Use of parasites  
• Use of predators  
• Use of botanical pesticides etc. |
Governments role in promoting Indian Agricultural system

Keeping in view the interest of the farmers and the need of self reliance, Govt has taken certain steps

Food Managements Of India

Keeping in view three basic objectives, such as (1) to prevent fall in price and protect the interest of farmers in the situation of over production (2) to pave the way for comfortable levels of food stock for Total Public Distribution Scheme (3) to meet the prescribed minimum buffer stock norms for food security, the government of India has made certain instruments like Minimum Support Price (MSP), Central Issue Price (CIP), Public Distribution System (PDS),

Macro Management of Agriculture

Agriculture being a state subject, the primary responsibility for increasing agriculture production, enhancing productivity and exploring the vast untapped potential of the sector rest with the state governments. However, in order to supplement the efforts of state governments, a number of centrally sponsored and central sector schemes are being implemented as a catalyst for enhancement of agricultural production and productivity in the country and consequential increase in prosperity of the farming community. An amount of Rs. 7049.36 crore had been released by Department of Agriculture and cooperation by the ends of March, 2008. A centrally sponsored scheme on National Food Security Mission has been launched in the country to enhance the production of rice, wheat and pulses by 10, 8 and 2 million tonnes respectively by the end of the 11th plan.  

Kissan Call Centre

Kissan Call Centres have been functioning since 21 January, 2004 and working in 25 different locations covering almost all the states of the country. At each of the KCC locations the Kissan call centres agents known as L-1 are responding to farmers queries instantly.
CHAPTER - 4

Status of Traditional Herbal Medicine
CHAPTER - 4

STATUS OF TRADITIONAL KNOWLEDGE IN HERBAL MEDICINE

The world is endowed with natural resources. And the continued existence of humanity depends upon these available resources. From time immemorial Human communities is always generating, refining and passing on knowledge from generation to generation. Traditional knowledge has played, and is still playing, a vital role in the daily lives of the vast majority of people.

The term "traditional" used in describing this knowledge does not imply that this knowledge is old or nontechnical in nature, but "tradition based." It is "traditional" because it is created in a manner that reflects the traditions of the communities, therefore not relating to the nature of the knowledge itself, but to the way in which that knowledge is created, preserved and disseminated.1

Traditional knowledge (TK) is used as the basis for decisions pertaining to food security, health, education, natural resources management, and other vital activities. TK is a key element of the social capital of the poor and constitutes their main asset in their efforts to gain control of their own lives. These all are not taught as a formal subject in educational institutes in India.

Medicine is the field where Indigenous Knowledge is taught as a formal subject in educational institutions. India has many Ayurveda, Unani, Siddha & Homoeopathy medical colleges and several university departments. All herbal drug based systems come under the control of Indian System of Medicine and Homoeopathy (ISM&H).

4.1 Contribution of traditional knowledge in Herbal medicine
4.2 Structure of Herbal medicine in India

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THE UNANI SYSTEM OF MEDICINE

Unani system of medicine, one of the ancient medical system of the world, originated in Greece under the patronage of Buqrat Hippocrates and (460BC-377BC), a Greek physician who is also known as the father of medicine was further developed by Arabs and Persians. Scholars and physicians of Unani medicine from Persian and Central Asian cities fled to India when these cities were ravaged by Mongols. The scholars and physicians got state patronage and were enrolled as court physicians. They subjected Indian drugs to clinical trials and as a result added numerous native drugs to their own system, and this way enriched it. This way the medicinal system was soon spread all over the country and continued to hold unchallenged way for a long period even after the downfall of Mughal Empire.

Unani medicine was enriched with traditional knowledge in Egypt, Syria, Iraq, Persia, India, China and other middle East and Far East countries. It was also benefited from the native medical system at the time at various parts of central Asia. That is why the system is known in different parts of world by different names such as Greco Arab Medicine, Ionian Medicine, Arab Medicine, Islamic Medicine, Traditional Medicine, Oriental Medicine, etc.  

During the British rule the Unani medicine suffered and its development was hampered due to lack of Government support. It was mainly the Sharifi Family in Delhi, the Azizi family in Lucknow, and the Nizam of Hyderabad due to whose efforts Unani Medicine survived in the British period. The Hindustani Dawakhana and the Ayurvedic and Unani Tibbiya College in Delhi are the two living examples of the immense contribution of Hakim Ajmal Khan (1868-1927) an outstanding physician and scholar of Unani Medicine, to the development of the two Indian systems of medicine, Unani and Ayurveda.

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2 Hakim Mohammad Khalid Siddiqui, “Tibb-e-Unani Ek Taaruf”, Central council for Research in Unani medicine (CCRUM), New Delhi, Pg. 1-5
4 Mohammed, Shoib Akram “Rahnuma-e-Rex Matab” Rex Remedies Pvt. Ltd., Delhi, Pg. 1-2
As far as Unani medicine is concerned, today India is the world leader. The government of India is providing increasing funds and support to the indigenous medical system.

**Basic Principles**

The unani system of medicine is based on Humoral theory, namely Dam (Blood), Balgham (Phlegm), Safra (Yellow bile) and Souda (Black bile) in the body. All human being has got a different humoural constitution, which represents the healthy state of the humoural balances of the body. According to Unani System of medicine, the human body is composed of seven components. These seven components are known as AL-UMUR-AL-TABIYA. These components are responsible for the maintenance of the health of the human body.

These components are:

1. Al-Arkan or Al-Anasir (Elements)
2. Al-Mizaz (temperament)
3. Al-Akhlat (Humours)
4. Al-Aza (Organs)
5. Al-Anwah (Vital Spirit)
6. Al-Quwa (Powers)
7. Al-Afal (Functions)

**Al-Arkan (Elements):**

According to Unani system of Medicine Arkan or Anasir (Elements) are simple and undividable matter which provide the primary components for the human body and other creations. The various substances in nature depend for their existence on their imtizaj (Chemical Combination). The great unani physician and Scholar Democritus (50 A.D.) said, "All matters were made up of small and undividable units called atoma or atom". The term atom has been derived from the unani word. It is provided that atoms are combined in different ways, the cells to form tissues, the tissues to form organs and organs to form organism. According to Unani system of medicine, it starts from very...
lowest level of matter. The number and properties of Arkan have always been changing from time to time. According to great Unani Physicians, Hippocratus (460-377 B.C.), Aristo (384-322 B.C.), Galen (130-200 B.C.) and Avicenna, that there are four primary Elements. According to this concept all these four Elements contribute to the formation of things in nature. The human body is also made up of these four elements. These elements are (i) Al-nar (Fire), (ii) Al-hawa (air), (iii) Al-ma (Water), (iv) Al-Ardh (Earth).

**AL-MIZAJ (Temperament)**

The meaning of mizaj is intermixture. Mizaj indicates the properties of the Unsur (Element), a molecule, a cell, a tissue, an organ, and of the organism as a whole. Each and every element (atom) molecule (murakkab), khilt (Humour), cell, organ and body as a whole is furnished with a mizaj upon which their properties function and life depends. Mizaj is also defined as new form of a matter, having something different from that present in the elements or components before coming in to Imtezaj (inter mixture or chemical combination, which results from the action and reaction of the different qualities and powers present in the different element or atom (or molecules of different components), when they are combined together, and it results in new form or quality after combination of more than one elements is called Mizaj. According to Unani system of medicine Mizaj is classified in 9 types. Only one is Motadil Mizaj (Normal temperament) and other eight are Gair motadil (abnormal temperament). Mizaj Mutadil is further classified in two types (i) Mutadil Haqiqi (Real normal temperament) (ii) Mutadil Tibbi (Medically normal temperament). The gair Mutadil mizaj is classified into two groups (i) Su-al-Mizaj-Sazij (Simple abnormal temperament) (ii) Su-al-Mizaj-maddi (abnormal temperament due to change in matter).

**Al-Akhat (Humours)**

Akhat are fluid part of human body which are product after metabolism of food. Akhtat’s main function are two serve the nutrition, growth and repair produce energy and preservation of human being and his species. This humoral theory was introduced by great Unani scholar and Phisycian Hippocratus (460 B.C.). The concept of Humours is one of the basic
psychological principles in unani System of medicine. According to Unani Medicine which is based on Humoral theory, are Dam (Blood), Balgham (Phlegm), Safra (Yellow bile) and Soda (black bile) in Human body.

According to Hippocrates the term Akhlat means all the fluids of the body and it is proved by him. He said that human body is composed of three things (i) Solid part of Jamidaj, Which is known as Aza (Organ) (ii) Liquid part or sayal are known as rutubal asliya or real fluids or Akhlat (ii) Gaseous part or hawaiyah, which is known as arwah (vital spirit). The Ratubat asliyah are of 4 types. (i) Dam, (ii) Balgham (iii) Safrah (iv) Soda. Hence the term Akhlat is applicable to all fluid of Human body. The temperament of Dam is Har and Retab (Hot and Moist), of Balgham is Barid-Ratab (Cold and Moist), of Safra is Har-Yabis (Hot and Dry) of soda is Barid-Yabis (Cold and Dry). According to Akhlat theory of Hippocrates, the cause of desease is change of quantity and quality of Akhlat or change of temperament of any Khilt. In Unani system of medicine diagnosis and temperament of any desease is based on Akhlat. Unani medicine plays a vital role when the individual experiences humoral imbalance. The correct diet and digestion can bring back the Humoral balance. Use of Unani medicine, results balance of humours by activating self preservation mechanism of the body. The Unani medicine not only normalise the exceeding imbalance but also improves the natural defence mechanism of the body.

Al-Aza (Organs)

Aza (Organs and tissue) is fourth most important component in Unani System of Medicine. According to some of Unani Physicians Aza are most important than Akhlat because Aza are composed of Akhlat. Aza has been devided in to two groups (i) "Aza" basitah or Mufardah (simple organ or cell and tissue) (ii) Aza Murakkabah (compound organs).

Aza Basitah (Simple Organ) means, the smallest part of organ which exactly resembles the whole. The Unani Physicians call the tissues as Aza Basitah. Aza Basitah are bones, cartilage, ligaments, tendons, membranes, fat, muscles, nerve etc. Aza Murakkaba are composed of many Aza Basitah e.g. hand, foot, stomach, intestine, heart, liver, brain etc.
Al-Arwah (Vital Spirit)

The word Arwah is plural of Ruh, which means gas or air (Pneuma). Ruh is a gaseous substance, obtained from the inspired air, it helps in all the metabolic activities of the body, it burns the Akhlat Latifah to produce all kinds of quwah (powers) and hararat ghariziyah. It is the source of vitality for all the organ of the body. According to the unani physician, the all gaseous part of the human body are called Arwah. This include specially to gaseous in the body, (i) Ruh (Oxygen) (ii) Dukhan (Carbon dioxide). Both these serve important function in the body even dukhan, which is waste product of human body, serve some important function in the body e.g. maintenance of P.H. of blood.

Al-Quwa (Powers)

Quwa provides different functions of Human body. Each and every organ is furnished with a power, quwat (Faculty) through which specific physiological functions are performed by that particular organ. These quwa are performed by that particular organ or tissues on which the specific functions of that organ depend, such as, liver can only perform the functions of Quwat-tabiyyah (Metabolism) it cannot perform of brain or the heart. Hence, every organ especially Aza Raisah (Vital, Organs)) have to perform the functions pertaining to their respective quwa.

There are Three types of quwa.

(i) Al-quwa al-tabiyyah (Natural Powers)
(ii) Al-quwa al-Nafsaniyah (Psychic or mental powers)
(iii) Al-quwa al-haiwaniyah (vital Powers).

Al-Afal (Functions)

It is difficult to separate Afal and Quwa (Powers). If there is function than quwa will be there because without quwa no function will start.

Al-Afal are classified into two groups:-

(i) According to Quwa
(ii) According to the number of quwat (power) participating in a function.
Al-Afal again are classified according to quwa

(i) Afal Tabiyah (natural Functions)
(ii) Afal Nafsaniya (Mental or psychic function)
(iii) Afal hayasaniyah (vital functions)

Al-Afal also classified according to number of quwat participating in a function

(i) Afat Mufradah (Simple Function)
(ii) Afat Murakkabah (Compound Function)

ADDITIONAL FACTORS

There are some additional factors which directly or indirectly affect the health of human body. These factors are known as Asbab Sitta Zaruriya (six essential causes).

In the concept of Unani Medicine; if there are causes for disease to develop than there are causes for preservation of health also.

The six essential causes are

1. Al-Hawa Al-Muhit (Atmospheric Air)
2. Al-Makul wal-mashrub (Foods and Drinks)
3. Al-Harkat Wal-Sukun-Albadniya (Movements and responses of the body)
4. Al-Harkat Wal Sukun-Al-Nafsiyat (mental/Psycological movements and response)
5. Naum-Wal-Yaqzah (Sleep and Wakefulness)
6. Al-Istifrag wal intibas (Evacuation & Retention)

There are some non-essential factors that are not related with every human being and hence, these factors do not necessarily influence each and every human body. For example, Profession, Habits, Sex, Temperament, Social factors etc.

These non essential factors are known as Asbab Ghair Zaruriya. These factors, influence to those individuals who come to introduce with these factors. These factors are as follows:
(i) Geographical condition of the country/city (Albilad)
(ii) Residential conditions (Al-masakin)
(iii) Occupation (Pesha)
(iv) Habits (Al-Adat)
(v) Age (Al-Asan)
(vi) Sex (Al-Ajnas)
(vii) Any Other Factors (Umur-muzadaltabi).

The Ayurveda System of Medicine

Origin

Ayurveda originated in India and is one of the oldest medical systems in the world. The word Ayurveda means science of life. It is the combination of two words — Ayus (Life) & Veda (Knowledge). It is said to have been taught by the creator, Brahma, to Daksha Prajapati, who taught it in turn to the divine twins called the Ashwinikumars. Ashwinikumars were the heavenly healers who taught this science to Indra. The personages mentioned were deities of early Vedic times. When mankind started suffering from various diseases, the wise men like Bharadwaja learnt from Indra the knowledge of medicine.

References of illness, cures and other health-related issues are found in vedas, the oldest recorded compendium of wisdom on the earth (6000 B.C.). The main source of knowledge of Ayurveda today is two sets of texts each consisting of three books viz.

1. Brihattrayi i.e., the three major classics
   - Caraka Samhita (1500-1000 B.C.)
   - Susruta Samhita (1500-1000 B.C.)
   - Vagbhata (600 A.D.)

2. Laghuttrayi i.e., the three minor classics
   - Madhava Nidana (700 A.D.)
   - Sarangdhara Samhita (1300 A.D.)

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Besides these classics, there are many more books, both ancient and contemporary, which carry the information on this Indian medical system.

**Basic Principles**

The objectives of Ayurveda are preservation and promotion of the health of a healthy person and restoration of health in the diseased. Good health is the fundamental pre-requisite to acquire materialistic, social and spiritual upliftment of human being.

The Universe, according to Ayurveda is composed of five basic elements — Pancha Mahabhootas viz. Earth (Prithvi), Water (Jala), Fire (Agni), Air (Vayu), and Space (Akash). As the human body is similarly constituted, there is a fundamental similarity between universe and man. A healthy balance between the microcosm (human being) and the macrocosm (universe) is the basis of health.

Ayurveda is based on the theory of three humours (Tridosha) i.e. Vata, Pitta and Kapha, seven body tissues (Saptadhatu) i.e., fluid components of the body (Rasa), Blood (Rakta), muscle tissue (Mamsa), adipose tissue (Medas), bone tissue (Asthi), bone marrow (Majja) and reproductive elements (Sukra) and three bio-wastes (Trimalas) i.e. Urine (Mootra), Faeces (Pureesha) and Sweat (Sweda). The essence of saptadhatu called Ojas is responsible for immunity and strength.

**Branches of Ayurveda**

Ayurveda is also known as Ashtanga Veda (science with eight branches) because it is classified into eight different branches. Ayurveda provides comprehensive preventive, promotive and curative aspects of health through eight major clinical specialties.

1. Kayachikitsa (Internal Medicine)
2. Bala chikitsa (Paediatrics)
3. Graha chikitsa - Bhoota Vidya (Psychiatry)
4. Urdhvanga chikitsa (Treatment of eyes, ears, nose, throat and head)
5. Shalya chikitsa (Surgery)
6. Damstra chikitsa - Agada tantra (Toxicology)
7. Jara chikitsa-Rasayana (Gerontology)
8. Vrishya chikitsa - vajikarana (Aphrodisiacs)

These major eight specialties have been further developed later into many sub-specialties of Ayurveda.

Therapies and Regimen

In Ayurveda the process of learning, research and clinical practice are experiential and scientific. Like other systems of ancient Indian learning, Ayurveda is discovered through most recognized schools of acquiring knowledge and producing evidence (Pramanas) viz. (1) Direct perception through sense organs (Pratyaksa), (2) Inference (Anumana) (3) Verbal texts from many of the trustworthy persons, who knows truth and communicate correctly (Aptopadesha) and (4) Logical/rational interpretation (Yukti), etc.

Every individual has a peculiar body-mind constitution which is responsible for the health or disease pattern of an individual. Ayurvedic concept of examination of constitution (Prakriti pareeksha) is to know body, mind constitution while selecting diet, medicine or treatment regimen. The human mind has three components i.e. Sattva, Raja and Tama, which interact with the biological components Vata, Pitta & Kapha and decides the psychosomatic constitution of an individual (Prakriti).

The diagnosis in Ayurveda is based on a two-fold approach to diagnostics viz. (1) Examination of the patient i.e., Rogi-pareeksha; and (2) Examination of the disease i.e., Roga-pareeksha. Therefore, Rogi-pareeksha is essentially concerned with ascertaining the constitution of the individual and status of his health and vitality.

This is achieved through ten fold examination of patients (Dasavidha pareeksha) comprising of (1) Constitution (Prakriti) (2) Disease susceptibility (Vikriti), (3) Essence (Sara), (4) Compactness (Samhanana), (5)
Anthropometry (Pramana), (6) Compatibility (Satmya), (7) Mind (Sattwa), (8) Digestion capacity of food (Aharasakti), (9) Physical strength (Vyayamasakti) and (10) Age (Vaya).

The general examination is made through popular eight types of examination of patient (Ashtasthanapareeksha) comprising examination of pulse (Nadi), urine (Mootra), faeces (Mala), tongue (Jihva), voice (Sabda), touch (Sparsha), eye/vision (Drik) and stature (Akriti) and also considering the state of pathways of internal transport systems (Srotas) and digestive faculty (Agni).

Ayurveda conceives life as a four dimensional entity. Ayu, the living entity is the sum total of physical body, senses, the psyche and the soul. The health is defined as balance of the three doshas, the agni, seven dhatus and the three malas, as well as the sensorial, mental and emotional and spiritual well being (prasanna). Ayurveda, the Science of Life lays great emphasis on preservation and promotion of health, thereby preventing diseases.

Elaborate descriptions are available on personal hygiene, which includes diet and regimen during day (Dinacharya), during night (Ratricharya), seasonal routine (Ritucharya) and behavioural and ethical practices (Sadvritta). Observance of certain rules regarding suppressible and non-suppressible natural urges also paves the way towards positive health.

Ideal treatment according to Ayurveda is one, which cures the disease without causing adverse effect. Three classical therapeutic streams advocated by Ayurveda are (1) Therapies with inexplicable mode of action (Daivavyapasrayachikitsa), (2) Rationale treatment (Yukti vyapasrayachikitsa) and (3) Preventive and remedial measures to Psychic disorders (Satwavajaya chikitsa).

The rational Ayurveda treatment is carried out in four parts. They are (1) Dosha pacifying therapy (Samsamana), and (2) Bio-cleansing therapy (Samsodhana or Panchakarma) (3) Avoiding causative factors (Nidana Parivarjana) and (4) Dietetics (Pathya Vyavastha).
Ayurvedic treatments rely heavily on plant materials. Sometimes, botanicals are mixed with metals, minerals or other naturally occurring substances and the formulae are prepared according to specific Ayurvedic text procedures; such preparations involve several precise treatment to detoxify and potentiate the medicines.

Specific diet (Pathya) is prescribed along with the drugs and treatment. The diet regimen is as important as remedies since the former helps to restore the balance as much as the latter.

**Specialized Procedures**

Ayurveda emphasizes preventative and healing therapies along with various methods of bio-cleansing and rejuvenation. Some procedures are aimed at the management of the disease. Scientific studies have validated the efficacy and acceptability of these procedures.

**Panchakarma** - Panchakarma means the "five therapies"/five therapeutic means of eliminating toxins from the body are Vaman (emesis), Virechan (purification), Nasya (nasal insufflation), Basti (enema) and Raktamokshan (blood-letting by using leech and different instruments). This series of five therapies help remove deep-rooted stress and illness causing toxins from the body while balancing the doshas (energies that govern all biological functions).

**Kshara Sautra-** A procedure using medicated thread is a unique minimally invasive para-surgical measure being successfully practiced as a promising therapy for ano-rectal disorders since time immortal by Indian surgeons, widely cited in ancient medical literatures for its safety and efficacy. This technique was practiced by Sushruta (1000-600 B.C.), the famed ancient Indian surgeon. This technique was revived, developed and standardized in the early seventies by eminent scientists like Prof.P.J.Deshpande, Dr.P.S.Shankaran (Banaras Hindu University, Varanasi).

**Rasayana-** Literally, rasayana means the augmentation of rasa, the vital fluid produced by the digestion of food. It is the rasa flowing in the body that sustains life. Rasayana in ayurveda is the method of treatment through
which the rasa is maintained in the body. This is a specialized branch of clinical medicine meant for preventing the effect of ageing and to improve memory, intelligence, complexion, sensory and motor functions. Numerous rasayana medicines are reported to possess diversified actions like immunoenhancement, free radical scavenging, adaptogenic or anti-stress and nutritive effects.

**Home Remedies**

Home remedies are medicines made at home by using natural ingredients such as spices, pulses, fruits, vegetables, seeds and commonly available herbs. This is a traditional practice and is closely linked to Ayurveda. Generally, homemade remedies are harmless and rarely cause reactions or side effects.

They work out less expensive when compared to other forms of medicines. Since ages, home made medicines have been used by our ancestors to cure common ailments like cold and cough, digestive problems etc. The link provides simple, easily preparable recipes for common ailments.

**Siddha**

The origin of Siddha System is attributed to Lord Siva himself. Lord Siva is considered as the first Siddha. He has preached to his consort Parvathi and in turn she handed down to Nandhi and he to the Siddhas. He taught Sage Agathiya and Agasthya to Pulathiyar, Bogar, Theraiyar and others of Pothigai Hills.

In Siva temples at various parts of Tamil Nadu, the Lord is named as Vaideeswaran, Marunideeswaran. The different cultural traditions in the world had profounded their medical system to cater to the needs of their society suitably like Greek, Chinese, Arabic and Indian. In India we had two distinct cultures one is vedic and the other one is tantric.

The sages of south India, who practised tantrism contributed and established a medical system to serve the humanity in general and their own

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society in particular. Those sages were called as Siddhars and the medical system profounded by them is called as Siddha system of medicine.

Though the creation of this system is ascribed to Lord Siva, the creator of the universe, the sage Agasthiya is considered as a father figure of this medical system. He is also considered to be the father figure to the Tamil language and culture.

Even today, Lord Siva is named as Vaitheeswaran, Maruntheeswarar. You all know that Tamil is one of the oldest languages in the world, which has got greater antiquity. It was nurtured and developed at different points of time by three Tamil academies (Tamil Sangam) of which the First Tamil Sangam dates back 3000 BC.

Fundamental Principles

1. Five elemental theory
2. Three humours
3. seven thathus
4. Fourteen natural urges

Five elemental theories:

Siddha Vaidya physicians believed in three major life governing forces or doshas. These life-governing forces were deduced to be the extensions of the component elements that made life. These are not abstract concepts as many authors believe. These doshas—namely vatta, pitta and kapha—stand for some fundamental aspects of life: form, energy and movement.

Siddha Vaidya considers that the body is constituted mostly of the earth element and it is located in the space element. The elements of water, fire and air help it to function. These three elements that confer functions to the body are called Tri Dosham (three functional elements). In general, the health and illness of the body is evaluated as an imbalance of just these three elements of water, fire, and air.

Dosha Corresponding element

- Vatta Air
• Pitta Fire
• Kapha Water

The knowledge about the balances and imbalances of these functional elements are used in disease classification and in preventive health applications. The doshas are further classified into sub-doshas. Vatha is divided into ten, Pitha is divided into five, and Kapha is divided into five sub-doshas. When diseases are classified, the dosha that predominantly is involved may be mentioned. Therefore, a particular disorder can be a Vatha type, a Pitta type, a Kapha type, or a blend of all three.

Relative Proportion of the Five Elements:

The body is composed mostly of the earth element. The location of the body is in space. Think of your hand, the thumb standing for the earth element, the little finger standing for space, then the elements of water and fire and air, which are necessary for bodily functions, are represented by the pointer finger—Vatta (air), the middle finger—Pitta (fire) and the ring finger—Kapha (water), respectively. The basis of Siddha Vaidya understanding is body-bases and we can see this knowledge in our hands. Excess or deficiency of one or more of these elements causes diseases and disorders, since it reflects functional disabilities.

Summarizing in a chart may make the element/body/plant associates clearer, each element being stationed in a particular part of the body and corresponding to a particular part of any plant. This basic understanding in Siddha Vaidya assumes that, on an elemental level, humans and plants and animals are all the same, for each of them possess the same five elements in the same ratios.

Element Quality / In Nature In the body In plants

• Earth Form / Solid Limbs Roots
• Water (Kapha) Motion / Liquid Abdomen Stem
• Fire (Pitta) Heat / Plasma Chest Leaves
• Air (Vatta) Breath / Gas Neck Flowers
• Space Location / Head Seeds Emptiness
Therefore, Siddha Vaidya, based in the natural world, employs corresponding aspects of plants; for example, in human beings who have too much of the fire element, balance can come from eating the leaves of a specific plant. We, it is obvious; owe so much to plants (and to animals). In this way, there is no higher or lower, for all the three classes of plant, animal and human are equally important and, elementally and essentially identical.

Siddha Vaidya pre-supposes that the body is primarily structured out of the earth element. This body is located in space. Once its structure and location are established by earth and space elements, then its functions are determined by the elements of air (Vatta), fire (Pitta) and water (Kapha). It is these three functions that are susceptible to imbalance, which we experience as illness. Siddha Vaidya uses these elements or doshas in the classification of diseases and disorders.

Sapta Dathu or the Seven Tissue Types:

Siddha Vaidya recognises seven types of essential tissue in the body which support all other tissues in its life and functions. These tissue types are called the seven dathus, which are the following:

Rasa (lymph):

The importance of lymph was recognised by Siddha physicians from very early periods. Lymph is considered to be the carrier of nutrients from the digestive process, and disorders of the lymph is dealt with in a serious manner.

Kurudhi (blood):

Blood and human life are inter-woven with one another. Disorders of blood or its reduced ability to function is a prime cause of disease according to Siddha Vaidya.

Tasai (muscle):

Muscles are important to give strength to body activities. Loss of muscle strength causes immobility and imbalance in the body. Conversely, an imbalance of Vatta can cause muscle tissue to suffer from immobility imposed on it due to symptoms such as pain.
Kozhuppu (adipose tissue):

Fatty tissue plays a very important role in the human body. The human body in balance should have a certain amount of fatty tissue. Fat is part of lipoproteins and many hormones. It is the other half of proteins in the make up of the cell membrane, the most intelligent entity in the cell next to DNA.

Elumbu (bone):

Bone provides the primary physical foundation for a human being. Bone also acts as a safe area for the marrow tissue and is a depot of calcium, without which muscular activities are impossible.

Majjai (marrow):

A healthy marrow is important not only to manufacture healthy blood but also for a strong immune system, since bone marrow is the area of blood-cell formation—red, white and platelets.

Sukkilam and Artavam:

These are highly conserved tissues in the body according to ancient Siddha Vaidya teachings. Siddha Vaidya maintains that the emission of sperm should not happen more than once a day. This gives rest for the testis and adequately conserves valuable resources. Emissions more than once a day can cause many diseases and disorders generally called disorders of Madam. The same is the case of Arthavam or the menstrual fluids. A heavy menstrual flow or passing clots is considered a sign of imbalance and should be corrected without fail.

Branches of Siddha

1. Maruthuvam General medicine
2. Pillai pini Paediatrics
3. Mananalam Mental diseases
4. Thalai noi maruthuvam- Ear, Nose, throat and Head diseases
5. Aruvai maruthuvam Surgery
6. Nanju maruthuvam Toxicology
The causative factors are grouped as the followings:

- Vitiation of three humours
- Astral influences
- Poisonous substances
- Psychological causes
- Spiritual causes
- Hereditary

The process of the diagnosis of the diseases are based on three diagnostic parameters:

- Poriyalarithal (Inspection through five sensual organs)
- Pulanalarithal (Inspection through five senses)
- Vinathal (Intoragation)

There are eight fold methodology (Envagai thervu) by which the exact diseases are diagnosed:

- Naa
- Niram
- Mozhi
- Vizhi
- Mazham
- Moothiram
- Naadi
- Sparisam
Among them the oil spreading pattern on the surface of the urine along with
the other parameters and pulse reading are very specific and sensitive in
diagnosing the diseases. The other factors like the constitution or the somato-
typing, seasonal factors, co-morbidity also play a vital role in assessing the
prognosis and the treatment of the diseases.

Treatment aspects

Classification of disease principles (Influencing factors in treatment of
individuals)

- Edaphic factors (Science of soil)
- Biotic factors (Constitutional and Somato typing)
- Seasonal factors
- Diet, Vehicle and adjuvant

Optimal results can be obtained if all these factors are taken into
account in prescribing the treatments Somototyping or the constitution of the
body, the influence of the land and the soil, the seasons, Diet based on the
constitution and the diseases, the vehicle and the adjuvants are the vital
factors in assessing the prognosis and the line of treatment.

Promotive aspects

- Kayakalpam is the procedure adopted in promotive aspects
- Kayakalpam (Gerontology) is of two types, Kalpa yogam (Yogic
  exercises) and Kalpa aviztham (drugs)
- Kalpa aviztham is divided into two types, Sirappu (specific) and Pothu
  Karpam (common)
- Kalpa yogam deals with eight yoga principles, such as Iyamam,
  Niyamam, Asanam, Pranayamam, Prathiyagaram, Tharanai,
  Thiyanam, Samathy

Strength areas and Specialties

Special areas in Siddha system of medicine are as follows
• Thokkanam
• Varmam
• Higher order pharmaceutical preparations such as Chunnam, Kattu, Sathu, Kazhangu and Gurukuzhigai

Thokkanam

Thokkanam is one among the treatment procedures used in Siddha system of medicine from time immemorial. Initially these procedures were used only for royal families to enhance rejuvenation and latter turned into a therapeutic application. An external remedy in siddha is classified as 32 in number. The unique remedy of its kind among all and which is subdivided into nine more procedures is thokkanam. Thokkanam as a whole focuses on treating diseases caused by aggravation of vatha the kinetic force of the body.

The humoral theory of Siddha states that vatha is the active force responsible for the physiological functioning of Neuro muscular as well as musculo skeletal systems. Thokkanam is also useful in pitta as well as kapha diseases. A simple thokkanam session wipes of sedentary feel which is a kapha aggravation.

Thokkanam is a word framed by combining two words Thokku and Anam. Thokku means skin, Anam mean support/tones/heat. Toning the skin, muscles and nerves where vatha lives. It is synonymously called as Marthanam. Marthanam is performed by mallars in older days. Mallars are masculine with calibre to perform martial arts including wrestling.

As per Siddha basic principles the meeting points of muscles, nerves, joints and skin including hair roots are places of flow of vital vatha energy. A depletion of vatha vital energy may lead to vatha. Which may result in Aggravations such as pain, altered tone, power, twitching, spasticity, rigidity, numbness and neuritis.

Varmam (Varmas or the Energy Points)

The other basic ingredient of importance in an over view of Siddha philosophy are the Varmas. Varmas are energy points in the body mainly located on the skin and adjacent tissue. Injury to these points is one of the
causes of illness in the body according to Siddha sages. Dr. Robert Becker provided the best explanation of energy points in his book, The Body Electric.

The electricity flowing through the individual Nadi is of very low voltage. Given the normal resistance of the skin, it would be impossible for the current to travel very far without the loss of signal strength. Here the Varmas come into play by acting as signal boosting stations! The functions of Varmas go much further than just step up transmitters. Varmas act as routing stations as well.

The branch of Siddha medicine practiced extensively in pockets of Tamil Nadu and Kerala and called Varma is intimately linked with the martial system of Kalari Payat, which was, and still is, taught in specialized schools called Kalari. This branch of science deals more with traumatology and accidental injuries. Meridians of energy flow exist throughout the body.

There are ten major energy trunks (Dasa nadi) and 72,000 minor energy channels (Nadi) that link every single one of the body’s many trillions of cells. The energy that flows through these channels is focused in certain areas of the body. There are 108 of these Varmas where energy is focused. Disruption of energy flow in these Nadi and Varmas can lead to illness.

In order to revive the energy flow to its original state, the Siddha physician will apply massages, manipulations and stretches, in addition to external and internal herbal and herbo-mineral formulae. Varma science was instrumental in Siddha Vaidya, developing into the areas of trauma-associated blunt injuries and open injuries. Many local applications are used to address both open and blunt injuries, along with internal mediations. Fixed and removable casts were in use in Siddha Vaidya until the development of orthopedic facilities in India.

Higher order pharmaceutical preparations

- Chunnam - (Potent inorganic oxides)
- Kattu - (Combustible into non-combustible inorganic)
- Sathu - (Extraction of extractives of inorganic)
- Kazhangu - (Amalgamation of different inorganic)
o Gurukuzhigai - (Mercury into non-combustible)

Home Remedies

The siddha system of medicine is based on the doctrine of Medicine is food and medicine is food (Marunthe unavu, Unave marunthu). To combat the common ailments they come across in their day to day life they have been using the common drugs used in their Kitchen. There numbers of recipes that can be used form the food .They are very safe and easy to prepare In common conditions like cough cold and stomach ailments.

Yoga

It is an Art and Science of living in tune with Brahmand- the Universe. Yoga has its origins in the Vedas, the oldest record of Indian culture. Swami Vivekananda defines Yoga as "It's a means of compressing one's evolution into a single life or a few months or even a few hours of one's bodily existence". By Yoga, Sri Aurobindo, meant a methodological effort towards self perfection by the development of potentialities latent in the individual. One of the classic definition of Yoga is "to be one with divine."

Yoga is a science as well as an art of healthy living. It is no way limited by race, age, sex, religion, caste, creed and any other boundaries and can be practiced by those who seek an education on better living and those who want to have a more meaningful life.

Maharishi Patanjali, rightly called as the "Father of Yoga", advocated the eight fold path of Yoga, popularly known as "Ashtanga Yoga" for all-round development of human personality. They are – Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana & Samadhi.

Streams of Yoga:

Swami Vivekananda has classified the methods of Yoga in to four streams such as Work, Worship, Philosophy and Psychic control.

Karma Yoga, the path of work, can be said as a way of enjoying work, or doing it effortlessly. The success or failure should not be allowed to cause
ripples in the mind. Bhakti Yoga, the path of worship is a systematic method of engaging the mind in the practice of divine love which softens our emotions and tranquillises our mind. Jnana Yoga, the path of philosophy, is a systematic way of tutoring the mind about the realities of life by contemplation so that this will strip off the garb of ignorance from our mind and the mind goes to its natural state of rest. Raja Yoga, the path of psychic control, is a systematic process of culturing the mind. It is based on the 8-limbed Yoga of Patanjali.

**Principles of Yoga**

According to Yoga, most of the diseases Mental, Psychosomatic and Physical originate in mind through wrong way of thinking, living and eating which is caused by attachment. So the basic approach of Yoga is to correct the life style by cultivating a rational positive and spiritual attitude towards all life situations.

Yoga in the way of treating, takes into consideration all the five Kosa’s (Sheaths) i.e. Manomaya Kosa, Annamaya Kosa, (grass Sheath) Pranamaya Kosa (Extral Body) (Psychic Body), Vijyanmaya Kosa (intellect Sheath) and Anandamaya Kosa (Bliss sheath).

Yoga takes up the cleansing of the body as the first measure to fight disease. The distinctive feature of Yoga is that it it performs the pancha karma by developing full efficiency and control of eliminative systems of the body. Yoga aims at preventing the disease and promoting health by reconditioning the psycho-physiological mechanism of the individual.

Yoga emphasises the development of brotherhood, harmony, fraternity and equality not only towards all human beings irrespective of colour, caste, nationality, age and sex but towards all living beings also. This attitude renders the thinking so positive that man is liberated from all mental malice and also all the mental, psychosomatic and physiological diseases arising thereof.

Yoga is not merely a system of treatment but has potential to develop around health i.e. physical, social, mental and spiritual. For social health, it
prescribes the practice of Yama & Niyama and Karma Yoga. A man devoted to karma Yoga looks all the living beings as his brethrens and helps them getting rid of painful situations. This concept of "Vasudhaiv Kutumba Kama" is the basic Philosophy of Yoga.

The practice of Yama – Niyamas purifies the heart of practitioner from vices like attachment, aversion, avarice and infatuation etc. and generates higher ethical qualities like sincerity, honesty, straightforwardness, cheerfulness, courage, detachment, patience, perseverance, tranquility, self control, truth, harmony and uprightness.

Our ancient seers have very sagaciously designed the Yogic practices to invigorate the entire psychosomatic constitution of man. A set of Asanas, Mudras and Pranayamas practised with faith, perseverance and insight rejuvenates the brain, heart, lungs, liver, pancreas, kidneys, bowels, all nerves, muscles, tissues, glands of the body by ensuring oxygenated and balanced blood supply, kindless up the appetite, bestows control over seminal fluid, senses and mind and imparts increased vitality, vigour and longevity to the practitioners.

Yoga Development and its Status

In our country, generations of Yogis and Scholars have contemplated their life in order to realize that there is a meaning to life and some purpose beyond the human sufferings. They had come to the conclusion that there is a way to escape the tragic problems of life by diverting our mind to something more interesting and everlasting.

They use to live in forests and eat whatever is provided by the Nature in its natural form. Not only that the ever changing climate could not harm them a bit. They apply holy ash of Havana on their body to keep away the germs & bacteria. The great Yogis and Scholars gave rational interpretations of their experiences and brought these within every one's reach by making a practically designed and scientifically prepared method of healthy living. Hence, the science of Yoga emerged to counter all these problems and human sufferings.
The greatest Physician in Greek medicine was Hippocrates, who is often called the "Father of Medicine". He studied climate, water, air, clothing, habits of eating & drinking and the effect they have in producing diseases. The Greeks believed that matter was made up of four elements - Earth, Air, Fire, Water and the same is applicable to body also. They also believed that the equilibrium among these elements maintains normal health status.

Despite spectacular bio-medical advances and massive expenditures, there is an increasing recognition of the side effects of existing health services. To provide health care, alternative ideas and methods have been considered and tried in large scale in the recent past. Contemporary medicine is no longer solely an art and science for the diagnosis and treatment of diseases. It is also the science for prevention of disease and promotion of health.

The sacred land of India, from the time immemorial contributed in its own way to the better living of mankind. Yoga & Naturopathy are the two of its kinds which can be the only answer to the rising levels of health care problems.

In recent times there is a growing awareness among the people about the efficacy and utility of Yoga and Nature Cure in keeping one fit at physical, mental, emotional, social and spiritual planes. These systems are emerging as the effective methods and means to improve the total personality and to build a healthy society. Above all, these systems are adopted as a way of life rather than a mode of treatment.

NATUROPATHY

Naturopathy

Vedas and other ancient texts explain how nature is a way of life. In ancient India these method of treatment were widely used. According to the morbid matter theory all the diseases arise due to accumulation of morbid matter in the body which can be cured if scope is given for its removal. The belief that the human body possesses inherent self constructing and self

http://indianmedicine.nic.in/naturopathy.asp
healing powers is one of its concepts. The distinctive quality of nature cure is that its theory and practices are based on the holistic approach. For treatment, the nature cure Physician primarily stresses on correcting all the factors involved for diseases such as one's un-natural habits in living, thinking, working, sleeping, relaxation, sexual indulgence etc, and also considers the environmental factors involved which on the whole disturbs the normal functioning of the body and lead it to a morbid, weak and toxic state. The five main modalities of treatment are air, water, heat, mud and space.

The basic principles on which the naturopathy is based on are:

**Basic Principles**

1. Basic cause of a disease is accumulation of morbid matter
2. Chronic diseases are the outcome of wrong treatment and suppression of the acute diseases.
3. Nature is the greatest healer.
4. In Naturopathy patient is treated and not the disease.
5. Nature Cure treats physical, mental, social (moral) and spiritual all four aspects at the same time.
6. According to Naturopathy "Food is Medicine".
7. Doing prayer according to one's spiritual faith is an important part of treatment.

**Acupuncture**

**History of Acupuncture Worldwide**

Acupuncture is a very ancient form of healing which pre-dates recorded history. The philosophy is rooted in the Taoist tradition. Acupuncture, though originated in oriental countries in the ancient times but, its philosophical understanding is amazingly wide open to the modern medical science. Historically, records are there regarding its Indian origin. However, acupuncture practised today in Indian sub-continent mainly shows Chinese origin.\(^\text{10}\)

Acupuncture is over 5,000 years old. It was not just practiced in China. The Egyptians talked about vessels that resembled the 12 meridians in 1550 B.C., in their medical treatises called the Papyrus Ebera. The South African Bantu tribesman scratched parts of their bodies to cure disease. The Arabs cauterized their ears with hot metal probes. The Eskimos used sharp stones for simple acupuncture. Brazilian cannibals shot tiny arrows with blow pipes to diseased parts of their bodies to cure disease.11

China and Taiwan today play a leading role in developing traditional Chinese medicine. In these countries there are some 232,000 traditional Chinese medical doctors and 50 institutes producing 30,000 traditional Chinese medical doctors annually. Korea has developed very effective hand acupuncture which compliments other acupuncture modalities. Russia since the end of the cold war has revealed research done behind the iron curtain that has contributed to sonic and reflexology treatments today. Japan has junior colleges of acupuncture. There are 8500 Japanese doctors in the Oriental Medical Association developing methodology in acupuncture to compliment western medicine.

In Europe oriental medical research is very active and quite advanced. Spain has an acupuncture school called Golden Clover. Germany, Austria and Italy all have very strong and active acupuncture centers. England has no organized acupuncture medical activity but there is a British Medical Acupuncture society which is quite active. France has pioneered ear acupuncture through its famous center in Lyons under the leadership of Dr. Nogier (he recently died).

In the United States more and more practitioners are now developing knowledge and new skills in acupuncture. Many are incorporating all the modalities from the various countries, using hand, ear, Chinese, Japanese and scalp acupuncture along with Russian reflexology and adapting these techniques to the modern times with use of modern technology to produce what is now called American Acupuncture. In 1996 in America, needles were removed from the "investigative" category to "accepted medical instruments".11
Being investigative, allowed insurance companies to deny payment for medical acupuncture treatment. There is a bill before congress with 12 sponsors to allow Medicare to pay for acupuncture treatments. An organization the American Academy Of Medical Acupuncture (AAMA) based in California, has a membership of nearly 1000 physician members from the entire country. All physicians who are members must have been previously accredited by formal training and certification. About 25% of these physicians work in pain centers around America. The National Institute of Health for the first time has formed a department of Alternative Health care to provide needed research funding in alternative avenues of medical care. In America there are about 8000 acupuncturists. 16 acupuncture schools, and 2 medical schools teaching acupuncture. UCLA medical school has been teaching acupuncture to physicians under the leadership of Dr. Joseph Helms. In 18 states, only doctors can perform acupuncture. Border states like Florida, California, and New York allow non physicians to perform acupuncture. All require licensing. Times are changing and American Acupuncture is alive and well!^12

Acupuncture's main use is intreating chronic and painful conditions such as arthritis, headaches and migraines. After dental caries (tooth decay) and the common cold, these are the most common afflictions of the human race. Its effectiveness has enabled acupuncture to survive against, at times, enormous odds. It was banned by law in China at the beginning of this century but continued to be practiced as folk medicine. Interest by Western doctors in acupuncture was stimulated by President Nixon's visit to China in 1972. Since that time medical interest in the subject has grown apace, underpinned by a number of important discoveries pointing to the effectiveness of Acupuncture.^13

Basic Principles of Accupuncture

Approximately 8000 yrs ago, Fu His, a Chinese, by observing the nature, formulated two symbols, a broken line and an unbroken line, representing the two major forces in the universe- creation and reception. This

^12 http://www.americanacupuncture.com/history.htm
duality was named as Yin-Yang and its fuse leads to a creative action giving birth to a third aspect. After a lot of ponder on this triplicity Fu His wrote a book called I-Ching means book of change which later on became the fundamental philosophy for all other writers.\textsuperscript{14}

The ancient Chinese hypothesised that energy circulated in the body via specific channels, which they called meridians. The Chinese believed that in addition to being in balance, the energy or life force (which the Chinese called chi) had to be able to circulate freely around the meridians. If a break occurred anywhere in this circulation, illness would result. An example is backache, which is viewed by the Chinese as a blockage in the "chi" circulating in the bladder meridian. The remedy was, put in the simplest terms, to insert a needle at the point of discomfort, thus encouraging flow to re-establish itself. Each meridian refers to a particular organ, and the energy flowing through that meridian can be taken as indicating the functional state of that organ. Inserting a needle into a point on the liver meridian for instance could be expected to affect the function of the liver, the effect would depend on the actual point used and the state of the patient at the time of treatment.\textsuperscript{15}

**HOMOEOPATHY**

This traditional medicine system has been originated in Germany. Dr. Christian Friedrich Samuel Heinemann (1755-1843) is the father of Homoeopathy who discovered the fundamental principles of Homoeopathy. It came to India in around 1810 A.D, with a German physician and geologist and got official patronage in 1839 when Dr. John Marlin Honigberger, a disciple of Heinemann revisited India and successfully treated Maharaja Ranjit Singh of Punjab.\textsuperscript{16}

**Basic Principles of Homoeopathy**

The first principle – According to Similia similibus curentur, a medicine which can induce a set of symptoms in healthy human beings, would be

\begin{itemize}
  \item \textsuperscript{14} [http://www.acupuncturecare.com/acupunct.htm]
  \item \textsuperscript{15} [http://www.suresoft.com/health/healthpt/acupct.html]
  \item \textsuperscript{16} L.V. Prasad (2002), “Indian System of Medicine and Homoeopathy” Report of WHO, R.O. South East Asia, Pg. 283
\end{itemize}
capable of curing the similar set of symptoms in disease state.\textsuperscript{17} The second principle – Single medicine states that one medicine at a time for a particular patient during the treatment. The third principle – Minimum dose advocates least potent dose of the drug, which would provide full and complete cure without any side effects. Here treatment is patient specific in other words an individual patient is treated not the disease.

**PREPARATION of Homoeopathic Medicine**

Medicines are prepared from natural sources viz. Vegetable, mineral, animal, insects etc. There is no toxic effect of these medicines since it is not the chemical or physical properties that are acting on the human system.\textsuperscript{18}

**Strength of the system**

Homoeopathic has its own area of strength. It cures allergic manifestations, autoimmune disorders and viral infections. Many surgical gynaecological and obstetrical conditions, ailment affecting eyes, nose, ear, teeth, skin, sexual organs etc. are amenable to the homoeopathic treatment. Behavioral disorder, neurological problems, metabolic diseases etc are also handled. Homoeopathy has effective answer to addiction to drugs, tobacco and alcohol and highly efficacious in elimination of addicts and their craving for these harmful substances.

These all are institutionalised form of traditional medicine. But their rest a large part of non-institutionalised, non-coded traditional medicinal knowledge which is a potential area for the indigenous traditional people.

\textsuperscript{17} [www.Altmed India.com, op. cit.]
\textsuperscript{18} [Annual Report (2002-2003), op. Cit., Pg. 29-30]
CHAPTER – 5

Legal Status of Traditional Knowledge
LEGAL STATUS OF TRADITIONAL KNOWLEDGE

As the whole world is being considered as a global village i.e., the borders of the countries are about to deplete and knowledge is easily transferred into a marketable commodity; there is a growing realization that the traditional wisdom representing our cultural identities is being lost. Easy accessibility of ITK leads it to be susceptible to misappropriation.

Traditional medicinal knowledge is being highly used by most of the developed countries & Pharmaceutical industries as the basis for their research and development process, because in one hand formulations used for the treatment of human ailments from T.K are time tested since they have been in practice since a long period of time and pharmaceutical companies can make huge savings because random testing has a success rate of about 1:10,000 but if testing is combined with local knowledge, the success rate can be improved in the range of about 1:2.\footnote{Rural Advancement Foundation International (1994), Bioprospecting/Biopiracy And Indigenous Peoples.} Being least optimistic, success rate increase to 1:5000 is attributed to the NIH.\footnote{Global Exchange (2004), Biopiracy: A New Threat to Indigenous Rights and Culture in Mexico.} On the other hand this information either exist in regional languages (codified TK) or transferred orally (non-codified), about which the patent offices are not aware of. Thus it results in grant of patents on non-patentable knowledge which belongs to developing countries from centuries. In case when the country concerned try for revocation of the patents it takes lots of time and huge costs which is not feasible for all of the cases.

A major issue of concern is that ever since the conclusion of the Marakesh agreement, prompted by this provision that plant varieties are expected to be protected in one of the following three ways-by patents, by a sui generic system or by the combination of the two. There has been a mad rush from these large multinational firms to collect germplasms of wild plants varieties located in the less developed countries. According to Das Gupta, the
MNCs are taking selected specimens out of the country by means legal and illegal and then after tinking and cross breeding with other varieties that they are claiming to be unique and different and then patenting those in their own country. This process of stealing and plundering the biological wealth of the 3rd world countries which account for nearly two third of the total by the multinational firms originates in the west has come to be known as 'biopiracy'. A correlation between the number of international applications whose record copies were received by the international bureau in 1995 & the GDP figures in US$ billion as per HDR 1995, shows that the value for the same was as high as 0.9 for 41 countries. This was significant at 99% level of significance at 39 degree of freedom.

R. A. Mashelkar, Director General of CSIR, while speaking at the inauguration of TKDL in New Delhi on 26 March 2002, pointed out that the global market for herbal/traditional medicines is US $ 60 billion, with an annual growth rate of 5-15%. In this, China's share is about US $ 7-8 billion and India's US $ 400-500 million. He also referred to a TKDL Task Force study of the US Patent and Trade Mark Office (USPTO) database conducted in March 2000. The study showed that out of 4896 references on 90 medicinal plants mentioned in the USPTO database, 80% of these references was on seven medicinal plants of Indian origin: Kumari, 'Mustaka, Tamraparna, Garjara, Atasi, Jambira, Kharbuja. The findings revealed that out of the 762 patents on medicinal plants studied, 360 of them could be characterized as traditional.

SOME EXAMPLES OF BIO-PIRACY CASES

Neem (Azadirachta indica A. Juss.)

The most talked about case of bio-piracy has been the patenting of neem tree whose medicinal and other properties are known to the people of India from time immemorial. In 1994, European Patent Office (EPO) granted a patent (EPO patent No.436257) to the US Corporation W.R. Grace Company and US Department of Agriculture for a method for controlling fungi on plants by the aid of hydrophobic extracted Neem oil. In 1995 a group of international NGOs and representatives of Indian farmers filed legal opposition against the patent. They submitted evidence that the fungicidal effect of extracts of Neem
seeds had been known and used for centuries in Indian agriculture to protect crops, and therefore was a prior art unpatentable. In 1999, the EPO determined that according to the evidence all features of the present claim were disclosed to the public prior to the patent application and the patent was not considered to involve an inventive step. The patent granted on was Neem was revoked by the EPO in May 2000. EPO, in March 2006, rejected the challenge made in 2001 by the USDA and the chemicals multinational, W. R. Grace to the EPO’s previous decision to cancel their patent on the fungicidal properties of the seeds extracted from the neem tree.  

Turmeric (Curcuma longa Linn.)

In 1995, two expatriate Indians at the University of Mississippi Medical Centre (Suman K. Das and Hari Har P. Cohly) were granted a US patent (no.5, 401,504) on use of turmeric in wound healing. The Council of Scientific & Industrial Research (CSIR), India, New Delhi filed a re-examination case with the US PTO challenging the patent on the grounds of existing prior art. CSIR argued that turmeric has been used for thousands of years for healing wounds and rashes and therefore its medicinal use was not a novel invention. Their claim was supported by documentary evidence of traditional knowledge, including ancient Sanskrit text and a paper published in 1953 in the Journal of the Indian Medical Association. Despite an appeal by the patent holders, the US PTO upheld the CSIR objections and cancelled the patent. The turmeric case was a landmark judgment case as it was for the first time that a patent based on the traditional knowledge of a developing country was successfully challenged. The US Patent Office revoked this patent in 1997, after ascertaining that there was no novelty; the findings by innovators having been known in India for centuries. The irony of such patenting is that patented products, processed by the foreign compares, would had to be purchased by Indians who are used to getting them free from nature.

3 http://www.tkdl.res.in/tkdl/langdefault/common/Biopiracy.asp (Bio piracy of traditional knowledge)
4 http://www.tkdl.res.in/tkdl/langdefault/common/Biopiracy.asp (Bio piracy of traditional knowledge)
A few battles won indeed, but there are many ahead. Close to 2000 wrong patents of medicines prescribed under the Ayurvedic, Unani and Sidha systems are still being granted annually at the global level, causing financial loss to India.\(^5\) Patents have been granted by the European Patent Office (EPO) on the use of over 285 traditional Indian medicinal plants such as papaya, Indian long pepper, kali tulsi, pudina, ginger, aloe, isabgol, aoonla, jira, soybean, tomato, almond, walnut and methi. Ayush secretary S Jalaja said, “People will now think twice before even applying for such dubious patents.”\(^6\)

Hoodia (*Hoodia gordonii* (Masson) Sweet ex Decne)

In 1995, South African Council of Scientific & Industrial Research (CSIR) patented Hoodia’s appetite-suppressing element (P57) and hence, its potential cure for obesity. In 1997 they licensed P57 to British Biotech Company, Phytopharm. In 1998, Pfizer acquired the rights to develop and market P57 as a potential slimming drug and cure for obesity (a market worth more than £ 6 billion), from Phytopharm for $ 32 million. In June 2001, the San people launched legal action against South African CSIR and the pharmaceutical industry on grounds of bio-piracy. They claimed that their traditional knowledge has been stolen, and the South African CSIR had failed to comply with the rules of the Convention on Biodiversity, which requires the prior informed consent of all stakeholders, including the original discoverers and users. However, in March 2002, a landmark was reached in which the San will receive a share of any future royalties. The settlement will not directly affect Phytopharm or Pfizer since the San would be paid out of the CSIR’s royalties, as South African CSIR is the patent holder. South African CSIR will probably receive a royalty of around 10% from Phytopharm, which itself will receive royalties from sales from Pfizer. Thus San are likely to end up with only a very small percentage of eventual sales.\(^7\)

\(^5\) AyurvedNews.com, Protecting India’s Traditional knowledge From Patent Piracy, February 11th 2009

\(^6\) AyurvedNews.com, Protecting India’s Traditional knowledge From Patent Piracy, February 11th 2009

\(^7\) http://www.tkdl.res.in/tkdl/langdefault/common/Biopiracy.asp (Bio piracy of traditional knowledge)
Developed countries doubles beak is also revealed in this way, they refer to the common heritage of mankind. They demand that all germplasm be recognized as a public resource and a part of the heritage of mankind. That would give them the right to collect germplasms in the wild without any compensation on the ground that these belong to the common heritage of mankind. But after improving these varieties through research and experimentations, they do not hesitate to sell these against payment to countries including the one from which germplasm had been originally collected. In this way, it is quite evident that modernization and globalization has not been sensitive to the interests of indigenous communities.

The Enola Bean

A common yellow bean that has been a familiar staple in Latin American diets for more than a century was granted patent protection in 1999, to a Colorado man, Larry Proctor as US Patent Number 5,894,079, by The United States Patent and Trademark Office (USPTO).

On the claim of developing "a new field bean variety that produces distinctly colored yellow seed which remains relatively unchanged by season" Proctor dubbed it the "Enola bean" and filed a patent application and obtained a 20-year patent that covered any beans and hybrids derived from crosses with even one of his seeds.

The International Center for Tropical Agriculture (known by its Spanish acronym, CIAT), which is supported by the Consultative Group on International Agricultural Research (CGIAR), led the legal challenge to the patent through the USPTO's reexamination process. The Food and Agriculture Organization (FAO) of the United Nations and ETC Group (formerly RAFI, the Rural Advancement Foundation International), a Canada-based nongovernmental organization dedicated to conservation and sustainable use of biodiversity, also denounced the Enola bean patent.

CIAT was able to dispute the inventor's claims to a unique color by providing published evidence of 260 yellow beans among the almost 28,000 samples of Phaseolus in its crop "genebank." At least six of the CIAT varieties
were, to most observers, identical to the bean described in Proctor's patent documents on the basis of color and genetic markers. CIAT also put forward publications to show that the claims in the patent application took credit for research already widely available in scientific literature and thus claims made regarding the breeding of the bean in his patent also failed to meet the patent office's statutory requirements for "non-obviousness and novelty." an appeal was heard on 16 January 2008, and the patent was revoked in May 2008.\(^8\)

Unless community rights over intellectual property is recognized, it will not be possible to economically reward the inventors of traditional medicines or seeds or resources that is useful to society at large (from which most of the modern medicines and seeds are derived).

**Basmati Case**

In late 1997, an American company RiceTec Inc, was granted a patent by the US patent office to call the aromatic rice grown outside India 'Basmati'. RiceTec Inc, had been trying to enter the international Basmati market with brands like 'Kasmati' and 'Texmati' described as Basmati-type rice with minimal success. However, with the Basmati patent rights, RiceTec would then be able to not only call its aromatic rice Basmati within the US, but also label it Basmati for its exports. That had grave repercussions for India and Pakistan because not only would India lose out on the 45,000 tonne US import market, which forms 10 percent of the total Basmati exports, but also its position in crucial markets like the European Union, the United Kingdom, Middle East and West Asia. In addition, the patent on Basmati was believed to be a violation of the fundamental fact that the long grain aromatic rice grown only in Punjab, Haryana, and Uttar Pradesh is called Basmati. RiceTec Inc, was issued the Patent number **5663484** on Basmati rice lines and grains on September 2, 1997.\(^9\)

Some other cases of bad patents submitted to TRIPS Council by developing countries.

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\(^8\) [http://www.ciat.cgiar.org/newsroom/enolabean2008.htm](http://www.ciat.cgiar.org/newsroom/enolabean2008.htm)

\(^9\) Rice Tec. Patent for Basmati grain and rice lines
Table- E

List of “Bad Patents” submitted to TRIPS Council By developing Countries

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Bioresource</th>
<th>Patent No</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quinoa</td>
<td>US 5,304,718</td>
<td>Graham Dutfield, Intellectual Property, Biogenetic Resources and Traditional Knowledge, Earth Scan, UK and USA, 2004, Chapter 5, p. 53</td>
</tr>
<tr>
<td>5</td>
<td>bringal, Karela, Jamun and Gurmar</td>
<td>US patent 5,900,240</td>
<td>Patent for composition of bringal, Karela, Jamun and Gurmar</td>
</tr>
<tr>
<td>6</td>
<td>Arhar or Pigeon pea or Cajanus</td>
<td>US patents 6,410,596 and 6,541,522</td>
<td>Patent for Arhar or Pigeon pea or Cajanus</td>
</tr>
<tr>
<td>7</td>
<td>Pepper</td>
<td>US patents 5,536,506, 5,744,161 and 5,972,382</td>
<td>Patents for Pepper</td>
</tr>
<tr>
<td>8</td>
<td>Amla</td>
<td>US patent 5,529,778</td>
<td>Patent for Amla</td>
</tr>
</tbody>
</table>

Source: WTO Document IP/C/W/459 (18 November 2005)

GLOBAL INITIATIVES

The earliest use of the term “intellectual property” appears to be in October 1845 Massachusetts Circuit Court ruling in the patent case Davoll et al. v. Brown, in which Justice Charles L. Woobbury wrote that “only in this way can we protect intellectual property, the labors of the mind, productions and
interests as much a man's own ...as the wheat he cultivates, or the flocks he
rears." ¹⁰

Modern usage of the term "Intellectual property" began with the 1967
establishment of the World Intellectual Property Organization (WIPO), but got
popularity with the Bayh-Dole Act in 1984. ¹¹ The World Commission on
Environment and Development, also known as the Brundtland Commission,
completed in 1987 was arguably the beginning of a wider acceptance of
indigenous knowledge as having a role to play in the conservation of global
biodiversity and environmental sustainability (Colorado 1996). ¹² Since then,
the importance of Indigenous, traditional and local knowledge has gathered
momentum in international documents pertaining to environment,
sustainability and biodiversity. The scope of IPR has been further expanded
by Trade Related Intellectual Property Agreement of World Trade
Organisation. ¹³

The era of globalization has brought fort-newer issues with relation to
indigenous communities their habitat & their traditional knowledge.

According to the third draft of the global Bio-
diversity strategy 1991. "Some 200 million indigenous people [4% of the world population] live in
and have special claims to territories that, in many cases harbor exceptionally
high level of Bio-diversity. Their Claims rest on their long occupation of a
particular place, their culture, spiritual and economic ties to the area and
ability, in most cases, to manage in sustainable. At the same time the cultural
diversity inherent in the worlds indigenous groups is imperiled by the
encroachment of dominant societies and economics. Preserving indigenous
territorial rights thus protects bio-diversity and the local culture, including
knowledge and resources management skill with potentially wide applications
as well as spiritualities to the environment that could provide direction for the
development of a bio-diversity ethos in the wider society." ¹⁴

¹⁰ (J Woodb. & M. 53, 3 West.L.J. 151, 7 F.Cas. 197, No. 3662, 2 Robb.Pat.Cas. 303,
Menv.Pat.Inv. 414)
¹¹ Mark A. Lemley, "Property, Intellectual Property, and Free Riding" (Abstract); see Table 1: 4-5.
¹³ The text of TRIPs may be found at http://www.wto.org/english/docs_e/legal_e/27-trips.pdf
However, contrary to this idea stands the intellectual property regime. IP traditionally referred to a design, technology or product invented by a person or corporation and rights refers to statutory rights (or rather privileges) that grant inventors the reward of exclusive right to use it or to earn realities by renting out to use. Such rights are conferred to by awarding patents, Plant Breeder Rights, copy rights, trademarks, and trade secrets to the owner or inventor. In recent years the amplitude of these rights have been tremendously increased to include biological living materials, which forms plant of bio-diversity of the region.

The issue of Traditional Knowledge has become contentious with the emergence of new intellectual property rights (IPR) and the conflicts between the provisions of Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement, the UN Convention on Biological Diversity (CBD) and the FAO International Treaty on Plant Genetic Resources (ITPGRFA).

The Convention on Bio Diversity

The UN Convention on Biological Diversity (CBD) was signed at Rio de Janerio in June 1992 and entered into force in 1993, which has its objectives as, "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding."

Article 8(j) of CBD requires parties to respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.
Article 15 of CBD deals with its provisions regarding access and benefit sharing of genetic resources. Describing the sovereignty over genetic resources the article states that “Recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation”[Article 15(1)]. It never grant states a property right over genetic resources but only recognises its right to restrict. Rather CBD by making the undue restrictions of nations clear, and in order to facilitate the access states that “Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention”[Article 15(2)].

Dealing with the terms of access Article 15 states that “Access, where granted, shall be on mutually agreed terms” [Article 15(4)] and “Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources” [Article 15(5)].

Taking equitable sharing of benefits arising from the utilization of genetic resources as a fundamental concept, Article 15 (7) of CBD states, “Each Contracting Party shall take legislative, administrative or policy measures...with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.”

The CBD constituted Expert panel on Access to Genetic resources and benefit sharing concluded in October 1999: “The degree of legislative simplicity in countries providing genetic resources will increase to the extent that countries and organizations receiving genetic resources take the legislative, administrative or policy measures to offer security to providers that these resources are utilized in accordance with the terms of the Convention” (SCBD, 1999).15

Article 27.3(b) of TRIPS Agreement states Members may also exclude from patentability: plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof. The provisions of this subparagraph shall be reviewed four years after the date of entry into force of the WTO Agreement.

At international level in various intergovernmental forums and processes, TK has got a position to be debated and discussed over. These include the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD), the World Intellectual Property Organization (WIPO) and the World Trade Organization (WTO). Sometimes, the negotiations focus specifically on TK protection, whether positive or negative, or else TK is discussed in the context of a wider negotiation, such as the WTO’s review of implementation of Article 27.3(b) of the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS), or the COP and its subsidiary working groups’ elaboration of an International Regime on Access and Benefit Sharing. The most substantial negotiations seem now to be those taking place at WIPO. These have reached the point of producing (but not agreeing upon) a set of draft provisions on the protection of traditional knowledge and of traditional cultural expressions.

Thus the attempt at global standardization and uniformity by way of TRIPS agreement is in conflict with the main trust of CBD. TRIPS and WTO are pushing for ‘conformity’ to international standardized norm in patents, services, labor, investment etc. irrespective of this history ecology levels of economic development etc. The CBD in its article 16(5) specifically assures that intellectual property rights must not be conflict with conservation and sustainable use of BOD, a provision that has been totally, ignored by those who composed the TRIPS agreements. Acceptance of TRIPs is mandatory for any country wishing to be a member of the WTO. In response, many countries requested the World Intellectual Property Organization (WIPO) to investigate
the relationship between intellectual property rights, biodiversity and traditional knowledge and to review the article 27.3(b) of trips agreement. WIPO began this work with a fact finding mission in 1999. Considering the issues involved with biodiversity and the broader issues in TRIPs the World Intellectual Property Organization (WIPO) Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore, was established in the 26th (12th Extraordinary Session) of the WIPO General Assembly, held in Geneva, 25 September to 3 October 2000 to consider and advise on appropriate actions concerning the economic and cultural significance of tradition-based creations, and the issues of conservation, management, sustainable use, and sharing of the benefits from the use of genetic resources and traditional knowledge, as well as the enforcement of rights to traditional knowledge and folklore. Thus, intellectual property rights and enforcement continued to be an important part of the ongoing trade rounds of the WTO, particularly in the Ministerial Declaration adopted on 14 November 2001, in Doha (Doha Declaration).

International Treaty on Plant Genetic Resources For Food and Agriculture (ITPGRFA)

The FAO Conference, through Resolution 3/2001, approved the International Treaty on Plant Genetic Resources for Food and Agriculture in November 2001. This was the first comprehensive international agreement dealing with plant genetic resources for food and agriculture.

Part III of the treaty recognises the enormous contribution of local and indigenous communities and farmers of all regions of the world, to the conservation and development of plant genetic resources.

It is a non binding agreement but assigns the realization of Farmer's rights to national governments, by making obliged to all the contracting parties.

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16 The Doha Ministerial Declaration was adopted 14 November 2001, with the mandate to address a variety of issues concerning international trade and economic development, including the marginalisation of least developed countries. Negotiations take place within the Trade Negotiations Committee and its subsidiaries, with other work occurring within WTO councils and committees, including the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore discussed below. The text of the Declaration may be found at [http://www.wto.org/english/tratop_e/minist_e/min01_e/mindecl_e.pdf](http://www.wto.org/english/tratop_e/minist_e/min01_e/mindecl_e.pdf)
to take measures to protect and promote farmers' rights in three ways: (i) protection of traditional knowledge relevant to plant genetic resources for food and agriculture; (ii) provide equitable participation in sharing benefits; and (iii) allow to participate in making decisions related to the conservation and use of plant genetic resources for food and agriculture. (FAO 2001).  

**International labour organisation:**

International Labour Organisation also recognises and protects the social, cultural, religious and spiritual values and practices of indigenous and tribal people through its convention no 169. Article 4 provides for special measures to be adopted as appropriate for safeguarding the persons, institutions, property, labour, cultures and environment of the peoples concerned. Article 8 states the need for the recognition of customary law systems.

**Tools opted globally to protect the Traditional Knowledge**

Several International conventions and agreements have been developed with the passage of time in order to address the problems faced by the traditional knowledge holders.

**Patent**

An inventor, discoverer or innovator of a product having the characteristic of novelty, non obviousness and utility or use value can get the legal monopoly over the use, production, and sale for a specific period of time (usually about 20 years). The Patent Co-operation Treaty (PCT) makes it possible to apply for a patent simultaneously in other PCT member countries.

Some important International Agreements on Patent are listed below;

- Paris Convention
- The Patent Cooperation treaty

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Trademark

Section 2, Article 15 describes trademark as any sign, or any combination of signs, capable of distinguishing the goods or services of one undertaking from those of other undertakings, shall be capable of constituting a trademark. Such signs, in particular words including personal names, letters, numerals, figurative elements and combinations of colours as well as any combination of such signs, shall be eligible for registration as trademarks. Where signs are not inherently capable of distinguishing the relevant goods or services, Members may make registrability depend on distinctiveness acquired through use. Members may require, as a condition of registration, that signs be visually perceptible.

Some important International Agreements on Trademarks are listed below

- The Paris Convention
- Madrid Agreement Concerning the International Registration of Marks, 1891 and the protocol Relating to that Agreement, 1989; and,

Geographical Indication

The TRIPS Agreement defines "geographical Indication" in Article 22.1, as an indication which identifies a good as originating in the territory of a Member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin.

Some important International Agreements on Geographical Indications are listed below;

- The Paris Convention;
• The Madrid Agreement for the Repression of False and Deceptive Indications of Source on Goods, 1891;
• The Lisbon Agreement for the protection of Appellations of Origin and their International Registration, 1979,

There are various centres which make effective efforts in identification, preservation, promotion and protection of traditional knowledge. Some of these are

Government aided organisation

1. The MOST (Management of Social Transformations) Programme of UNESCO has created the Best Practices Database. On the basis of the four criteria for Best Practices, MOST is collecting information from all parts of the world about a variety of projects, policies and strategies related to the eradication of poverty and the reduction of social exclusion. At present, the MOST Database provides examples of Best Practices for policies and projects in Poverty Eradication, Social Exclusion/Integration, Women and Gender Equality, Homelessness and Housing, Economic Development, Community Participation and Urban Governance, and Crime Prevention. (http://www.unesco.org/most/index.html)

2. The World Bank Indigenous Knowledge Database

It aims to 'increase and improve the available information on indigenous knowledge, its collection and classification' as well its application. It seeks to facilitate better adaptation of global knowledge to local conditions, to design activities to better serve the country needs and to share IK through 'South-to-South' exchange. The Internet site goes on to list 50 documents detailing indigenous practices and asks for further contributions, comments and criticisms (http://www.worldbank.org/)

1. The Centre for Indigenous Knowledge in Agriculture and Rural Development (CIKARD) of Iowa state University. CIKARD is the foremost research and knowledge collection organisation in this field, and frequently publishes in the Indigenous Knowledge Development Monitor. This organisation focuses its efforts on 'preserving and using the local knowledge
of farmers and other rural people around the globe.'It acts as a global clearinghouse for collecting, documenting, and disseminating information on indigenous knowledge of agriculture, natural resource management, and rural development. In addition it formulates agricultural and natural resource management policies and designs technical assistance programs based on indigenous knowledge.

2. **The Centre for International Research and Advisory Network.** (CIRAN). This organisation hosts pages for the Indigenous Knowledge and Development Monitor, online version. In addition, CIRAN hosts the 'Indigenous Knowledge Homepage'. This is a site that searches indexes and makes available all relevant information on the Internet pertaining to indigenous knowledge, including papers, journals, mailing lists and Usenet groups.

3. **The International Development Research Centre.** (IDRC). The mandate of IDRC is to 'help researchers and communities in the developing world find solutions to their social, economic, and environmental problems. IDRC connects people, institutions, and ideas to ensure that the results of the research it supports and the knowledge that research generates, are shared equitably among all its partners, North and South.' IDRC and its collaborative networks offer access to huge amount of information IK.

4. **The Centre for World Indigenous Studies.** This organisation is 'dedicated to wider understanding and appreciation of the ideas and knowledge of indigenous peoples and the social, economic and political realities of indigenous nations. It also operates the Fourth World Documentation Project (FWDP) whose aim is ' to present the online community with the greatest possible access to Fourth World documents and resources.'

**INDIAN INITIATIVES**

It takes about five to seven years to oppose a granted patent at the international level and the process costs about Rs3 crore per case. Thus, the
country has lost over 15,000 patents of medicinal plants to the West. So Govt and Non-Govt organisations took many initiatives to avoid these problems.

**Government’s Effort in Documentation**

On 2 February 2009 the Indian government granted access to its Traditional Knowledge Digital Library (TKDL), a unique database that houses the country’s traditional medical wisdom, to examiners at the European Patent Office (EPO) to use the extensive database to prevent "bio-piracy".

The TKDL is the result of a US$ 2 million joint project between five Indian government organisations, including the Council of Scientific and Industrial Research (CSIR), the National Institute of Science Communication and Informative Resources (NISCAIR), Indian Council of Agricultural Research (ICAR), the Technology Information Forecasting Assessment Council (TIFAC) and the health ministry’s department of AYUSH (Ayurveda, yoga and naturopathy, unani, siddhi and homeopathy). An eight years rigorous effort resulted into the database that lists over 200,000 treatments and extends to 30 million pages. The vast data base encompasses of 54 authoritative textbooks on ayurvedic medicine, Nearly 150,000 ayurvedic, unani and siddha medicines, and over 1,500 physical exercises and postures in yoga, more than 5,000 years old.

**Methodology used for TKDL**

Slokas from ayurvedic texts are first identified. Each sloka is read and converted into structured language using Traditional Knowledge Resource Classification (TKRC). TKRC is innovative in itself. The TKRC classification has been evolved for about 5000 subgroups as against one group in file International Patent Classification (IPC) for traditional knowledge. The TKDL portal would be based on XML standards and would be platform-independent. The codes for each sloka are fed into a data entry screen and also saved on the database. Computer-savvy ayurveda experts carry out the data entry.

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18 AyurvedNews.com, Protecting India’s Traditional knowledge From Patent Piracy, February 11th 2009
19 27-%20R--current%20science%20biopiracy
These are then decoded in different languages. The ayurvedic formulations can be presently decoded in English, French, German, Hindi, Japanese and Spanish. In future, it would be available in 20 foreign languages and all Indian languages. The decoded format of the formulation is easy to read and understand, even by the layman.

The web version of TKDL would include a web-based search interface. This would provide for a full text search and retrieval of traditional knowledge information on IPC and keywords in multiple languages. TKRC would be an integral part of TKDL, and would provide a background on ayurvedic concepts, definitions and scientific basis of Indian systems of medicine. In addition, it would carry information on practitioners, hospitals and dispensaries. There are several search features incorporated in the format.

According to V. K. Gupta, Director of National Institute of Science Communication, the TKDL software developed in-house does not do transliteration but it does smart translation. Once abstracted, data from the slokas are converted into several languages using Unicode meta data methodology. The software developed can perform smart translation of botanical names and ayurvedic descriptions from traditional terminology into modern terminology. Examples of this are ‘Kumari’ to ‘Aloe Vera’, or ‘Mussorika’ to ‘small pox’, etc.

**Basic Functions of TKDL**

Protects Prior Art:

The TKDL allows examiners to compare patent applications with existing traditional knowledge. New patent applications need to demonstrate significant improvements and inventiveness compared to prior art in their field. If the medical use of an herb is a traditional practice, and thereby public knowledge, it is considered prior art under EPO regulations.

Highlights the gray literature:

The TKDL is so precise that it lists the time, place and medium of publication for prior art. This new catalogue system, called the Traditional
Knowledge Resource Classification (TKRC), ensures meticulous documentation.

**Non Government Organisation’s Effort**

Various Non Governmental Organisations are also playing active roles in developing database and bringing the local art and culture on the national and international scenario.

1. Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) is a grassroots NGO working primarily in arid and semi-arid areas of Gujarat. SRISTI has developed a national network of NGOs, local communities, local government, scientists, State Administration and Forest Department working towards conservation of biological diversity and indigenous knowledge. SRISTI has initiated a global network of grassroots organisations and individuals via the "Honey Bee Network" which is operational in 71 countries to date. Through the Internet as well as otherwise, member organisations and individuals have contributed to the database on indigenous knowledge and provide information on developing resource management strategies, techniques for value addition and marketing etc. SRISTI believes that adding value to indigenous knowledge will help local communities co-exist with biodiversity resources by reducing primary extraction, generating long-term benefits, and thus enhancing sustainable use.

SRISTI has developed a rich database of information on biodiversity as well associated indigenous knowledge, innovations and common property resource institutions. The database on indigenous knowledge and innovations contains thousands of uses of plants by farmers, pastoralists and others for crop protection, medicinal use, and veterinary disease control, among others.

2. RUPAYAN an NGO promoted by late Komal Kothari of Rajasthan is playing an important role in preserving and recognising rich heritage of art and culture of Marwar region of Rajasthan.

3. Gujarat Grassroots Innovations Augmentation Network(GIAN) is a Not-For-Profit society. Its aim is to promote, organize and conduct programmes,
schemes or activities to scout, document, augment innovations by small farmers, artisans, pastoralists etc., primarily in disadvantaged rural areas. IIM-Ahmedabad is providing institution building support to GIAN and SRISTI is providing access to its data base of innovations and also other logistical help.

4. In Sri Lanka, an independent institute named ECO is promoting a consortium of NGOs to work on eco-agriculture and cosmovision. This group includes representatives of government extension services, universities, banks as well as regional development authorities. A documentation of indigenous farming knowledge, including technical and spiritual practices, is in process and an astrological farming calendar is being compiled. - (Upawansa 1999)

LEGISLATIVE EFFORTS

India has taken various legislative steps from time to time in the form of new laws and amendment of older Acts, which has been discussed briefly.

Patent (Amendment) Act, 2002:

The Patents (Amendment) Act, is an amendment to the Patents Act, 1970. This Act makes the Indian patent law not only TRIPs compliant but also incorporates safeguards for protection of public interest, national security, biodiversity, traditional knowledge, etc. The opportunity has also been utilised to harmonise the patent granting procedures with international practices and to make the system user friendly.\(^{20}\)

The provisions supportive to Traditional knowledge those have been either amended or incorporated are such as:

Section 3 of the Act has been modified to include exclusions permitted by TRIPS Agreement and also subject matters like discovery of any living or non-living substances occurring in nature in the list of exclusions which in general do not constitute patentable inventions and also to specifically exclude the inventions which in effect are traditional knowledge [Sec 3(p)].

\(^{20}\) IPA_amendment_2002_min_of_commerce.pdf
“Disclosure of the source and geographical origin of the biological material in the specification, when used in an invention” [Section 10.4(d)] while applying for patents in India are needed.

25.1(j) states that the complete specification does not disclose or wrongly mentions the source or geographical origin of biological material used for the invention, would be as grounds for opposition and for revocation of the patents.

Protecting traditional knowledge from being patented, 25.1(k) states that the invention so far as claimed in any claim of the complete specification is anticipated having regard to the knowledge oral or otherwise, available within any local or indigenous community in India or elsewhere, as one of the grounds for opposition or revocation of the patent.

Protection of Plant Varieties and Farmer's Rights Act, 2001:

According to the Article 27.3(b) of Trips Agreement, Members may exclude from patentability: plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof, on the basis of this India opted for a *sui generis* system. India's Act No. 53, 2001 is to provide for the establishment of an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants.21

Justification of The Act:

In a way to justify the act it has been considered necessary to recognize and protect the rights of the farmers in respect of their contribution made at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties; and it has been considered necessary to protect plant breeders' rights to stimulate investment for research and development, both in the public and private sector, for the

development of new plant varieties, for accelerated agricultural development in the country; and also such protection would facilitate the growth of the seed industry in the country which would ensure the availability of high quality seeds and planting material to the farmers; and to give effect to the aforesaid objectives, it is necessary to undertake measures for the protection of the rights of farmers and plant breeders.

The act recognises the farmer’s rights in many ways. Such as:

(1) Farmer engaged in the conservation of genetic resources of land races and wild relatives of economic plants and their improvement through selection and preservation shall be entitled for recognition and reward from the Gene Fund [Section 39.1 (iii)], and the benefit sharing will be determined according to the extent and nature of the use of genetic material of the claimant in the development of the variety relating to which the benefit sharing has been claimed and the commercial utility and demand in the market of the variety relating to which the benefit sharing has been claimed [Section 26 (5)].

(2) Farmer shall be deemed to be entitled to save, use, sow, resow, exchange, share or sell his farm produce including seed of a variety protected under this Act in the same manner as he was entitled before the coming into force of this Act: Provided that the farmer shall not be entitled to sell branded seed of a variety protected under this Act [Section 39.1(iv)].

(3) Breeders are required to disclose in their application for registration, a complete passport data of the parental lines from which the variety has been derived along with the geographical location in India from where the genetic material has been taken and all such information relating to the contribution, if any, of any farmer, village community, institution or organization in breeding, evolving or developing the variety [Section18.1(e)], failure to which is subjected to rejection.

(4) On receipt of copy of the certificate of registration, the Authority shall publish such contents of the certificate and invite claims of benefit sharing to the variety registered under such certificate, and if any
person or group or firm or governmental or nongovernmental organization claiming its contribution to the evolution of the registered variety found valid, the breeder would be required to pay compensation to the National Gene Fund (Section 26).

**Biological Diversity Act, 2002:**

Following convention on Biological Diversity, the Bio-Diversity Act 2002 was promulgated in the parliament, followed by the establishment of National Bio Diversity Authority, in 2003. The operation of National Biodiversity Authority occurs at three levels.

1. National Level
2. State Level
3. Village Level

India became one of the signatories to the CBD convention held at Rio de Janerio way back on the 5th day of June, 1992. The Act No. 18, 2003 is an act to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.\(^{22}\)

According to the section-4 of Bio-Diversity Act 2002, “No person shall, without the previous approval of the National Biodiversity Authority, transfer the results of any research relating to any biological resources occurring in, or obtained from, India for monetary consideration or otherwise to any person who is not a citizen of India or citizen of India who is non-resident or a body corporate or organization which is not registered or incorporated in India or which has any non-Indian participation in its share capital or management.”

In sum, Farmers’ Rights are a moral but largely rhetorical recognition of the contribution of farmers to the world’s stock of genetic resources, and they provide only a limited mechanism to share benefits from using crop genetic resources or to promote their conservation.\(^{23}\)

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22 [bio_div_act_2002.pdf](#)
23 [CAPRI WORKING PAPER NO.36 Farmers’ rights and protection of traditional agricultural Knowledge By Stephen b. Brush](#)
CHAPTER – 6

Research Methodology
CHAPTER 6

RESEARCH METHODOLOGY

The study aims at exploring the potentials and finding the means and ways of promoting the traditional knowledge by developing effective policy recommendations for the achievement of benefit sharing of the traditional knowledge holders of India in particular and the world population in general. The broad aspects of research methodology are briefly given below:

Nature of the Study

The nature of this study is characterized by the following features-

1. Descriptive Research.
2. Applied Research
3. Empirical research
4. Exploratory research

A. Descriptive Research

As the major purpose of this research is the description of the state of affairs as it exists. This research has been put into the descriptive research category. It aims at obtaining the information on people's attitudes towards the acknowledgement of the contribution of traditional knowledge. The management of traditional knowledge is socially oriented and leads to the improvement of quality of life and supplies better amenities to mankind in keeping with the growing and varied requirements of the society.

Being a descriptive research, it tries to identify the complex human behavior and the set patterns in it over which there is no control of the researcher. A descriptive research may not make a critical evaluation as an Analytical research can do. However the human intelligence has led to the development of logical and systematized techniques being reasonably accurate in studying social phenomena. Individually human beings may be unpredictable, but collectively they tend to be reasonably accurately
predictable. Advancements in descriptive research methods have increased the accuracy of predictions considerably.

**An Applied Research**

As the research aims at finding a solution for an immediate problem facing a society it has been categorised under the heading of Applied research. A research in marketing is required to have a bias for application as D. S. Tull and D. I. Hawkins, state in the very first line of their book ‘Marketing Research’- “Marketing Research serves a single purpose that of providing information to assist marketing managers and the executives to whom they report to make better decisions”. Therefore, in spite of keeping the study wide enough and exploratory in nature, an attempt has been made to relate each aspect of the study with a managerial decision based on it. Each of the hypotheses is related with a management action. This enhances the value of the research beyond the fundamental research.

**It Relies on Empirical Evidence**

Most of the times relying on experience and observations has been preffered over relying solely on theory, or research has been done without giving due regards for the system and theory. It is data based research, coming up with conclusions which is capable of being verified by observations and especially when the available information is insufficient, the empirical study is the only way to get it.

In this particular case also, lack of sufficient written information on various use of traditional techniques has been the main reason for preferring an empirical study. An extensive survey in the four East and North Indian districts/ cities has been conducted and it is expected that the results may necessitate the changes in the presently held opinions and help in building a new theory altogether.

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An Exploratory Research

The approach of the study is exploratory in the sense that it is mostly directed towards the development of hypothesis rather than their testing. This approach is generally followed for new areas of investigations where the problem itself may not be very clear and is needed to be diagnosed. The domain of the research is also required to be reasonably wide but properly specified.

This approach was thought necessary for this study in view of the emerging needs of the present condition of traditional knowledge holders in general and in few specified fields such as herbal medicine, agriculture sector in particular. Neither is the herbal medicines industry well defined in India, nor do we get enough examples of studies in this area.

The exploratory nature has necessitated keeping the coverage of the study wide enough to cover all dimensions of the contribution of traditional knowledge.

Research Approach

As the research is concerned with qualitative phenomenon, i.e., phenomenon relating to or involving quality or kind is has been categorized as a qualitative research. This research aims at discovering the mindset of general public regarding traditional knowledge, using in depth interviews for the purpose. Applying qualitative research is relatively a difficult job and needs some more experience and observations.

This approach can further be specified as inferential approach, as this research forms a data base from which characteristics or relationships of population has been inferred. This means survey research where a sample of population is questioned to determine its characteristics, and is then inferred that the population has the same characteristics.

An advantage of this approach is that it brings the researcher and the respondent face to face and their cooperative efforts help to build up a better research database. Personal contact enables the researcher to use his
intelligence to elicit precise information from them and analyze the data in the light of his experience. In fact it establishes a liaison between the research laboratories and field situations and stimulates research both ways.

This approach involves considerable time and effort in field investigations and requires sampling, questionnaire design, questionnaire administration and data analysis. The approach that has been decided to be used in this survey is structured and direct using personal interview method.

The research is also concerned with subjective assessment of attitudes, opinions and behavior. Research here is also a function of researcher's insights and impressions. This research approach has generated results in non quantitative form or in the form which are not subjected to rigorous quantitative analysis.

**Area selection and scope determination**

Covering the whole area being enriched with the contribution of traditional knowledge was not possible in the study due to time and cost constraints. The study has been divided into two parts.

Firstly a step has been taken towards achieving the goal of finding out the important areas where the contribution of Traditional Knowledge is very high or the areas highly enriched with traditional knowledge by conducting a survey at Aligarh district of UP. This study aimed to use primary cross-sectional data to identify the areas in which the use of traditional knowledge is very high. And also the areas in which the contribution of ITK is high in enriching the fields. Using stratified random sampling, 180 participants were selected to take part in this study, and data were collected through a structured questionnaire by interviewing the selected participants.

The areas that have been highly voted in favour of high use of traditional knowledge are listed below.

1. Agriculture
2. Herbal Medicine
3. Handicraft
Secondly an attempt is made in the current study to identify various traditional tools used for agricultural operations, traditional pest management practices, seed selection practices etc. by the farmers in coastal districts of Orissa namely Jajpur and cuttack districts. For this purpose Using stratified random sampling, 180 participants were selected to take part in this study and data were collected through an open ended structured questionnaire and it has been filled by the researcher herself through Participatory Rural Appraisal (PRA) tools like observation, Individual (One to one) discussion, Focus Group Discussion (FGD).

For the purpose of drawing conclusions and testing of hypothesis, the following methods were used in the process of data analysis:

1. percentage calculation for different parameters
2. Rank coefficient using the ranks and multiplying them with the appropriate weightage-coefficients rank wise
3. Rating scores for Likert scale analysis by multiplying the frequencies with the appropriate weightage-coefficients

T test for significance test

Hypotheses formulation

After understanding and rephrasing the research problem into meaningful terms from an analytical point of view i.e., the formulation of a general topic into a specific research problem, the researcher undertook literature survey connected with the problem. On the basis of knowledge gathered from the literature survey the researcher formulated working hypotheses i.e., tentative assumptions made in order to draw out and test its logical or empirical consequences.

Hypothesis for Chapter-6

The views between the respondents regarding the level of use of traditional knowledge in agricultural and herbal medicinal sector vary significantly.
(Ho1): There is a distinct level of use of TK in agriculture as perceived by the
respondents of age group 1 of various professions.

(Ho2): There is a distinct level of use of TK in herbal medicine as perceived by
the respondents of age group 1 of various professions.

(Ho3): There is a distinct level of use of TK in handicraft as perceived by the
respondent of age group 1.

Hypothesis 4 (Ho4): There is a distinct level of use of TK in agricultural sector
as per the respondents of various professions perceptions of age group 2 (25-
35).

Ho5: There is a distinct level of use of TK in herbal medicinal sector as
perceived by various respondents of various professions of age group 2.

Hypothesis 6 (Ho6): There is a distinct level of use of TK in handicraft sector
as perceived by various respondents of age group 2.

Hypothesis 7 (Ho7): There is a distinct level of use of TK in agriculture as
perceived by the respondents of age group 3 (25-35) of various professions.

Hypothesis 8 (Ho8): There is a distinct level of use of TK in herbal medicine
as perceived by the respondents of age group 3 (25-35) of various
professions.

Hypothesis 9 (Ho9): There is a distinct level of use of TK in handicraft sector
as perceived by the respondents of age group 3 of various professions.

Hypothesis 10 (Ho10): There is a distinct level of use of TK in agriculture as
perceived by the respondents of age group 4 (45 & above of various
profession.

Hypothesis 11 (Ho11): There is a distinct level of use of TK in herbal
medicine as perceived by the respondents of various professions of age
group 4 (45 & above).

Hypothesis 12 (Ho12): There is a distinct level of use of TK in handicraft as
perceived by the respondents of age group 4 of various professions.
Hypothesis 13 (Ho13): There is a distinct level of use of TK in agriculture as expressed by respondents of various professions belonging to rural area.

Hypothesis 14 (Ho14): There is a distinct level of use of TK in herbal medicine as expressed by respondents of various professions form rural area.

Hypothesis 15 (Ho15): There is a distinct level of use of TK in handicraft sector as perceived by various respondents of different professions of rural area.

Hypothesis 16 (Ho16): There is a distinct level of use of TK in agricultural sector as perceived by various respondents of different professions of urban area.

Hypothesis 17 (Ho17): There is a distinct level of use of TK in herbal medicinal sector as perceived by various respondents of different professions of urban area.

Hypothesis 18 (Ho18): There is a distinct level of use of TK in handicraft sector as expressed by respondents of various professions of urban area.

Hypothesis 19 (Ho19): There is a distinct level of use of TK in handicraft sector as expressed by respondents of various professions of urban area.

Hypothesis 20 (Ho20): There is a distinct level of use of TK in herbal medicine as perceived by the respondents of different professions of semi urban area.

Hypothesis 21 (Ho21): There is a distinct level of use of TK in handicraft as perceived by the respondents of different professions of semi urban area.

Hypothesis 22 (Ho22): There is a distinct level of enrichment in three sectors by traditional knowledge as perceived by respondents of different age groups.

Hypothesis 23 (Ho23): There is a distinct level of enrichment in three sectors by traditional knowledge as perceived by respondents of different profession.

Hypothesis 24 (Ho24): There is a distinct level of enrichment in three sectors by traditional in knowledge as perceived by respondents of different areas.

Hypothesis 25 (Ho25): There is a distinct level of enrichment in agricultural sector as perceived by the respondents of different professions.
Hypothesis for Chapter -8

Ho26: Traditional Agricultural Tools are Easy to handle and cost effective.

Ho27: Traditional seeds and use of pesticides are inversely related.

Ho28: Traditional Agricultural Practices are more sustainable than modern agricultural practices.

Research Design

“A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure”\(^2\) The conceptual structure within which the research has been conducted has been stated below. The pre-requisite for the purpose involves to specify the means of obtaining the information, availability and the skills of the researcher, explanation of the reasoning leading to the selection of obtaining data and evaluate it in terms of time and resource constraints. As such the design includes an outline of what the researcher has done from writing the hypothesis and its operational implications to the final analysis of data.

The design of the structure of the study happens to be in respect of what, where, when, how much, by what means etc. Keeping in view the above, the overall research design has been split into following six stages:

1. Pilot Survey
2. Sample Size Determination
3. Sample Selection
4. Questionnaire Design
5. Field Work
6. Analysis and Testing

Now before we determine the above mentioned variables, it is preferable to prepare a list of the needed information.

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\(^2\) Claire Selltiz and others, Research Methods in Social Sciences, 1962, p. 50.
Information Requirement

After being satisfied with the statement of the research objective the researcher prepares a list of the information which is needed, to achieve the objectives.

1. What is the level of use of Traditional knowledge in various fields?
2. Whether Traditional knowledge helps in enriching the areas?
3. What are the tools being used in agricultural practices?
4. What are the methods of Production traditionally?
5. How do the traditional people control pests and diseases? Etc.

Sources of Data

Other than the secondary sources (published or unpublished) available to provide the relevant information from different websites, government agencies and the libraries the focus in this research is on the primary sources of information which is collected through survey of the following groups of respondents.

1. Students
2. Businessman
3. Service holder
4. Professionals
5. marginal farmers
6. small farmers
7. big farmers
8. old aged people and women engaged in farm activities.

An effort has been made to cover the cross-sections of the above groups. Separate questionnaires have been designed for separate groups of respondents.
Resource-Quantity Compromise

In an ideal world, a field research will involve the personal interviewing of all the individuals who can give relevant information or whose opinion is important. However, a trade-off between ideals and economic reality are inevitable. A number of reasons have been given by Livingstone:

1. Too many people are to be interviewed either in absolute terms or within any reasonable financial budget.
2. It may be impossible to get round all the people who are distantly located.
3. Some people may be unwilling to be interviewed but still might be ready to supply limited information sought in another way than by interview.
4. For indigenous Traditional Knowledge Language also become a constraint

There are of course other reasons but these, as well as three of the four listed above, almost inevitably come down to costs. With an unlimited budget most obstacles can be overcome, but no researcher is ever remotely likely to have an unlimited budget.

The compromise has mainly been done by way of limiting the scope of the study to only Eastern & Northern Zones of the country and a sample has been drawn of a limited number of cities from this. The questionnaire has also been designed to cover only the more relevant questions needed for the study to keep it within the manageable limits. The details of the design variables in the following pages will clearly show the nature of this compromise.

Pilot survey

While trying to prepare a design of the survey, it was thought necessary to conduct a test or pilot survey to ensure the work ability of the design before giving it a final shape. The pilot survey was mainly conducted for three purposes.

1. To determine the sample size.
2. To test the questionnaire.
3. To improve the fieldwork organization.
The most common method of sample size determination requires three kinds of specifications, namely allowable error, confidence coefficient and the estimate of the standard deviation of the population. The first two of these specifications are matters of judgment involving the use of data but the third specification, the estimate of the standard deviation of the population, is the responsibility of the researcher. Sometimes these estimates are available from the previous studies. But no previous study on these marketing aspects could be known that had been conducted for the study under consideration.

In the absence of such sources, one has to go for a pilot survey to estimate the population standard deviation and use it for sample size determination.

Another reason for conducting the pilot survey is to ensure that the questionnaire that has been designed and looks simple and unambiguous to the designer will appear equally so to the respondent. There is, therefore, a strong case for trying out the questionnaire in a pilot survey before the main launch. It can be a humbling experience for the designer to find what can go wrong.

If the researcher is not going to do the entire interview himself, it is useful for him to involve others in the pilot survey, while keeping himself also fully associated with it. This gives a good idea to the researcher of the possible difficulties in the fieldwork of the main survey. This helps the researcher in better fieldwork organization and control.

A small sample of 180 respondents was drawn from the city of Aligarh on convenience basis. It comprised of all the ‘types’ of the consumers i.e. urban, semi-urban and rural. The researcher visited a number of places to administer the first draft of the questionnaire. The problems arising in the field situations were carefully noted. The reactions of respondents to different questions were also carefully noted. The experience led to the modifications in the initial design in the following dimensions.

1. Changing the nature and wordings of some of the questions.
2. Changing the sequence of the questions looking to the level of difficulty.
3. Cutting short the size of the questionnaire by omitting some of the less important questions.

4. Preparing a different instruction set for the investigators.

5. Modifying the fieldwork plan in respect of time and effort requirement.

The analysis of the pilot survey was also done, so as to be used in the sample size determination. This facilitated deciding on the most immediate design variable i.e. sample size determination.

Sample Size determination

The logic of Sampling Distribution gives a relationship as follows-

\[
\text{Number of Standard Errors} = \frac{\text{Allowable Error}}{\text{Implied by Confidence Coefficient}} \text{ Standard Error}
\]

Where Standard Error (defined as Standard Deviation of the Sampling Distribution) of the ‘proportion’ is given by-

\[
\sigma_p = \sqrt{\frac{\pi (1-\pi)}{n}}
\]

The area under the sampling distribution between any two points can be calculated in terms of z-values. The z-value for a point is the number of standard errors a point is away from the mean. The z-values may be computed as follows-

\[
Z = \frac{\bar{X} - \mu}{\sigma_p} = \frac{D}{\sqrt{p(1-p)/n}}
\]

\[
D = p - \pi \quad \text{where Population Proportion} = \pi
\]

\[
\sigma_p = \frac{p - \pi}{z}
\]
Using the above formula, we take confidence coefficient level (CL) of 95%. The corresponding z-value associated with CL is 1.96 and take allowable error to be only 5%.

Thus the sample size calculation is summarized as-

Steps:

1. Level of precision \( D = p - \pi = \pm 0.05 \)
2. Confidence Level (CL) \( CL = 95\% \)
3. z-value associated with the CL \( z = 1.96 \)
4. Standard Deviation of the Population Estimate \( \pi \): \( \pi \) can take various values
5. Sample size \( n = \frac{\pi(1-\pi)z^2}{D^2} \)

Now, whatever the proportions (value of \( p \)), the sample size comes out to be less than 385. It will be more than sufficient to estimate the population proportions with 95 percent confidence, allowing only 5 percent error. Therefore a sample size of 400 has been decided for the study.

Sample Selection

A stratified cross sectional sampling design has been used. Stratification has been done on the basis of the type of city. The following two regions and the types of cities have been included in the study:

Region: 1. Eastern Zone & 2. Northern Zone

Types of cities: 1. Large size cities & 2. Small cities.
In the first stage two cities were selected from each zone i.e. Eastern Zone and Northern Zone. In the second stage respondents have been taken in equal number from each of the cities to ensure sufficient representation of each zone and the selected city. The whole population (Eastern and Northern India) has been divided into two strata (Divisions) of East and North zone. Out of these zones four cities were chosen on convenience basis. Consequently the following selections were made.

<table>
<thead>
<tr>
<th>Zones</th>
<th>Populations*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eastern Zones</strong></td>
<td></td>
</tr>
<tr>
<td>Cuttack</td>
<td>(Large city) 2,341,094</td>
</tr>
<tr>
<td>Jajpur</td>
<td>(Small city) 1,624,341</td>
</tr>
<tr>
<td><strong>Northern Zone</strong></td>
<td></td>
</tr>
<tr>
<td>Delhi</td>
<td>(Large city) 13,850,507</td>
</tr>
<tr>
<td>Aligarh</td>
<td>(Small city) 2,9992,286</td>
</tr>
</tbody>
</table>

* On the basis of census India 2001

This type of stratified sampling is on the one hand, expected to allow representation of all segments of the population in sufficient number and on the other hand facilitate using statistical tests to study the behavioral patterns of the different strata.

**Questionnaire Design**

Collecting information from the sample members, through questionnaire is quite popular in case of big samples as the research scholar has done here. The kind of questionnaire needed is a simple and straightforward one, in a get-up that may retain their interest till the end, a style that may not irritate them and its contents that may not lead to a non-response from them.

Before structuring the questionnaire the researcher has well kept in mind that a good questionnaire is easy to understand, simple to answer, interesting to complete and enjoyable to return. If one wants to design it he needs to know the respondents, their tastes and preferences and their culture.
The final drafts of the questionnaires, as used in the main survey have been included in the annexure.

Questions that put too great a strain on the memory or intellect of the respondent, questions of a personal character, questions related to personal wealth etc., have generally been avoided.

This whole analysis only ensures that the questionnaires are such that respondents can answer the questions correctly, but another equally important aspect is whether they will answer the questions correctly. This aspect calls for an attention to the field work exercise in the process of data collection.

Field Work

Conducting a survey in four cities of two zones requires making a team for the fieldwork. Investigators were required who may be familiar with these cities and who may personally visit these to interview the respondents and get the questionnaire filled up.

There was no difficulty in getting the first survey done at Aligarh and Delhi. This was a favourable factor in the conduct of the survey. For the second questionnaire also the researcher went to her home town and collected data.

The field work was finally completed but only after taking up the third phase of work. The whole exercise proved that the realities are different from theories.

Analysis and Testing of Results

The data after collection has been processed and analysed. The analysis involves converting a series of recorded responses in the questionnaires into descriptive statements and inferences about relationships. The important steps followed in the analysis of this survey are:

1. Editing
2. Coding
3. Classification

4. Tabulation

5. Use of Statistical Tests

Editing has been done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation. Since the questionnaires were fully structured ones, with a very few open-ended questions, the editing was not a very difficult task. The questionnaires found incomplete or illegible were rejected and were replaced by others, arranged in the next phase of the survey.

In the process of coding numerical have been assigned to the answers so that responses can be put into a limited number of categories or classes. Such classes are appropriate to the research problem under consideration. They possess the characteristics of exhaustiveness i.e., there is a specific class for every item and also mutually exclusive which means that a specific answer has been placed in one and only one cell in a given category set. Another rule has been observed that is unidimensionality by which is meant that every class is defined in terms of only one concept.

The research studies resulted in a large volume of raw data which has been reduced into homogenous groups in order to get meaningful relationships. This was a process of arranging data in groups or classes on the basis of common characteristics.

In the tabulation stage, the responses were recorded from the questionnaires to the “Master Chart”. Each row of it showed responses to one questionnaire and the different columns were meant for different questions. This information was further condensed on two charts called summarized tabulation sheets. This is a frequency chart showing the frequency of different answers by different segments of the respondents. Different columns represent the question number and the rows represent the codes of alternative answers, segment-wise.
This is followed by making individual tables for each aspect of the study and a few for cross analysis relating those aspects with background factors like profession, age, home town etc.

For the purpose of drawing conclusions and testing of hypothesis, the following methods were used in the process of data analysis:

1. Percentage calculation for different parameters
2. Rank coefficient using the ranks and multiplying them with the appropriate weightage-coefficients rank wise
3. ‘t’ test for significance test
CHAPTER – 7

Quantitative Analysis of Traditional Knowledge
CHAPTER-7

QUANTITATIVE ANALYSIS OF PRIMARY DATA

The beginning of 'agriculture' marks the beginning of 'civilized' or 'sedentary' society. Climate change and increase in population 10,000 BC onwards led to the evolution of agriculture. During the Bronze Age (9000 BC onwards), domestication of plants and animals transformed the profession of the early homo sapiens from hunting and gathering to selective hunting, herding and finally to settled agriculture. Eventually the agricultural practices enabled people to establish permanent settlements and expand urban based societies. Cultivation marks the transition from nomadic pre-historic societies to the settled Neolithic lifestyle sometime around 7000 BC. The contribution of agriculture and allied activities to India's economic growth in recent years has been no less significant than that of industry and services. The importance of agriculture to the country is best summed up by this statement: "If agriculture survives, India survives".

With the passage of time people are trying to exploit this nature through modern technology in one hand and on the other hand think traditional knowledge as out dated. To bring the people out of this mirage rigorous research work is needed along with positive sensitization after finding out their stage of colonization and perception about Indigenous Traditional knowledge.

A step has been taken towards achieving the goal by conducting a survey at Delhi and Aligarh district of UP. This study aimed to use primary cross-sectional data to identify the areas in which the use of traditional knowledge is very high. And also the areas in which the contribution of ITK is high in enriching the fields.

By analyzing the data collected, we arrived to the following conclusions.

1 http://www.agriculturalproductsindia.com/agro/history.html
Profession Wise Analysis

Taking all the respondents in favor of high level of use of TK, into consideration we find that there are five sectors which have very high level of use of traditional knowledge.

This study aimed to use primary cross-sectional data to identify the areas in which the use of traditional knowledge is very high. And also the areas in which the contribution of ITK is high in enriching the fields. Using stratified random sampling, 180 participants were selected to take part in this study, and data were collected through a structured questionnaire by interviewing the selected participants.

By analyzing the data collected, we arrived to the following conclusions.

Profession Wise Analysis

Taking all the respondents in favor of high level of use of TK, into consideration we find that there are five sectors which have very high level of use of traditional knowledge.

The highest percentage of business class (i.e 29%) favored to herbal medicine and tourism made its share equally (i.e 29%). Agriculture was chosen as a field having very high level of use of traditional knowledge by second highest percentage of business class (i.e 26%) which contributes almost one quarter of the whole class. But by tabulating the views of service sector we arrived to the points that according to 28% of them (that is the highest percentage of service holder having the same view) favored to agriculture and herbal medicine also got the same percentage of service class, which is followed by 26%, favoring to music. Only 10% and 8% respondents of this cluster favor to handicraft and tourism respectively. Equal no of professional respondents (22%) which is highest among them, brought herbal medicine, agriculture and tourism in the first place in accordance with very high level of use of traditional knowledge. Rest 19% favored to music and least 8% to handicraft. Farmers who can be categorized to some extent as the sole proprietor of traditional knowledge, voted to herbal medicine and agriculture,
21% each, placing them at first position having very high level of use of traditional knowledge. According to 20% farmer music has very high level of use and same is the case of tourism. Handicraft attracted only 18% farmers. Agriculture and music each attracted highest percentage of students i.e. 22% each in placing them at first place as of very high level of use of traditional knowledge in them. 2nd highest students i.e. 21% favored to herbal medicine and handicraft & tourism took their place at 3rd no. by getting favor of only 17.5% each. Retired/Housewife who are generally confined to home, favored highest in no. i.e 26% to herbal medicine which is followed by 21% to each handicraft, agriculture and music. The very high level of use of Traditional knowledge in Tourism is favored by a least i.e. 7% of retired/housewife.

Here it can be concluded that from the point of view of all the classes except retired/house wives, in agriculture there is a very high level of use of traditional knowledge. Herbal medicine took the second highest favor followed by handicraft.

Sector-Wise Analysis

It also has been analyzed, sector wise that what the combination of proportions of respondents, varying professions favoring to the sector as of very high level of use of traditional knowledge. Handicraft as a sector having very high level of use of traditional knowledge constitute proportion such as 24% farmer as well as 24% retired/housewife, followed by 22 students, 16% professionals, 8% service holders & rest 6% business class. In case of herbal medicine also farmers lead having 20% followed by retired/house wives (19%). Students’ share stood 3rd i.e. 17%. 16% professionals were there and rest 28% constitute business and service holder as 50-50. Agriculture is also the field in which farmer’s share is highest i.e. 20% followed by 19% students. Both professionals and retired/house wives are of 16% each. Service holder & business class constitute 15% & 14% respectively. Tourism is the sector which is least favored by service holder i.e. 5%. Retired/house wives were also not much favoring as shown by figure i.e. only 12%. Both business as well as student class constitute 19% each. Farmers are the highest supporter having 24% followed by 21% professionals. Very high level of use of traditional
knowledge in music was highly favored by both students and farmers constituting 22% each. Which was followed by 19% retired/house wives and 16% service holder as well as professionals. Business class shared only 5%.

By analyzing the data sector wise we came to the conclusion that people favored to their own profession more as the use of traditional knowledge such as farmer favored highly to agriculture.

Areas Highly Enriched By Traditional Knowledge

This was all about the high level of use of traditional knowledge. But what matters more is that whether the contribution of traditional knowledge is there in enriching the said areas. This has also been analyzed on the basis of the views of the respondents.

According to 47% business class agriculture is the area in which traditional knowledge have played the greatest role in enriching the said field followed by 40% to herbal medicine and only 13percentage to tourism. In case of service sector 50% favored to agriculture as highly enriched by traditional knowledge and the rest 50% constituted as herbal medicine36%, tourism and music 7% each. More than 50% (53%) professionals favored to herbal medicine followed by 40% to agriculture. Rest 7% goes to handicraft. The majority of farmers (36%) favored to their own field i.e. handicraft followed by 29% to agriculture. Herbal medicine constituted 21% followed by 14%.Students who are in the process of acquiring knowledge, highly favored to agriculture i.e. 60% followed by 33% students to handicraft. In 3rd position comes agriculture with 7% vote by students. Retired/house wives who are busy in household chores, supported handicraft by 54% vote. From the rest 31% goes to herbal medicine & agriculture come in the 3rd position having 15% supports from retired/house wives.

Age Wise Analysis

By analyzing the views of the respondents having clusters of different age groups we came to the conclusion that about half of the respondents having age group 15-25 are of the view that traditional knowledge plays an
important role in enriching herbal medicine. Rest fifty-fifty were in favor of agriculture and handicraft. Where as more than 50% of respondents having age group 25-35 are of their opinion that agriculture is the area which has been highly enriched by traditional knowledge. 35% respondent having this age-group support to herbal medicine and a very few are of the opinion that traditional knowledge plays an important role in handicraft sector. The highest respondents (44%) of the age group 35-45 favored to agriculture as highly enriched by traditional knowledge followed by a little lower second highest to herbal medicine where as handicraft was least favored. In case of respondents belonging to the age group 45& above, 38% gave their opinion in terms that agriculture is the area where the contribution of traditional knowledge is very high in enriching the field. It was followed by 34% respondents favoring to handicraft and 28% to herbal medicine.

On the whole by analyzing age wise, the contribution of traditional knowledge in the said fields we can conclude that the age group 15-25 which is on the very early stage of experiencing the life are in favor of herbal medicine giving a more skewed graph, where as the age group 25-35 & 35-45 who have to some extend lived the 50% of their life and are quite energetic as well as enthusiastic are in favor of agriculture, gave a more to less skewed graph respectively. But the age group 45 & above which has the highest experience of life and everything gave there view with a more normal figure where agriculture leads in being enriched by traditional knowledge and is followed by a little less respondents in favor of handicraft and further a little less in favor of herbal medicine.

**Location Wise Analysis**

As area wise analysis is very important to draw any conclusion about the contribution of traditional knowledge in enriching any area we divided the whole segment into thee categories such as urban, rural and semi urban. According to 40% rural respondents agriculture is the area which is highly enriched by traditional knowledge, followed by 34% supporting to handicraft and 26% to herbal medicine, where as 50% urban respondents are in favor of agriculture, followed by 41% to herbal medicine and the rest few to i.e. 9% to handicraft. By
taking into consideration the view of the semi-urban respondents we found that 43% respondents are in favor of agriculture, followed by 35% to herbal medicine and rest 22% to handicraft.

By concluding the area wise analysis we reached at the points that rural people who are generally the warden of traditional knowledge gave their response showing a quite normal curve in which agriculture stands first followed by handicraft and herbal medicine in 2nd and 3rd position respectively, with a very little differences where as urban respondents who are generally considered as commercial minded drew a quite skewed graph favoring highly to agriculture i.e. by 50% and is followed by still a larger portion to herbal medicine and the rest few to handicraft. Semi urban population placed first to agriculture followed by herbal medicine. Handicraft got though a little vote in its favor by semi urban group still higher in comparison with urban population.

Now by taking into consideration the whole no of supporters to agriculture, herbal medicine and handicraft, as the areas highly enriched by traditional knowledge. The support come 46% in figure which is followed by 32% to herbal medicine & rest 22% to handicraft. So the final reference can be drawn from the above analysis is that agriculture is the area which has been highly enriched by traditional knowledge.

And from this analysis the data has further been filtered and minimised covering Agriculture, Herbal Medicine and Handicraft for further deep understanding with the help of t test, rank co-efficient etc.

**Age Group wise Analysis**

Table 1.1 shows that there is a significant difference between the views of the respondents of different professions of age group 1 (15.25). In other words according to the responses of different professions of age group 1, the level of use of TK is different in the sector of agriculture.
Table 1.1

Level of use of TK in Agriculture as expressed by various professions of age group 1 (15-25)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Students</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>Inf</td>
<td>Significant</td>
<td>6</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>Inf</td>
<td>Significant</td>
<td>6</td>
</tr>
<tr>
<td>Service</td>
<td>Student</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Inf</td>
<td>Significant</td>
<td>10</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Inf</td>
<td>Significant</td>
<td>10</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>6</td>
</tr>
</tbody>
</table>

As a result we accept the null hypothesis (Ho1): there is a distinct level of use of TK in agriculture as perceived by the respondents of age group 1 of various professions.

Table 1.2

Level of use of TK in herbal medicine as expressed by various professions of age group 1 (15-25)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Students</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>6</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>6</td>
</tr>
<tr>
<td>Service</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>10</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>10</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 1.2 shows that there is no significant difference between the views of the respondents of different professions of age group 1 or according to the responses of different professions of age group 1, the level of use of TK in herbal medicine is not significant.

As a result we reject the null hypothesis 2 (Ho2): There is a distinct level of use of TK in herbal medicine as perceived by the respondents of age group 1 of various professions, and accept the alternate hypothesis 2 that
(H₂): There is no significant difference in the level of use of TK in herbal medicine as perceived by different professions of age group 1.

**Table 1.3**

**Level of use of TK in Handicraft as expressed by various professions of age group 1 (15-25)**

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Students</td>
<td>1.5</td>
<td>0.5</td>
<td>1.25</td>
<td>0.433</td>
<td>0.412</td>
<td>0.816</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>1.5</td>
<td>0.5</td>
<td>1.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
<td>Non-sig.</td>
<td>6</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.354</td>
<td>1.732</td>
<td>Non-sig.</td>
<td>6</td>
</tr>
<tr>
<td>Service</td>
<td>Student</td>
<td>1.5</td>
<td>0.5</td>
<td>1.25</td>
<td>0.433</td>
<td>0.412</td>
<td>0.816</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.337</td>
<td>1.054</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>0.5</td>
<td>0.354</td>
<td>1.732</td>
<td>Non-sig.</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 1.3 also shows the rejection of null hypothesis 3 (Ho3): There is a distinct level of use of TK in handicraft as perceived by the respondent of age group 1. And the alternate hypothesis 3 (H₃): There is no significant difference in the responses of various professions of age group 1, regarding the level of use of TK in handicraft sector, is accepted.

Hypothesis 4 (Ho4): There is a distinct level of use of TK in agricultural sector as per the respondents of various professions perceptions of age group 2 (25-35).

**Table 2.1**

**Level of use of TK in Agriculture as expressed by various professions of age group 2 (25-35)**

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>1.25</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.233</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Businessman</td>
<td>Student</td>
<td>1.25</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.233</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>18</td>
</tr>
<tr>
<td>Serviceman</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.091</td>
<td>0.287</td>
<td>0.222</td>
<td>0.746</td>
<td>Non-sig.</td>
<td>26</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.091</td>
<td>0.287</td>
<td>0.171</td>
<td>0.968</td>
<td>Non-sig.</td>
<td>30</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.091</td>
<td>0.287</td>
<td>0.192</td>
<td>0.864</td>
<td>Non-sig.</td>
<td>28</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>12</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
</tbody>
</table>
The null hypothesis appears to be rejected as the table 2.1 shows that there is no significant difference in the responses of respondents of various professions of age group 2, regarding the level of use of TK in Agricultural sector. Hence it leads to the acceptance of alternate hypothesis (H14): There is no significant difference in the level of use of TK in Agricultural sector as per the perceptions of the respondents of various professions of age group 2.

Hypothesis (Ho5) : There is a distinct level of use of TK in herbal medicinal sector as perceived by various respondents of various professions of age group 2.

Table 2.2 clearly rejects the null hypothesis thus accepting the alternate hypothesis (H15): There is no significant difference in the opinion of various respondents of different professions of age group 2 regarding the level of use of TK in herbal medicine.

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>Non-sig</td>
<td>14</td>
</tr>
<tr>
<td>Businessman</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>Non-sig</td>
<td>18</td>
</tr>
<tr>
<td>Serviceman</td>
<td>Student</td>
<td>1.333</td>
<td>0.471</td>
<td>1.182</td>
<td>0.386</td>
<td>0.292</td>
<td>0.782</td>
<td>Non-sig</td>
<td>26</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.182</td>
<td>0.386</td>
<td>0.198</td>
<td>1.443</td>
<td>Non-sig</td>
<td>30</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.333</td>
<td>0.471</td>
<td>0.212</td>
<td>2.092</td>
<td>Non-sig</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.182</td>
<td>0.386</td>
<td>0.222</td>
<td>1.288</td>
<td>Non-sig</td>
<td>28</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.333</td>
<td>0.471</td>
<td>0.239</td>
<td>1.852</td>
<td>Non-sig</td>
<td>12</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>16</td>
</tr>
</tbody>
</table>

Hypothesis 6 (Ho6) : There is a distinct level of use of TK in handicraft sector as perceived by various respondents of age group 2.
Table 2.3
Level of use of TK in Handicraft as expressed by various professions of age group 2 (25-35)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>2</td>
<td>0.707</td>
<td>1.75</td>
<td>0.829</td>
<td>0.438</td>
<td>0.607</td>
<td>Non-Sig.</td>
<td>14</td>
</tr>
<tr>
<td>Businessman</td>
<td>Student</td>
<td>2</td>
<td>0.707</td>
<td>1.25</td>
<td>0.433</td>
<td>0.335</td>
<td>2.789</td>
<td>Significant</td>
<td>18</td>
</tr>
<tr>
<td>Serviceman</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.273</td>
<td>0.445</td>
<td>0.276</td>
<td>1.445</td>
<td>Non-sig.</td>
<td>26</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>2.4</td>
<td>0.49</td>
<td>1.273</td>
<td>0.445</td>
<td>0.258</td>
<td>6.225</td>
<td>Significant</td>
<td>30</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>2.4</td>
<td>0.49</td>
<td>1</td>
<td>0</td>
<td>0.29</td>
<td>8.548</td>
<td>Significant</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1.75</td>
<td>0.829</td>
<td>1.273</td>
<td>0.445</td>
<td>0.304</td>
<td>1.948</td>
<td>Non-sig.</td>
<td>28</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1.75</td>
<td>0.829</td>
<td>1</td>
<td>0</td>
<td>0.376</td>
<td>2.051</td>
<td>Non-sig.</td>
<td>12</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1.75</td>
<td>0.829</td>
<td>2.4</td>
<td>0.49</td>
<td>0.379</td>
<td>1.95</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 2.3 shows that more than 60% respondents of various professions of age group 2 go in favour of no significant difference in the opinion regarding the level of use of TK in handicraft sector. Hence the null hypothesis is rejected leading to the acceptance of alternate hypothesis i.e. (H16): There is no significant difference in the level of use of TK in handicraft as perceived by various respondents of distinct professions of age group 2.

Hypothesis 7 (Ho7) : There is a distinct level of use of TK in agriculture as perceived by the respondents of age group 3 (25-35) of various professions.

Table 3.1
Level of use of TK in Agriculture as expressed by various professions of age group 2 (35-45)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>1.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.295</td>
<td>2.309</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1.167</td>
<td>0.373</td>
<td>1.286</td>
<td>0.452</td>
<td>0.254</td>
<td>0.697</td>
<td>Non-sig.</td>
<td>24</td>
</tr>
<tr>
<td>Farmer</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.279</td>
<td>1.47</td>
<td>Non-sig.</td>
<td>18</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1.167</td>
<td>0.373</td>
<td>0.253</td>
<td>1.033</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Serviceman</td>
<td>1.5</td>
<td>0.5</td>
<td>1.286</td>
<td>0.452</td>
<td>0.271</td>
<td>1.103</td>
<td>Non-sig.</td>
<td>24</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.5</td>
<td>0.5</td>
<td>1.167</td>
<td>0.373</td>
<td>0.27</td>
<td>1.773</td>
<td>Non-sig.</td>
<td>22</td>
</tr>
</tbody>
</table>
Table 3.1 shows that the difference in the opinion is not significant. So it leads to rejection of null hypothesis Ho7 and acceptance of alternate hypothesis 7 (H17), which say there is no significant difference in the level of use of TK in agriculture as perceived by the respondents of age group 3 of various professions.

Hypothesis 8 (Ho8): There is a distinct level of use of TK in herbal medicine as perceived by the respondents of age group 3 (25-35) of various professions.

Table 3.2 shows a 1:2 ratio of level of significance to non-significance. Hence the null hypothesis is being rejected leading to the acceptance of alternate hypothesis 8 (H18): There is no significant distinction as perceived by different respondents of various professions of age group 3 regarding the use of TK in herbal medicine.

**Table 3.2**

**Level of use of TK in Herbal medicine as expressed by various professions of age group 2 (35-45)**

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>1.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.295</td>
<td>2.309</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1.5</td>
<td>0.5</td>
<td>1.286</td>
<td>0.452</td>
<td>0.271</td>
<td>1.103</td>
<td>Non-sig</td>
<td>24</td>
</tr>
<tr>
<td>Farmer</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.279</td>
<td>1.47</td>
<td>Non-sig</td>
<td>18</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>0.5</td>
<td>0.293</td>
<td>2.309</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Serviceman</td>
<td>1.5</td>
<td>0.5</td>
<td>1.286</td>
<td>0.452</td>
<td>0.271</td>
<td>1.103</td>
<td>Non-sig</td>
<td>24</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.5</td>
<td>0.5</td>
<td>1.5</td>
<td>0.5</td>
<td>0.289</td>
<td>0</td>
<td>Non-sig</td>
<td>22</td>
</tr>
</tbody>
</table>

Hypothesis 9 (Ho9): There is a distinct level of use of TK in handicraft sector as perceived by the respondents of age group 3 of various professions.
Table 3.3

Level of use of TK in Handicraft as expressed by various professions of age group 2 (35-45)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>3</td>
<td>0.816</td>
<td>1</td>
<td>0</td>
<td>0.375</td>
<td>5.657</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1.333</td>
<td>0.471</td>
<td>2.429</td>
<td>0.495</td>
<td>0.274</td>
<td>5.524</td>
<td>Significant</td>
<td>24</td>
</tr>
<tr>
<td>Farmer</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>2.429</td>
<td>0.495</td>
<td>0.292</td>
<td>6.708</td>
<td>Significant</td>
<td>18</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1.333</td>
<td>0.471</td>
<td>0.285</td>
<td>1.633</td>
<td>Non-sig</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Serviceman</td>
<td>3</td>
<td>0.816</td>
<td>2.429</td>
<td>0.495</td>
<td>0.315</td>
<td>2.105</td>
<td>Significant</td>
<td>24</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>3</td>
<td>0.816</td>
<td>1.333</td>
<td>0.471</td>
<td>0.328</td>
<td>5.863</td>
<td>Significant</td>
<td>22</td>
</tr>
</tbody>
</table>

The null hypothesis is being accepted as more than 80% respondents as shown in table 3.3 went in favour of it. Except between farmers and professions of this group, according to all other groups, the distinction of level of use of TK in handicraft is significant.

Hypothesis 10 (Ho10) : There is a distinct level of use of TK in agriculture as perceived by the respondents of age group 4 (45 & above) of various profession.

Table 4.1

Level of use of TK in Agriculture as expressed by various professions of age group 4 (45 & Above)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serviceman</td>
<td>Retired</td>
<td>1.2</td>
<td>0.4</td>
<td>1</td>
<td>0</td>
<td>0.261</td>
<td>1.19</td>
<td>Non-sig</td>
<td>34</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>nan</td>
<td>nan</td>
<td>Non-sig</td>
<td>8</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.2</td>
<td>0.4</td>
<td>0.32</td>
<td>0.97</td>
<td>Non-sig</td>
<td>32</td>
</tr>
<tr>
<td>Farmer</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Nan</td>
<td>Nan</td>
<td>Non-sig</td>
<td>20</td>
</tr>
<tr>
<td>Farmer</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.2</td>
<td>0.4</td>
<td>0.159</td>
<td>1.956</td>
<td>Non-sig</td>
<td>44</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Nan</td>
<td>Nan</td>
<td>Non-sig</td>
<td>18</td>
</tr>
<tr>
<td>Businessman</td>
<td>Serviceman</td>
<td>1.667</td>
<td>0.9</td>
<td>1</td>
<td>0</td>
<td>0.396</td>
<td>1.581</td>
<td>Non-sig</td>
<td>20</td>
</tr>
<tr>
<td>Businessman</td>
<td>Retired</td>
<td>1.667</td>
<td>0.9</td>
<td>1.2</td>
<td>0.4</td>
<td>0.31</td>
<td>1.911</td>
<td>Non-sig</td>
<td>34</td>
</tr>
<tr>
<td>Businessman</td>
<td>Professional</td>
<td>1.667</td>
<td>0.9</td>
<td>1</td>
<td>0</td>
<td>0.496</td>
<td>1.265</td>
<td>Non-sig</td>
<td>8</td>
</tr>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>1.667</td>
<td>0.9</td>
<td>1</td>
<td>0</td>
<td>0.232</td>
<td>2.697</td>
<td>Significant</td>
<td>20</td>
</tr>
</tbody>
</table>
Table 4.1 shows that except businessman and farmer all other combination of different professions of age group 4 (45 & above) responded non-significantly. In other words the null hypothesis is rejected and the alternate hypothesis 10 (H10): There is no significant difference in the level of use of TK in agriculture as perceived by various respondents of different professions of age group 4.

Hypothesis 11 (Ho11): There is a distinct level of use of TK in herbal medicine as perceived by the respondents of various professions of age group 4 (45 & above).

Table 4.2 shows that as a whole there is not significant level of difference as per the perception of the respondents of various professions of age group 4. Hence the null hypothesis is rejected and the alternate hypothesis 11 (H11): There is no significant difference in the level of use of TK in herbal medicine as perceived by the respondents of various professions of age group 4.

Table 4.2

Level of use of TK in Herbal medicine as expressed by various professions of age group 4 (45 & Above)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retired</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.333</td>
<td>0.471</td>
<td>0.118</td>
<td>3.764</td>
<td>Significant</td>
<td>34</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.333</td>
<td>0.471</td>
<td>0.35</td>
<td>1.265</td>
<td>Non-sig</td>
<td>8</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>32</td>
</tr>
<tr>
<td>Farmer</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>1.333</td>
<td>0.471</td>
<td>0.164</td>
<td>2.697</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Farmer</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>44</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>18</td>
</tr>
<tr>
<td>Businessman</td>
<td>Serviceman</td>
<td>1.333</td>
<td>0.471</td>
<td>1.333</td>
<td>0.471</td>
<td>0.396</td>
<td>0</td>
<td>Non-sig</td>
<td>20</td>
</tr>
<tr>
<td>Businessman</td>
<td>Retired</td>
<td>1.333</td>
<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.118</td>
<td>3.764</td>
<td>Significant</td>
<td>34</td>
</tr>
<tr>
<td>Businessman</td>
<td>Professional</td>
<td>1.333</td>
<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.35</td>
<td>1.265</td>
<td>Non-sig</td>
<td>8</td>
</tr>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>1.333</td>
<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.164</td>
<td>2.697</td>
<td>Significant</td>
<td>20</td>
</tr>
</tbody>
</table>

Hypothesis 12 (Ho12): There is a distinct level of use of TK in handicraft as perceived by the respondents of age group 4 of various professions.
Table 4.3

Level of use of TK in Handicraft as expressed by various professions of age group 4 (45 & Above)

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retired</td>
<td>Serviceman</td>
<td>1.267</td>
<td>0.573</td>
<td>2</td>
<td>0</td>
<td>0.313</td>
<td>3.044</td>
<td>Significant</td>
<td>34</td>
</tr>
<tr>
<td>Professional</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>inf</td>
<td>Significant</td>
<td>8</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.267</td>
<td>0.573</td>
<td>0.384</td>
<td>0.902</td>
<td>Non-sig</td>
<td>32</td>
</tr>
<tr>
<td>Farmer</td>
<td>Serviceman</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>inf</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Farmer</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.267</td>
<td>0.573</td>
<td>0.19</td>
<td>1.819</td>
<td>Non-sig</td>
<td>44</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig</td>
<td>18</td>
</tr>
<tr>
<td>Businessman</td>
<td>Serviceman</td>
<td>2.333</td>
<td>1.247</td>
<td>2</td>
<td>0</td>
<td>0.456</td>
<td>0.598</td>
<td>Non-sig</td>
<td>20</td>
</tr>
<tr>
<td>Businessman</td>
<td>Retired</td>
<td>2.333</td>
<td>1.247</td>
<td>1.267</td>
<td>0.573</td>
<td>0.367</td>
<td>3.174</td>
<td>Significant</td>
<td>34</td>
</tr>
<tr>
<td>Businessman</td>
<td>Professional</td>
<td>2.333</td>
<td>1.247</td>
<td>1</td>
<td>0</td>
<td>0.57</td>
<td>1.912</td>
<td>Non-sig</td>
<td>8</td>
</tr>
<tr>
<td>Businessman</td>
<td>Farmer</td>
<td>2.333</td>
<td>1.247</td>
<td>1</td>
<td>0</td>
<td>0.267</td>
<td>4.077</td>
<td>Significant</td>
<td>20</td>
</tr>
</tbody>
</table>

As the table 4.3 shows among the various groups of different professions 50% go in favour of the null hypothesis by responding a significant difference in the responses and another 50% showed non significant. Now there is Home town wise analysis of distinct level of use of TK in various fields as expressed by various respondents of various professions from different home town.

Hypothesis 13 (Ho13): There is a distinct level of use of TK in agriculture as expressed by respondents of various professions belonging to rural area.

Table 5.1 shows that in between some combinations of rural people like service-student, retired/housewife-student, professionals-student, professional-service, farmer-service, farmer-professional, business-student, business-retired the distinction is non-significant. And other professionals distinctly vary in their opinion. But as a whole we reject the null hypothesis and accepted the alternate hypothesis 13 (H13): There is no significant difference between the responses of various organizations, of different location.
### Table 5.1

**Level of use of TK in Agriculture as expressed by various professions of home town 1**

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.173</td>
<td>2.06</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Student</td>
<td>1.4</td>
<td>0.49</td>
<td>1.25</td>
<td>0.433</td>
<td>0.323</td>
<td>0.64</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Service</td>
<td>1.4</td>
<td>0.49</td>
<td>1</td>
<td>0</td>
<td>0.185</td>
<td>2.93</td>
<td>Significant</td>
<td>22</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.233</td>
<td>1.53</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Professional</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.4</td>
<td>0.49</td>
<td>0.249</td>
<td>2.18</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.13</td>
<td>2.74</td>
<td>Significant</td>
<td>30</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>30</td>
</tr>
<tr>
<td>Farmer</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.4</td>
<td>0.49</td>
<td>0.14</td>
<td>3.88</td>
<td>Significant</td>
<td>32</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>30</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
<td>1.667</td>
<td>0.745</td>
<td>1.25</td>
<td>0.433</td>
<td>0.361</td>
<td>1.36</td>
<td>Non-sig.</td>
<td>18</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>1.667</td>
<td>0.745</td>
<td>1</td>
<td>0</td>
<td>0.23</td>
<td>3.22</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Retired</td>
<td>1.667</td>
<td>0.745</td>
<td>1.4</td>
<td>0.49</td>
<td>0.34</td>
<td>0.93</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.667</td>
<td>0.745</td>
<td>1</td>
<td>0</td>
<td>0.308</td>
<td>2.4</td>
<td>Significant</td>
<td>18</td>
</tr>
<tr>
<td>Business</td>
<td>Farmer</td>
<td>1.667</td>
<td>0.745</td>
<td>1</td>
<td>0</td>
<td>0.174</td>
<td>4.26</td>
<td>Significant</td>
<td>34</td>
</tr>
</tbody>
</table>

Hypothesis 14 (Ho14): There is a distinct level of use of TK in herbal medicine as expressed by respondents of various professions form rural area.

Table 5.2 shows that majority of various combinations of different professions of rural area are non significantly different in their views. Hence we reject the null hypothesis and accept the alternate hypothesis: There is no significant distinction in the level of use of TK in herbal medicine as perceived by the respondents of different professions of rural area.
Table 5.2

Level of use of TK in Herbal medicine as expressed by various professions of home town 1

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Student</td>
<td>1.286</td>
<td>0.452</td>
<td>1.25</td>
<td>0.433</td>
<td>0.296</td>
<td>0.17</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.206</td>
<td>1.72</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.214</td>
<td>1.92</td>
<td>Non-sig.</td>
<td>22</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.233</td>
<td>1.53</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Professional</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.24</td>
<td>1.71</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.13</td>
<td>2.74</td>
<td>Significant</td>
<td>30</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.136</td>
<td>3.02</td>
<td>Significant</td>
<td>30</td>
</tr>
<tr>
<td>Farmer</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>32</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>30</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
<td>1.333</td>
<td>0.471</td>
<td>1.25</td>
<td>0.433</td>
<td>0.308</td>
<td>0.38</td>
<td>Non-sig.</td>
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</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>1.333</td>
<td>0.471</td>
<td>1.286</td>
<td>0.452</td>
<td>0.267</td>
<td>0.25</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Retired</td>
<td>1.333</td>
<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.218</td>
<td>2.13</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.333</td>
<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.245</td>
<td>1.9</td>
<td>Non-sig.</td>
<td>18</td>
</tr>
<tr>
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<td>Farmer</td>
<td>1.333</td>
<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.138</td>
<td>3.37</td>
<td>Significant</td>
<td>34</td>
</tr>
</tbody>
</table>

Hypothesis 15 (Ho15): There is a distinct level of use of TK in handicraft sector as perceived by various respondents of different professions of rural area.

Table 5.3 shows the null hypothesis true. There is a significantly different opinion among the professionals of rural area.
Table 5.3

Level of use of TK in Handicraft as expressed by various professions of home town 1

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Student</td>
<td>1.571</td>
<td>0.495</td>
<td>1</td>
<td>0</td>
<td>0.251</td>
<td>3.114</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Student</td>
<td>1.4</td>
<td>0.49</td>
<td>1</td>
<td>0</td>
<td>0.249</td>
<td>2.177</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Service</td>
<td>1.4</td>
<td>0.49</td>
<td>1.571</td>
<td>0.495</td>
<td>0.291</td>
<td>0.804</td>
<td>Non-sig.</td>
<td>22</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>2.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.25</td>
<td>7.937</td>
<td>Significant</td>
<td>14</td>
</tr>
<tr>
<td>Professional</td>
<td>Service</td>
<td>2.5</td>
<td>0.5</td>
<td>1.571</td>
<td>0.495</td>
<td>0.312</td>
<td>4.021</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>2.5</td>
<td>0.5</td>
<td>1.4</td>
<td>0.49</td>
<td>0.333</td>
<td>4.422</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>30</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.571</td>
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<td>0.142</td>
<td>5.506</td>
<td>Significant</td>
<td>30</td>
</tr>
<tr>
<td>Farmer</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.4</td>
<td>0.49</td>
<td>0.14</td>
<td>3.881</td>
<td>Significant</td>
<td>32</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>2.5</td>
<td>0.5</td>
<td>0.139</td>
<td>14.23</td>
<td>Significant</td>
<td>30</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
<td>1.667</td>
<td>0.471</td>
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<td>0</td>
<td>0.245</td>
<td>3.795</td>
<td>Significant</td>
<td>18</td>
</tr>
<tr>
<td>Business</td>
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<td>0.471</td>
<td>1.571</td>
<td>0.495</td>
<td>0.274</td>
<td>0.48</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
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<td>Retired</td>
<td>1.667</td>
<td>0.471</td>
<td>1.4</td>
<td>0.49</td>
<td>0.297</td>
<td>1.237</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Business</td>
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<td>1.667</td>
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<td>0.5</td>
<td>0.317</td>
<td>3.586</td>
<td>Significant</td>
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<tr>
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<td>0.471</td>
<td>1</td>
<td>0</td>
<td>0.138</td>
<td>0.733</td>
<td>Significant</td>
<td>34</td>
</tr>
</tbody>
</table>

Hypothesis 16 (Ho16): There is a distinct level of use of TK in agricultural sector as perceived by various respondents of different professions of urban area.

Table 6.1 clearly rejects the null Hypothesis 16 (Ho16): There is a distinct level of use of TK in agriculture sector as perceived by various respondents of different professions of urban area. As the responses of various respondents of different professions of urban area do not vary significantly. Thus the alternate hypothesis 16 (H16): There is no significant difference in the level of use of TK in agriculture as perceived by the respondents of different professions of urban area, found.
Table 6.1
Level of use of TK in Agriculture as expressed by various professions of home town 2

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.25</td>
<td>2.646</td>
<td>Significant</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>0.5</td>
<td>0.362</td>
<td>1.826</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>0.5</td>
<td>0.362</td>
<td>1.826</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
<td>1.2</td>
<td>0.4</td>
<td>1</td>
<td>0</td>
<td>0.167</td>
<td>1.791</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>2.4</td>
<td>0.8</td>
<td>2</td>
<td>0</td>
<td>0.318</td>
<td>1.333</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.2</td>
<td>0.4</td>
<td>1.5</td>
<td>0.5</td>
<td>0.316</td>
<td>1.333</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
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<td>Farmer</td>
<td>1.2</td>
<td>0.4</td>
<td>1</td>
<td>0</td>
<td>0.324</td>
<td>0.926</td>
<td>Non-sig.</td>
<td>12</td>
</tr>
<tr>
<td>Professional</td>
<td>Service</td>
<td>1.5</td>
<td>0.5</td>
<td>1.5</td>
<td>0.5</td>
<td>0.354</td>
<td>0</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.185</td>
<td>3.568</td>
<td>Significant</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>0.5</td>
<td>0.25</td>
<td>2.646</td>
<td>Significant</td>
<td>14</td>
</tr>
<tr>
<td>Retired</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Service</td>
<td>Student</td>
<td>1.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.185</td>
<td>3.568</td>
<td>Significant</td>
<td>20</td>
</tr>
</tbody>
</table>

Hypothesis17(Ho17): There is a distinct level of use of TK in herbal medicinal sector as perceived by various respondents of different professions of urban area.

From table 6.2 it can be clearly shown that there is no significant difference in between the views of different professionals of urban area. So the null hypothesis 17(Ho17): is rejected and the alternate hypothesis17(H17): There is no significant difference in between the views of the respondents of various professions of urban area regarding the use of traditional knowledge in herbal medicine is accepted.
### Table 6.2
Level of use of TK in Herbal medicine as expressed by various professions of home town 2

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1.25</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.23</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.143</td>
<td>0.35</td>
<td>0.3</td>
<td>0.77</td>
<td>Non-sig.</td>
<td>16</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.34</td>
<td>1.054</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.34</td>
<td>1.054</td>
<td>Non-sig.</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
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<td>0.4</td>
<td>1.143</td>
<td>0.35</td>
<td>0.25</td>
<td>0.356</td>
<td>Non-sig.</td>
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<td>Service</td>
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<td>0.4</td>
<td>1.25</td>
<td>0.433</td>
<td>0.31</td>
<td>0.239</td>
<td>Non-sig.</td>
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<td>Professional</td>
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<td>0.8</td>
<td>1</td>
<td>0</td>
<td>0.32</td>
<td>4.667</td>
<td>Significant</td>
<td>16</td>
</tr>
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<td>0.4</td>
<td>1</td>
<td>0</td>
<td>0.32</td>
<td>0.926</td>
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</tr>
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<td>Service</td>
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<td>0.433</td>
<td>1.25</td>
<td>0.433</td>
<td>0.33</td>
<td>0</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
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<td>Student</td>
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<td>0.433</td>
<td>1.143</td>
<td>0.35</td>
<td>0.27</td>
<td>0.603</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
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<td>Service</td>
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<td>0</td>
<td>1.25</td>
<td>0.433</td>
<td>0.23</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Retired</td>
<td>Student</td>
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<td>0</td>
<td>1.143</td>
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<td>0.21</td>
<td>1.101</td>
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</tr>
<tr>
<td>Service</td>
<td>Student</td>
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<td>0.433</td>
<td>1.143</td>
<td>0.35</td>
<td>0.27</td>
<td>0.603</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
</tbody>
</table>

Hypothesis18 (H018): There is a distinct level of use of TK in handicraft sector as expressed by respondents of various professions of urban area.

### Table 6.3
Level of use of TK in Handicraft as expressed by various professions of home town 2

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>0.866</td>
<td>0.33</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>2.5</td>
<td>0.5</td>
<td>1.286</td>
<td>0.452</td>
<td>0.39</td>
<td>4.362</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>2.5</td>
<td>0.5</td>
<td>2</td>
<td>0</td>
<td>0.24</td>
<td>2.582</td>
<td>Significant</td>
<td>10</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>2.5</td>
<td>0.5</td>
<td>1</td>
<td>0</td>
<td>0.24</td>
<td>7.746</td>
<td>Significant</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
<td>2.4</td>
<td>0.8</td>
<td>1.286</td>
<td>0.452</td>
<td>0.32</td>
<td>4.149</td>
<td>Significant</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>2.4</td>
<td>0.8</td>
<td>2</td>
<td>0</td>
<td>0.32</td>
<td>1.333</td>
<td>Non-sig.</td>
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<td>0.8</td>
<td>1</td>
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<td>4.667</td>
<td>Significant</td>
<td>16</td>
</tr>
<tr>
<td>Business</td>
<td>Farmer</td>
<td>2.4</td>
<td>0.8</td>
<td>2.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.215</td>
<td>Non-sig.</td>
<td>12</td>
</tr>
<tr>
<td>Professional</td>
<td>Service</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>inf</td>
<td>Significant</td>
<td>14</td>
</tr>
<tr>
<td>Professional</td>
<td>Student</td>
<td>1</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.24</td>
<td>1.706</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Retired</td>
<td>Service</td>
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<td>0.866</td>
<td>2</td>
<td>0</td>
<td>0.33</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Retired</td>
<td>Student</td>
<td>1.5</td>
<td>0.866</td>
<td>1.286</td>
<td>0.452</td>
<td>0.34</td>
<td>0.727</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
<td>Service</td>
<td>Student</td>
<td>2</td>
<td>0</td>
<td>1.286</td>
<td>0.452</td>
<td>0.24</td>
<td>4.264</td>
<td>Significant</td>
<td>20</td>
</tr>
</tbody>
</table>
The null hypothesis is true. As shown in the table 6.3 in view of more than 50% of varied combination of respondents of various professions of urban area, there is a significant difference in the level of use of TK in Handicraft.

Hypothesis19(Ho19): There is a distinct level of use of TK in handicraft sector as expressed by respondents of various professions of urban area.

Table 7.1

<table>
<thead>
<tr>
<th>Level of use of TK in Agriculture as expressed by respondents of various professions of home town 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>profession 1</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Farmer</td>
</tr>
<tr>
<td>Farmer</td>
</tr>
<tr>
<td>Farmer</td>
</tr>
<tr>
<td>Farmer</td>
</tr>
<tr>
<td>Professional</td>
</tr>
<tr>
<td>Retired</td>
</tr>
<tr>
<td>Retired</td>
</tr>
<tr>
<td>Service</td>
</tr>
</tbody>
</table>

The null hypothesis is false as per table 7.1. As there is no significant difference in the views of the respondents of various professions of semi-urban area, we will reject the null hypothesis and accept the alternate hypothesis19(H19): There is no significant difference among the views of various respondents of semi-urban area regarding the use of TK in Handicraft sector.

Hypothesis 20 (Ho20): There is a distinct level of use of TK in herbal medicine as perceived by the respondents of different professions of semi urban area.
Table 7.2

Level of use of TK in herbal medicine as expressed by various professions of home town 3

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Farmer</td>
<td>1.25</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.487</td>
<td>0.73</td>
<td>Non-sig.</td>
<td>8</td>
</tr>
<tr>
<td>Business</td>
<td>Professional</td>
<td>1.25</td>
<td>0.433</td>
<td>1.286</td>
<td>0.45</td>
<td>0.296</td>
<td>0.173</td>
<td>Non-sig.</td>
<td>20</td>
</tr>
<tr>
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<td>1.25</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.187</td>
<td>1.897</td>
<td>Non-sig</td>
<td>10</td>
</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>1.25</td>
<td>0.433</td>
<td>1.29</td>
<td>0.43</td>
<td>0.329</td>
<td>0</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Business</td>
<td>Student</td>
<td>1.25</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.233</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
<tr>
<td>Farmer</td>
<td>Professional</td>
<td>1.0</td>
<td>0</td>
<td>1.286</td>
<td>0.45</td>
<td>0.49</td>
<td>0.837</td>
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</tr>
<tr>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>12</td>
</tr>
<tr>
<td>Farmer</td>
<td>Service</td>
<td>1.0</td>
<td>0</td>
<td>1.29</td>
<td>0.43</td>
<td>0.487</td>
<td>0.73</td>
<td>Non-sig.</td>
<td>8</td>
</tr>
<tr>
<td>Farmer</td>
<td>Student</td>
<td>1.0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>8</td>
</tr>
<tr>
<td>Professional</td>
<td>Retired</td>
<td>1.286</td>
<td>0.452</td>
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<td>2.105</td>
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<td>0</td>
<td>1.29</td>
<td>0.43</td>
<td>0.187</td>
<td>1.897</td>
<td>Non-sig.</td>
<td>18</td>
</tr>
<tr>
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<td>Student</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Nan</td>
<td>Non-sig.</td>
<td>18</td>
</tr>
<tr>
<td>Service</td>
<td>Student</td>
<td>1.29</td>
<td>0.433</td>
<td>1</td>
<td>0</td>
<td>0.233</td>
<td>1.528</td>
<td>Non-sig.</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 7.2 rejects the null hypothesis as there is no significant difference in the view of different professions of semi urban area. Thus the alternate hypothesis 20 (H120) : There is no significant difference in the view perceived by different professions of semi urban area regarding the use of TK in herbal medicine.

Hypothesis 21(Ho21): There is a distinct level of use of TK in handicraft as perceived by the respondents of different professions of semi urban area.

Table 7.3 shows the null hypothesis as true. Thus it is been accepted as there is a significant level of difference in the use of TK as expressed by various respondents of different professions of semi urban area.
Table 7.3

Level of use of TK in handicraft as expressed by various professions of home town 3

<table>
<thead>
<tr>
<th>profession 1</th>
<th>profession 2</th>
<th>Mean</th>
<th>S.D</th>
<th>S.D.</th>
<th>S.E.</th>
<th>t (val)</th>
<th>Significant or Non-significant</th>
<th>D.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Farmer</td>
<td>3.5</td>
<td>0.866</td>
<td>1</td>
<td>0</td>
<td>0.688</td>
<td>3.651</td>
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<tr>
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<td>Professional</td>
<td>3.5</td>
<td>0.866</td>
<td>1.429</td>
<td>0.5</td>
<td>0.35</td>
<td>6.807</td>
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</tr>
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<td>Retired</td>
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<td>0</td>
<td>0.265</td>
<td>9.487</td>
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</tr>
<tr>
<td>Business</td>
<td>Service</td>
<td>3.5</td>
<td>0.866</td>
<td>2.5</td>
<td>0.87</td>
<td>0.465</td>
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</tr>
<tr>
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<td>Student</td>
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<td>0.866</td>
<td>1.5</td>
<td>0.5</td>
<td>0.413</td>
<td>5.292</td>
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<tr>
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<td>1.146</td>
<td>Non-sig. 14</td>
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<td>1</td>
<td>0</td>
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<td>0</td>
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<td>Non-sig. 12</td>
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<tr>
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<td>Non-sig. 8</td>
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<td>0.523</td>
<td>1.265</td>
<td>Non-sig. 8</td>
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<tr>
<td>Professional</td>
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<td>2.5</td>
<td>0.87</td>
<td>0.265</td>
<td>5.692</td>
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<tr>
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<td>Student</td>
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<td>0</td>
<td>1.5</td>
<td>0.5</td>
<td>0.201</td>
<td>3.286</td>
<td>Significant 18</td>
</tr>
<tr>
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<td>Student</td>
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<td>0.866</td>
<td>1.5</td>
<td>0.5</td>
<td>0.413</td>
<td>2.646</td>
<td>Significant 14</td>
</tr>
</tbody>
</table>

From the above analysis it can be very clear that most of the respondents from cross sectional classes are of the same opinion in general about the use of traditional knowledge in various fields.
<table>
<thead>
<tr>
<th>PROFESSION</th>
<th>RANK</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>T</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSINESS</td>
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<td>14</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>2</td>
<td>10</td>
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Hypothesis 22 (Ho22): There is a distinct level of enrichment in three sectors by traditional knowledge as perceived by respondents of different age groups.

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<td>14</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Score (S)</td>
<td>210</td>
<td>182</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>Co-efficient (S/N)</td>
<td>4.2</td>
<td>3.95</td>
<td>3.23</td>
<td></td>
</tr>
<tr>
<td>Age 3 (35-45)</td>
<td>1</td>
<td>16</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16</td>
<td>10</td>
<td>2</td>
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<td></td>
<td>3</td>
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<td>8</td>
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<td>4</td>
</tr>
<tr>
<td>Score (S)</td>
<td>164</td>
<td>144</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Co-efficient (S/N)</td>
<td>4.1</td>
<td>3.79</td>
<td>3.18</td>
<td></td>
</tr>
<tr>
<td>Age 3 (45 &amp; Above)</td>
<td>1</td>
<td>22</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>24</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Score (S)</td>
<td>212</td>
<td>212</td>
<td>186</td>
<td></td>
</tr>
<tr>
<td>Co-efficient (S/N)</td>
<td>3.9</td>
<td>3.41</td>
<td>3.6</td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis is true as per the table 8.2. The table indicates the responses age wise, where the level of enrichment has been recorded in a more
descending order. In other words the age group-1 has marked the areas with a higher score than age group-2 and the same happens with age group-2 and three. We can conclude that the scoring has declined with increasing age except the handicraft sector. Where the fourth age group has given coefficient 3.6 which is higher than age group two's 3.1. Age group 1 acknowledges TK very high in enriching the agricultural sector, then to herbal medicine and lastly to handicraft.

Hypothesis 23 (Ho23) : There is a distinct level of enrichment in three sectors by traditional knowledge as perceived by respondents of different profession.

### Table 8.3

*Profession-wise major fields where the contribution of traditional knowledge is high in enriching it*

<table>
<thead>
<tr>
<th>Fields</th>
<th>class</th>
<th>Business</th>
<th>Service</th>
<th>Professional</th>
<th>Farmer</th>
<th>Student</th>
<th>Retired/ House Wife</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Rank Score</td>
<td>112</td>
<td>102</td>
<td>116</td>
<td>116</td>
<td>140</td>
<td>84</td>
<td>670</td>
</tr>
<tr>
<td></td>
<td>Rank Co-efficient</td>
<td>4.3</td>
<td>4.25</td>
<td>4.14</td>
<td>3.86</td>
<td>5</td>
<td>3.72</td>
<td>4.211</td>
</tr>
<tr>
<td>Herbal Medicine</td>
<td>Rank Score</td>
<td>128</td>
<td>110</td>
<td>94</td>
<td>112</td>
<td>72</td>
<td>106</td>
<td>622</td>
</tr>
<tr>
<td></td>
<td>Rank Co-efficient</td>
<td>4.26</td>
<td>3.9</td>
<td>4.27</td>
<td>3.73</td>
<td>2.76</td>
<td>3.5</td>
<td>3.737</td>
</tr>
<tr>
<td>Handicraft</td>
<td>Rank Score</td>
<td>18</td>
<td>34</td>
<td>64</td>
<td>92</td>
<td>82</td>
<td>96</td>
<td>386</td>
</tr>
<tr>
<td></td>
<td>Rank Co-efficient</td>
<td>1.8</td>
<td>1.88</td>
<td>3.2</td>
<td>3.83</td>
<td>3.72</td>
<td>4</td>
<td>3.072</td>
</tr>
</tbody>
</table>

From Table 8.3 it can be drawn that the null hypothesis 21 (Ho21) is true. Business class gave rank coefficient 4.3 which is very high to agriculture, then to herbal medicine (4.2) then to handicraft 1.8. Retired/housewife ranked handicraft as highly enriched.

Hypothesis 24 (Ho24): There is a distinct level of enrichment in three sectors by traditional in knowledge as perceived by respondents of different areas.

From table 8.4 the null hypothesis can be rejected. Thus the alternate hypothesis 24 (H124): There is no such distinction in the level of enrichment in three sectors by traditional knowledge as perceived by respondents of different areas, is accepted.
Table 8.4

Enrichment level of different fields as expressed by different locationals

<table>
<thead>
<tr>
<th>Location</th>
<th>Rank</th>
<th>A</th>
<th>J</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>1</td>
<td>24</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>2</td>
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<td>18</td>
<td>28</td>
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<td>3</td>
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<td>26</td>
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<td>4</td>
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<td>6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Score (S)</td>
<td></td>
<td>190</td>
<td>252</td>
<td>272</td>
</tr>
<tr>
<td>Co-efficient (S/N)</td>
<td>3.675</td>
<td>4.06</td>
<td>4.12</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1</td>
<td>4</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4</td>
<td>16</td>
<td>14</td>
</tr>
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<td></td>
<td>3</td>
<td>14</td>
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<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Score (S)</td>
<td></td>
<td>88</td>
<td>186</td>
<td>182</td>
</tr>
<tr>
<td>Co-efficient (S/N)</td>
<td>3.14</td>
<td>4.04</td>
<td>3.95</td>
<td></td>
</tr>
<tr>
<td>Semi-urban</td>
<td>1</td>
<td>6</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
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<td></td>
<td>4</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Score (S)</td>
<td></td>
<td>98</td>
<td>168</td>
<td>180</td>
</tr>
<tr>
<td>Co-efficient (S/N)</td>
<td>3.5</td>
<td>4.2</td>
<td>4.28</td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 25 (Ho25): There is a distinct level of enrichment in agricultural sector as perceived by the respondents of different professions.

The null hypothesis is true. It can be clearly shown from the table 8.3 where agriculture has found a highest rank co-efficient i.e. 4.2 followed by 3.73 to herbal medicine and 3.07 to handicraft.

Thus from the above analysis it can be shown very clearly that out of five points of scoring agriculture score has scored a very high rank by all the respondents in a view that this sector has been highly enriched by TK.
CHAPTER – 8

Qualitative Analysis of Traditional Knowledge
Orissa is endowed with rich natural resources in the form of vast mineral deposits, forest, fertile land, plentiful surface and ground water resources, long coastline, and picturesque tourist potential. But, such resources have not been exploited adequately for income generation activities. As a result, Orissa ranks very low among the Indian states in terms of per capita income, and it has become one of the poorest states of the country. Large proportion of people in the state have very poor living conditions. As per an estimate, among the fifteen major states of India, the position of Orissa with regard to living conditions or standard of living is fourteenth.

The economy of Orissa is a balanced mix of agricultural and industrial sectors. In the agricultural sector, the presence of fertile soils and favorable climate has aided Orissa to emerge as one of the leading agricultural states of the country. The significance of small scale industries like handloom and handicrafts can not be overlooked as they contribute a considerable amount of revenue to the state's economy. A list of the major contributors to the Orissa economy and leading industries of the state are:

- Agriculture
- Forest based husbandry
- Minerals
- Cement
- Paper
- Sugar
- Fertilizer
- Iron and steel
- Handloom
- Information and technology

In Orissa Agriculture is the major contributor to the state's economy as Agriculture is the chief occupation in Orissa. About 76% of the total working
population is engaged with agriculture and agriculture related industries. The total cropped area in Orissa is 87,46,000 Hectares and out of that 18,79,000 Hectares are under irrigation.

Orissa is one of the largest producers of rice in India. The state grows almost one tenth of the total rice production of the country. Favorable climate and presence of rich soils accounts for the flourishing agriculture of Orissa. In the coastal plain of East Orissa rice is traditionally grown in two well defined seasons, namely *kharif* and *dalua*. Of these two, *kharif* (rainy) is the most important rice season. The *kharif* rice is the main crop, covering over 85% of the total rice area, and depends entirely on the southwest monsoon. It is sown in June and harvested in October-December, depending upon the duration of the cultivar and topography of the field. The *dalua* (summer) crop coincides with the dry season and depends entirely on irrigation. The source of irrigation water is tank. The *dalua* season stretches from December-January to April-May. Farmers grow only high-yielding varieties during this season. The main crops cultivated in the state are: Rice, Jute, oil seeds, Pulses, Coconut, Mesta, Sugarcane, tea, Rubber, Cotton, Gram, Mustard, Maize, same, Ragi, Potato, Soybean. The principal problem that Orissa agriculture faces is the shortage of water in many areas. Lack of irrigation facilities in these drought prone areas create great obstacles to the agriculture. Flood and low per Hectare production are other agricultural problems of the state.

The Agricultural Department of the Orissa Government and its three wings - Directorate of Horticulture, Directorate of Agriculture, Directorate of Soil Conservation and Watershed Mission is working hard to find solutions of these hindrances. Some of the major agricultural hubs in Orissa are: Cuttack, Dhenkanal, Baleshwar, Sambalpur.

The study has been undertaken in order to find out various traditional agricultural tools used in Odisha for the operation of Agricultural activities. As these tools are very much cost effective and need least technical soundness to be operated, most of the rural small marginal and big farmers as well use these tool, which are mad of mostly wood and iron. For the study two districts of eastern Orissa has been selected. These are as follows:
Jajpur, with a total area of 2899 sq km is situated between 20°.30'-21°.10' north latitude and 85°.40' - 86°.44' east longitude. The district receives an annual rainfall of 1500 mm, with a maximum mean of 352 mm in July and a minimum mean of 5 mm in December (Govt. of Orissa, 1993). The southwest monsoon during which most of the precipitation occurs starts in June and continues up to October. With ten blocks the district has a total population of 1900054 (2001 census). It has been enriched with fertile lands, as it lies on the banks of river Baitarini. It produces a large amount of cash crops. Connected with all major Indian Cities the district also has a fair share of industries. The Archeological Museum at Ratnagiri, Beleswar Temple and Barahjew Temple are some of the prime appeals of Jajpur district.
Spanning over an area of 3932 sq km, Cuttack has a total population of 23, 40,363 according to census 2001. The rural population of the district has a share of 16, 98,786. It is predominantly an agri-based district, and it earns its revenue through mining of lease, animal husbandry, horticulture and other allied commercial function. Barabati Fort, Chhatia and stone Revetment are some of the must-visit tourist destinations of Cuttack.

From each district randomly four villages and from each village 25 rural people engaged in Agricultural activities were selected. These key informants form a combination of marginal farmers, small farmers, big farmers, old aged people and women engaged in farm activities. The number of respondents from each strata completely relied on the availability. Participatory Rural Appraisal (PRA) technique was used as the methodology of data collection. The respondents were interacted one to one and with the help of group discussions as well. The responses were documented through a combination
of structured and open ended questionnaire. For the reliability of the information cross questioning and other triangulation techniques were used.

Results and discussions

TRADITIONAL AGRICULTURAL TOOLS IN COASTAL ORISSA

Traditionally farmers have been using a variety of tools for agricultural and household purposes in India which are made up of locally available materials like stones, wood, bamboo and iron etc. Those tools were economical in terms of labour, and money. These tools are operated easily by the farmers without any technical knowledge. It has been noticed that after Industrial Revolution in India there has been substantial improvement in design and metallurgy of agricultural tools. Many of them are modified and produced using modern technology in affordable price. However, there is abundant store of knowledge in the area of traditional hand tools, their craftsmanship, technique of production and are still in practice and of great value too. Most of these tools were produced by local artisans and are cost effective. The indigenous knowledge possessed by them is really worth and it is our responsibility to preserve and protect them. It can also be utilized for modern designing of equipments and implements.

In this regard an attempt is made in the current study to identify various traditional tools used for agricultural operations by the farmers in coastal districts of Orissa namely Jajpur and cuttack districts. Both primary and secondary method of data collection was used to collect information. Participatory Rural Appraisal (PRA) tools like observation, Individual (One to one) discussion, Focus Group Discussion (FGD) were used to document the indigenous tools and implements used by farmers (mostly small & marginal farmers) in coastal Orissa. Key informants also include farmwomen, Agricultural Extension officers(Block level), Village Head(Big Farmers). In the study more than thirty agricultural tools were identified and documented which were used by the farmers belonging to small, marginal and big categories in coastal Orissa.

The various tools/implements identified during the study are described below:
PLOUGH:-

The plough is a tool used in farming for initial cultivation of soil in preparation for sowing seed or planting. It has been a basic instrument for most of recorded history, and represents one of the major advances in agriculture. The primary purpose of ploughing is to turn over the upper layer of the soil, bringing fresh nutrients to the surface, while burying weeds and the remains of previous crops, allowing them to break down. It also makes the soil loose, and allows it to hold moisture better.

WEEDER

A weeder has a split tip like a serpent's tongue, and a long thin handle. Many models have a curved piece of metal along the handle which is put against the ground while the tip is digging. The curved metal piece acts as a fulcrum in a lever system. It is helpful to remove weeds either with a tap root or a fibrous root system.

SPADE

A spade is a tool designed primarily for the purpose of digging or removing earth. Early spades were made of riven wood. After the art of metalworking was discovered, spades were made with sharper tips of metal. Before the advent of metal spades manual labor was less efficient at moving earth, with pick being required to break up the soil in addition to a spade for moving the dirt. With a metal tip, a spade can both break and move the earth in most situations, increasing efficiency.

SICKLE

Sickle is a hand-held agricultural tool with a variously curved blade typically used for harvesting grain crops or cutting succulent forages chiefly for livestock feeding purposes, either in fresh green state or as hay. One noteworthy feature of sickles is that their edges have been made in two very distinct manners/patterns - smooth or serrated. While both can (albeit with a different technique) be used for cutting either green grass or mature cereals, it is the serrated sickle that still dominates the duty of harvesting grain - with other words the "reaping".
KNIFE

It is very small handy tool made up of iron was used in harvesting the pulses crops like gram (Green & Black) etc. It is used by both male and female farmers.

Grain Separator:

A machine for removing dust and foreign matter from grain, for removing the husks from the products of the processing of crops, and for checking the quality of the hulled product, by-products, and hulls. Grain separators are both manual and electric mostly found among the farmers in coastal Orissa.

Stone Roller

Stone roller is used in threshing of pulse crops like green gram, horse gram and black gram. In Costal Orissa farmers mostly use to grind rice.

BAMBO WINNOWER

Bamboo Winnower is an agricultural tool developed by ancient cultures for separating grain from chaff. It is also used to remove weevils or other pests from stored grain. Threshing, the separation of grain or seeds from the husks and straw, is the step in the chaff-removal process that comes before winnowing. "Winnowing the chaff" is a common expression.

In its simplest form it involves throwing the mixture into the air so that the wind blows away the lighter chaff, while the heavier grains fall back down for recovery. Techniques included using a winnowing fan (a shaped basket shaken to raise the chaff) or using a tool (a winnowing fork or shovel) on a pile of harvested grain.

Pulse/Rice Siever (Chaluni)

It is used in separating splitted pulse grains/rice from unsplitted pulse grains. It removes stones and other waste materials.
**Stone Grinder (Ruguna)**

Ruguna (moist Grinder) are used for grinding paddy/rice or other grains. The tool is used in rural areas because of its cost effectiveness in grinding all kinds of cereals.

**STONE ROLLER (CHAKI)**

CHAKI (Dry Grinder) The tool is used in grinding rice and wheat to make flour.

**Measuring Tool (Gauni)**

It is made up of cane and is used for measuring rice/paddy/cereals/pulses and oil seeds. It can measure a weight of 3 kg. Both male and female farmers operate it. It is very common practising measuring tool in coastal Orissa.

**Measuring Tool (Sero)**

It is made up of cane and is used for measuring rice/ paddy/ cereals /pulses and oil seeds. It can measure a weight of 1 kg. Sero is one third (1/3) of Gauni. Both male and female farmers operate it. It is very common in coastal Orissa.

**Leveller (Grain Drawer)**

It is made up of wooden Plate along with a long bamboo stick. Commonly used to level the harvested paddy/grains. It also separates grains from plant materials or helps drying rice /paddy by helping to spread evenly and collecting grains in a heap quickly.

**Leveller (mai)**

Two parallel wood beams with space between and connected by wood strips. Small farmers and farm owners for leveling the field after ploughing. It is generally used by male farmers. It is very commonly practised among small and marginal farmers in coastal Orissa.
Bullock cart (Sagada)

It is a two-wheeled vehicle pulled by oxen (draught cattle). It is a means of transportation used since ancient times in many parts of the world. They are still used in villages today where modern vehicles are too expensive or the infrastructure does not favour them. Used especially for carrying goods, the bullock cart is pulled by two bullocks. The cart is attached to a bullocks by a rope attached to yokes. The driver and any other passengers sit on the front of the cart, while load is placed in the back.

Bamboo Pan (Tokei)

It is made up of bamboo stick and used for collection of plant products and broadcasting of seeds. Handling and transportation of grains is easier and quicker with the help of this tool. It is a very common tool in coastal districts.

Bambo Pan (Gandua)

It is made up of bamboo stick and used for collection of cowdung and other wastes from field. Handling and transportation of cowdung/waste is easier and quicker with the help of this tool. It is a very common tool in coastal districts, mostly used by female farmers.

Crow Bar (Sabala)

A straight bar of iron or steel, with the working end is pointed and sometimes flat pointed. It is commonly used to dig land (hole shaped). It is a very common tool mostly found in every household.

Water lifter (Tenda)

It is used to lift water from well/pond for irrigation purpose. An iron bucket is attached to a long bamboo whilst on the other side a heavier stone is fixed with the bamboo. It becomes easier to pull water without much effort.

Shovel (Belcha)

A shovel is a tool for digging, lifting, and moving bulk materials, such as soil, coal, sand, or ore. Shovels are extremely common tools that are used extensively in agriculture. Shovel is a hand tool consisting of a broad blade
with edges or sides that is fixed to a medium-length handle. Shovel blade/plate is usually made of sheet steel or iron and are very strong. Shovel handles are usually made of wood.

**Chopper (Katuri)**

It has a wooden handle with an iron plate of curved shape. It is handy and commonly used to cut bamboo, wood, plants, tree branches etc. It is a very common tool found in every house hold in coastal districts of Orissa. Both male female farmers use it.

**Yoke (juali)**

A yoke is a wooden beam, normally used between a pair of Oxen or other animals to enable them to pull together on a load when working in pairs, as oxen usually do; some yokes are fitted to individual animals. There are several types of yoke, used in different cultures, and for different types of oxen. Yoke is very common in coastal Orissa amongst farmers.

**Hoe (kanka)**

A hoe is a hand tool used for farming, Gardening and on Allotments. It is made of a sharp blade, usually made from metal, attached to a long wooden handle. It is commonly used to remove weed and unwanted crops from gardens and fields. A hoe is considered to be one of the most basic implements needed to maintain a successful farm or garden.

**Pick Axe (Gainti)**

A pickaxe is a hand tool with a hard head attached perpendicular to the handle. The head is usually made of metal, and the handle is most commonly wood, metal. The head is a spike ending in a sharp point, may curve slightly, and often has a counter-weight to improve ease of use. The stronger the spike, the more effectively the tool can pierce the surface. Rocking the embedded spike about and removing it can then break up the surface.

**Mini spade**

It is a Plain iron plate with an wooden handle of one feet long. It becomes easier to dig soil and clay. Normally in soft and fertile land. Both male and female can easily operate it.
Narrow mini Spade (Alu Koda)

Plain iron plate in narrow shape with an wooden/bamboo handle of one foot long. Like mini spade Alukoda is used to dig soil and clay. Normally in soft and fertile land. Both male and female can operate it.

Khurpi

It is a small iron plate with a wooden handle. Normally it is used to cut grass and other plants to clean the field. It is used by both male and female farmers.

Hand pumps

Hand Pumps are manually operated pumps they use human power and mechanical advantage to move fluids or air from one place to another. They are widely used in coastal districts for a variety of industrial, irrigation and consumption purposes. There are many different types of hand pump available, mainly operating on a piston, diaphragm or rotary vane principle with a check valve on the entry and exit ports to the chamber operating in opposing directions. Most hand pumps have plungers or reciprocating pistons, and are positive displacement.

The Indigenous tools used by the farmers of Orissa are being identified and described below:
<table>
<thead>
<tr>
<th>Figure No</th>
<th>Stages</th>
<th>Tools</th>
<th>Components</th>
<th>Cost and Average</th>
<th>Operation</th>
<th>Made of</th>
<th>Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Plough</td>
<td>Country plough</td>
<td>• Shoe (different shape and size)</td>
<td>Rs. 1200/ unit &amp; 4-5 year</td>
<td>-Tillage &amp; seed placement and plant growth</td>
<td>Black Berry/Akasia wood for body and light wood/sometimes bamboo for beam and thick iron attached base(shoe).</td>
<td>-Bullock drawn Plough highly preferred by small and marginal farmers. - For scattered lands tilling by male.</td>
</tr>
<tr>
<td>02</td>
<td>Bose Plough</td>
<td>-3 meters length (wooden bar)</td>
<td>-Iron plate curved plate (37.5 cm long)</td>
<td>Rs. 1200/ unit &amp; 4-5 year</td>
<td>Tillage &amp; seed placement and plant growth</td>
<td>Black Berry/Akasia wood for body and light wood/sometimes bamboo for beam and handle mild steel bar</td>
<td>Bullock drawn Plough highly preferred by small and marginal farmers to make the land fertile. - For scattered lands tilling by male.</td>
</tr>
<tr>
<td>No.</td>
<td>Tool/Equipment</td>
<td>Description</td>
<td>Price</td>
<td>Uses</td>
<td>Materials</td>
<td>Drawn By</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>----------------</td>
<td>-------------</td>
<td>-------</td>
<td>------</td>
<td>-----------</td>
<td>----------</td>
<td></td>
</tr>
</tbody>
</table>
| 03  | Dry Land Weeder | - Body (length 50 cm & 8 cm diameter)  
- Comb like structure (per nail 25 cm length & 2.5 cm diameter) | Rs. 800/-  
10 years | - To remove deep rooted weeds along with their rhizome/other grasses | - Blackberry/Akasia wood for body  
-Iron Nails | -Bullock Drawn  
-1 acre / day  
-Mostly used by male farmers |
| 04  | Weeder | - It has a thin, long handle and a triangular scraping head.  
The length of handle is 50 cm and diameter is 8 cm. The comb like structure is 25 cm which is working area. | Rs 300/-  
10 years | - It is designed to scrape out weeds growing in crevices, stone walls and other deep and narrow places. | -Iron  
-wooden handle | Mostly used by male farmers. |
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Description</th>
<th>Price</th>
<th>Use</th>
<th>Prepared by</th>
</tr>
</thead>
</table>
| 05  | Spade (phauda) | • Handle (65 cm length)  
• working area (22 cm length & 18 cm breadth) | Rs. 150/unit 5 years | -Formation of bunds, bridges & furrows & irrigation channels  
phasi or kurum even bamboo & iron | By male labourers |
| 05  | Harvesting    | • Handle (15 cm height and 5 cm width)  
• working area (20 cm length and 3 cm width) | Rs. 25/unit 5 years | -Jamun or kurum wood  
Handle  
- Iron (C shaped) | Male & Female for reaping and cutting weeds/Grasses/cereals/pulses  
Most preferred tools. |
| 06  | Knife         | • Handle (5 cm)  
• working area (8 cm) | Rs. 10/unit 5 years | Harvesting pulses like green gram, Bengal gram, horse gram  
-Iron  
-Wooden belt | Male & Female |
<table>
<thead>
<tr>
<th>No.</th>
<th>Season</th>
<th>Tool/Method</th>
<th>Description</th>
<th>Cost</th>
<th>Use</th>
<th>Material/Tool</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 07  | (Paniki) | Pole knife                        | • Handle (5 meter length)  
• Working area iron curved knife (10 cm surface)                  | Rs. 100/unit 5 years | Harvesting fruits like tamarind, lemon, alma etc.                       | -Bamboo -Iron (curved)         | Harvest fruit without climbing tree both by men & women               |
| 09  | Post Harvest | Grain separator               | • Handle (200 cm length)  
• Iron (10 cm length)                                          | Rs. 30/unit 20 years | Separate the horse gram from the plants                               | -Wood -Iron rod                | Shake the plant materials forcibly so that the threshed material and grains are separated by standing straight without bending, reducing drudgery, both by Male & female. |
<p>|     |          | (mechanical)                     | (manual)                                                                    |            |                                                                      |                               |                                                                       |
| 10  | Post harvest | Rice separator(DHANA PITA DHADA) | Bamboo mesh interwoven into a rectangular shape of 3 by 6 feet               | Rs. 200/unit 6-7 yrs | Threshing rice                                                        | Bamboo strips interwoven       | Operated by both male &amp; female worker                                 |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Paddy Thresher</td>
<td>Wood roller with iron nails</td>
<td>Rs 3,000/- Per Unit</td>
</tr>
<tr>
<td>12</td>
<td>Post harvest</td>
<td>Stone roller</td>
<td>- Circular roller (95 cm length &amp; 30 cm diameter) - Wooden Handle (15 cm length &amp; 2.5 cm diameter)</td>
</tr>
<tr>
<td>12</td>
<td>Kula</td>
<td>Bamboo Winnower (Kula)</td>
<td>- 'U' shaped thin strips of bamboo woven (35 cm length, 25 cm breadth, 3 cm depth)</td>
</tr>
<tr>
<td>No.</td>
<td>Category</td>
<td>Description</td>
<td>Price</td>
</tr>
<tr>
<td>-----</td>
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<td>-----------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>13</td>
<td>Post Harvest</td>
<td><strong>PADDY /Rice sieve (CHALUNI)</strong>&lt;br&gt;- Working base area (40 cm diameter and 8 cm height)&lt;br&gt;- Holes of uniform and desired size to separate different sizes of grains</td>
<td>Rs. 100/unit 10 years</td>
</tr>
<tr>
<td>14</td>
<td>Stone grinder</td>
<td><strong>Stone grinder (Ruguna)</strong>&lt;br&gt;- Working area (35 cm diameter)&lt;br&gt;It lasts 10 years.</td>
<td>Rs. 200/- (per unit)</td>
</tr>
<tr>
<td>15</td>
<td>Paddy Thresher</td>
<td><strong>Paddy Thresher (Dhinki)</strong>&lt;br&gt;- Wooden log (2 meters)&lt;br&gt;- Wooden Thrasher (72 cm length, 10 cm diameter)&lt;br&gt;- Iron ring</td>
<td>Rs 800/- Per unit 15 years</td>
</tr>
<tr>
<td>No.</td>
<td>Category</td>
<td>Description</td>
<td>Material</td>
</tr>
<tr>
<td>-----</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| 15  | Milling tool   | - Roller stone  
- Stone Base (Surface)  
- Rs. 200 / unit  
- 10 years  
- Grinding leaves, rice  
- Stone  
- Mainly used by women in household purposes. |                |                 |
| 16  | Measuring tools| - Cylindrical  
- 6-8 YRS, RS 40-50  
- Measuring grains  
- Bamboo/cane knit basket.  
- Weight up to 3 kg or varies locally. |                |                 |
| 17  | Serro          | - Cylinder  
- RS 30-40  
- 6-7 YRS  
- Measuring grains  
- Bamboo/cane knit basket.  
- Weight varies usually 3-4 seero full grains make a Gouni. |                |                 |
| 18  | Other tools    | - Handle  
(length 200 cm)  
- Base comblike or plane structure (30 cm height, 20 cm width)  
- Rs. 140 cm / unit  
- 10 years  
- Separates grains from plant materials or helps drying rice /paddy by helping to spread evenly and collecting grains in a heap quickly.  
- Iron /wood base and bamboo handle  
- Operated mostly by male labourers |                |                 |
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Description</th>
<th>Price</th>
<th>Use</th>
<th>Lifespan</th>
</tr>
</thead>
</table>
| 19  | Bamboo Pan | **Bamboo pan (Tokai)**                                                       |        | **- Depth**: 12 cm  
                               |         | **- Diameter**: 30-40 cm                                                  | Rs. 40-60 | **Collection of plant products**  
                               |         | **- Broadcasting of seeds.**                                               | / unit   | **Bamboo stick**  
<pre><code>                           |         |                                                            | 1-2 years| **- Both man &amp; women use.**     |
</code></pre>
<p>| 27  | Yoke (juali) | <strong>Its shape wood of 1.5 meters with two wood plate to separate and fix Ox.</strong> | Rs 400/- | <strong>- It is used to bind Bullock for ploughing purposes</strong>              | Wood Log  | <strong>Its longevity is of 4-5 years.</strong>  |
| 28  | Hoe (kanka)| <strong>An Sharp Iron plate with a wooden handle of 2.5 feet.</strong>                     | Rs 150/- | <strong>- It is used mostly in barren land (comparatively hard) soil.</strong>   | Its made of iron and wood. | <strong>Its longevity is of 5-7 yrs.</strong> |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Tool Name</th>
<th>Description</th>
<th>Price Per Unit</th>
<th>Usage</th>
<th>Material</th>
<th>Lifespan</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>Pick Axe</td>
<td>A sharp iron pointed (both side) with a wooden handle of 2.5 feet.</td>
<td>Rs 200/-</td>
<td>Primarily used in barren land.</td>
<td>Its made of wood and iron.</td>
<td>Its longevity is of 8-10 yrs.</td>
</tr>
<tr>
<td>30</td>
<td>Mini Spade (kodhi)</td>
<td>Plain iron plate with an handle of one feet long.</td>
<td>Rs 150/-</td>
<td>To dig soil and clay. Normally in soft and fertile land.</td>
<td>Its made of Iron Plate with wooden handle</td>
<td>Its durability is 4-5 yrs</td>
</tr>
<tr>
<td>31</td>
<td>Narrow mini Spade (Alu Koda)</td>
<td>Plain iron plate in narrow shape with an wooden/bamboo handle of one feet long</td>
<td>Rs 150/-</td>
<td>To dig soil and clay. Normally in soft and fertile land.</td>
<td>Narrow shape iron plate with wooden handle</td>
<td>Its durability is 5-6 yrs.</td>
</tr>
<tr>
<td>No</td>
<td>Item</td>
<td>Description</td>
<td>Price</td>
<td>Uses</td>
<td>Material</td>
<td>Durability</td>
</tr>
<tr>
<td>----</td>
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</tr>
<tr>
<td>32</td>
<td>Khurpi</td>
<td>Small iron plate with a wooden handle of 2 feet long. Normally it is used to cut grass and other plants to clean the field. It is made of iron plate and wooden handle.</td>
<td>Rs 100/-</td>
<td>For cleaning fields.</td>
<td>Iron</td>
<td>8-10 years</td>
</tr>
<tr>
<td>33</td>
<td>Hand Pump</td>
<td>Hand Pumps are manually operated pumps they use human power and mechanical advantage to move fluids or air from one place to another. Normally it is used for irrigation, water consumption. It is made of iron. It lasts for 15-20 years. Often need various part for maintenance.</td>
<td>Rs 20,000/-</td>
<td>For irrigation and water consumption.</td>
<td>Iron</td>
<td>15-20 years</td>
</tr>
<tr>
<td></td>
<td>Sugar cane Juice machine</td>
<td>It has two operation modalities (manual and motor). Two iron roller with thread. It has also manual handle.</td>
<td>Rs 10,000/- per unit.</td>
<td>It is used to extract juice from sugar cane.</td>
<td>Its longevity is of 10-15 years.</td>
<td></td>
</tr>
</tbody>
</table>
Land Classification as categorised by the Respondents:

Land Type:

The respondents classified the land into three types on the basis of its terraces. Such as Dhipa jami (Upper Terraces), which are generally prone to drought as these fields are unable to retain rain water. Khala jami (Lower Terraces) which are prone to flood as during rainy season in these fields water retention is very high where as drainage system is poor. And majhili jami (middle terraces) are those field which are neither prone to drought nor to flood.

Soil Type:

The soils have been divided into three major categories, such as Balia mati(Sandy soil), Dorasa mati(Silty soil), Kelua mati(cleyed soil). As the Balia mati is of sandy type, it has lower water holding capacity, as a result it is more prone to drought. Dorasa mati are silty and so have highest water holding capacity. In between these two types of soil type, lies kelua mati in terms of water holding capacity.

Considerable international and national breeding effort has been exerted to develop rice cultivars for the production environments of Eastern India. However, the existing research suggests that farmers are still using their traditional landraces and the production of crop from these ecosystems.

**Table 9.2**

**Farmer’s perception on Selection of seeds**

<table>
<thead>
<tr>
<th>Perceived Problem</th>
<th>Percentage Of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional seeds</td>
</tr>
<tr>
<td>Most Fertile Soil</td>
<td>10%</td>
</tr>
<tr>
<td>Low fertile Soil</td>
<td>90%</td>
</tr>
<tr>
<td>Application of Fertilizer</td>
<td>0%</td>
</tr>
<tr>
<td>Erosion of Soil Fertility</td>
<td>0%</td>
</tr>
<tr>
<td>Pest Tolerance</td>
<td>89%</td>
</tr>
<tr>
<td>Need of technical Management</td>
<td>2%</td>
</tr>
<tr>
<td>Capital Application</td>
<td>0%</td>
</tr>
</tbody>
</table>
Correlation between Soil, Seeds and fertilizers:

It has been clearly noticed that the selection of high yielding variety of seeds are positively co related with the fertility of the land. Ninety percent of the farmers said that they grow improved seeds, on their most fertile piece of land (Table 5). Thus farmers perceive that improved seeds perform better under better fertility regimes; the same relationship is being observed in between application of fertilisers and use of high yielding variety of seeds which indicates the perception of the farmers is that improved cultivars perform better only when chemical fertilizers are applied. Hence it can be perceived that Ninety-four percent of the farmers applied chemical fertilizers to improved cultivars. Besides this, more than 90% of the farmers thought that traditional cultivars did better on low fertility fields and did not erode the fertility status of their fields. As far as the pest tolerance is concerned nearly 90% people opined that traditional seeds are more tolerable to pests than high yielding seeds. More technically sound farmers are needed for the cultivation of new improved high yielding seeds. Capital application and traditional seeds are inversely proportionate to each other. Nearly 95% people gave their opinion in favour of high use of capital application in improved seeds.

Some significant logics found in the method of making and maintaining compost

1. Farmers are very much scientific in the method of making compost. In order to check the volatization of nitrogen from the compost, they maintain proper moisture and regularly cover tank with silt mud layers. They also used to make heaps of 10 to 15 cart loads of compost in the crop land at one place and cover it with top soil (6 to 7 inches) to protect moisture and further augment composting, and to check the nitrogen volatization. Further inorder to incorporate the compost they plough as soon as possible after spreading the compost in the land.

Traditional pest management practices and crop protection method as per the respondents:

The herbal and homemade formulations for plant protection or pest management in traditional agricultural practices are seen as very much cost
effective as well as a utilization of waste and refuses which would otherwise incur cost to be cleaned off.

- The farmer aims at doing without manures, as much as possible, at keeping up the fertility of his land simply by crop rotation or feeding the cattle oil cakes and utilizing all the cattle dung, urine and litter in manuring his field.

- The farmers rationally do not cultivate by mixing or in succession two corps sharing in common, the same pests and diseases. As a result the pests do neither get a favourable condition to grow up with a multiplier effect nor further get a chance to grow consistently on the same field. The pests of a crop which would have multiplied in case that crop had been grown in the same field, would die for the want of the host plant.

- Instead of cultivating the same crop in the same field every year, farmers use to rotate the cultivation of crop i.e a variety of crops are produced on the same field in each successive year. The judicious rotation system gives rest to the land.

- The farmers judiciously grow one crop with deep roots and another with more shallow roots so that different layers of soil can be tapped for nutrients. Different crops take food substances from different levels of land. For eg. Crop like barley exhausts the top soil where as crop such as maize or cotton draw food from deeper layers of the soil.

- By adopting the judicious mixed cropping system the traditional farmers maintain the bio diversity of the agricultural land as well as the food security system of rural India.

- In order to minimize risks under rainfed conditions and checking runoff and soil loss mixed cropping system was practiced by indigenous people.

- In case of peas & mustered, mustered seed are sown first, and after a fortnight the pea seed. Here mustered affords means of climbing to the peas, and is itself benifitted by the root nodules of the peas.
- Instead of spraying chemicals, the larvae and grubs are picked up manually.
- By pinching off the terminal portion, eggs are being removed from the leaves.
- Ash is being dusted on the plants in order to control pest. Inter cropping, crop rotation, fumigation etc are done to improve soil fertility and reduce pest. Cow dung is being used as a suspension sprinkled on the seed in order to prevent from fungal and bacterial attacks.
- In order to ward off birds from the crop field people produce noises with the help of drumsticks. They also use effigies to create a fear factor in birds.

**The method of selecting grains for further production**

1. According to the respondents the traditional process of selecting grains is such as during winnowing of grains the heavy grains which falls near the winnower are kept for seed purposes for next cultivation.

2. The grains which looks healthier look of the grains is also a basis for selection of seed for further production

1. **Tillage**: When single or double corps are grown in the same field in a year, the fallow period available in between the corps help in soil hardening weed growth and loss of nutrients due to erosion. This necessitates more number of tillage operation than needed. The case of relay cropping such as sowing cotton in the stubbles of finger millet, has clearly demonstrated that there is no need for preparatory cultivation for cotton for successful growth. Similarly in the paired row system of mixed crops, the interspace is covered by the second corp and helps in controlling weeds and reducing the time needed for after cultural operation. Thus this technology helps in reducing the cost of tillage operations considerably.

2. Many experiments conducted on cropping system, instead of individual crop, has shown considerable saving on the manorial budget particularly with
P & K without affecting the yield. The usage of leguminous crop in the sequence helps in the reduction of N requirement for the following next crops.

3. **Water** : In the irrigated garden land mixed crops, the water loss by evaporation is considerably reduced. The design of irrigation method is changed due to the paired row system and considerable water saved.

4. **Plant protection** : The opportunity for greater weed growth in the multiple, relay and mixed cropping system is considerably reduced. Again due to the mixing of crops, the spread of pests and diseases are reduced. These help in the reduction of chemicals needed for the control.
CHAPTER – 9

Conclusions and Recommendations
CONCLUSION

The relationship between man and his environment is a dynamic system, because any human ingenuity or mistakes leads to natural disasters or chance discoveries which ultimately change the ecosystem from within. Man exploited the nature in a very crude manner and the nature in turn replies in terms of disasters, natural calamities. Etc So it is high time for us to get alert and behave in tunes with the nature

The first "scientific" approach to organic farming can be quoted back to the Vedas of the "Later Vedic Period", 1,000 BC to 600 BC. (Randhawa 1986 and Pereira 1993). The essence is to live in partnership with, rather than exploit, nature. The "Vrkshayurveda" (Science of plants), the "Krshisasthra" (Science of agriculture) and the "Mrgayurveda" (Animal Science) are the main scripts that reflects traditional knowledge. Here agriculture was not developed just as a production system, but as a culture. Great attention was paid to agricultural technologies and agronomic practices and sophistication was achieved through genetic diversity, crop rotation and mixed cropping systems. Animal husbandry was an integral part of the farming practice. (Mahale and Sorée 1999)

The process of economic growth and development, though vital for any nation’s progress, is done at the cost of environmental degradation through industrialisation and urbanisation. Transportation, burning of fossil fuels and deforestation has led to the emission of green house gases into the atmosphere. These gases absorb the heat of solar rays, which results in the warming of the atmosphere, seas and oceans leading to floods, droughts, severe storms, melting of ice at the poles, receding of glaciers and rise in sea

water levels. These issues have brought the concerns for environmental conservation and sustainable development to the forefront.\(^3\)

Following the dynamic pressures in agriculture vulnerable situations are created for the people which include:

- Since the traditional agricultural technique was neither taught orally nor documented, such important scientific practices were lost over generations.

- More and more amount of production of carbon dioxide by more use of mechanisation instead of manual labour.

- Nutritional imbalances as a result of following monoculture: As a result of the modern agricultural practices many different crops were replaced by mainly rice and wheat and in turn the reduction of pulses, oilseeds, millets and other crops declined. Owing to this the supply of locally produced food which contains all needed proteins, minerals and vitamins, decreased. And the unavailability of locally diversified food products led its prices to go up because of transportation costs. This ultimately resulted in nutritional imbalance.

- The shift from organic manure to chemical fertilizers not only reduces the plants resistance but also makes vulnerable to pest attacks. Thus there is a linkage between heavy use of fertilizers and vulnerability of plants. Even those high yielding varieties of crops, which are specially bred for disease resistance become highly susceptible to certain types of diseases when heavy doses of fertilizers are applied. As a result of high use of chemical fertilizers NO\(_2\) is released, which is a greenhouse gas.

- Pesticide contamination of food, water, and human as well as animal life: As a result of the much higher use of pesticides since 1965, food and water got contaminated.

- Building dams with by heavy rainfall can lead to floods: According to many estimates, the extent of area irrigated compared to the capacity

\(^3\) Mainstream, Vol XLVI, No 25, Indian Cultural Heritage and Environmental Conservation through Traditional Knowledge, by Bharti Chhibber, 8 June 2008
built is very low, averaging about 40%. We have problems like water logging at the head part of the water bodies and deficit at the tail-ends. Big dams have their own problems like rehabilitation of people, ecological concerns and whether they adequately serve their purpose. So these are issues with respect to surface irrigation.

- Creating income inequalities: As this method of production is capital intensive, it led to make the rich richer and poor poorer.

It can very clearly concluded with evidence from the analytical chapters that almost all the respondents irrespective of age, profession, location agree about high contribution of traditional knowledge to almost every sector, specially to Agriculture.

It is widely seen and accepted that there are many areas in which the modern methodology *per se* may not be satisfactory but one is not able to clearly articulate an alternative methodology that would be acceptable to the traditional practitioners and also comprehensible to the modern educated public at large.

Because the basic theories, foundational principles and World view are widely different, there is a clear lack of confidence among a large body of traditional practitioners.

It can be concluded by saying that in one hand Traditional agricultural practice is very potent tool for improving the economic position of farmers irrespective of their category (viz. small farmer, marginal farmer or big farmer) and for banishing unemployment and underemployment, by better utilization of resources such as animals and machineries, water etc. The system provides the farmer a dual product of grains to the farmer as well as feeds and fodders for animals. In this way Real income increases for all big, small & marginal farmers.

On the other hand the traditional agricultural practices decrease the cost of cultivation of crops not only without adversely affecting yield but also by increasing the soil fertility. It tremendously reduces the tillage operational
budget, manorial budget, water consumption, as well as the budget of chemical needed in order to control pests and diseases.

Poverty of the local population in the form of indebted farmers, landless farmers, unemployed or only seasonally employed land labourers are all the direct or indirect result of a move towards modernisation leaving traditional agriculture far behind.

RECOMMENDATIONS

The problem is nobody has yet perfected a farming system that produces high yields, makes a good living for farm families, protects and enhances the environment and still produces good, affordable food. There is a great need to evolve methodologies to comprehend and assess traditional knowledge.

The researcher recommends that there should be a new technology of production which would be economically viable, socially acceptable and ecologically sound and Traditional knowledge can be regarded as an important source for the new technology for the future.

Though we have a good knowledge of the traditional agricultural practices followed by resource poor farmers, we have very few research institutions willing to carry out validation research involving traditional techniques. The tools that are used in Traditional agricultural tools as found in the analytical chapters are economically viable and with a few research on this by changing its size and shape in order to reduce loss of energy new tools can be introduced.

The need of the hour is that there should be a production technique that would counter all the ecological side effects of green revolution like degradation of soil fertility as a result of chemical fertilizers. Water retention in the soil can be very well done through traditional agricultural practices. To be ecologically viable mixed cropping is must as it leads to conserve bio diversity. Pollutions with hazardous chemicals should be replaced with biological manures.
Some of the traditional practices need early attention.

Conscious selection of agricultural practices which implies knowledge systems about the crop and its environment, which are subsets of the more general traditional knowledge and indigenous knowledge should be practiced.

Publications on package of practices published by the Department of Agricultural Extension and the Agriculture Universities are focused on high cost chemical external inputs. These are not only expensive, but also destructive to soil health, environment and crop yields. More documentation on low cost, organic and local available inputs, with the experiences of successful organic farmers is necessary.

Many farmers who have a scientific approach and practical knowledge, can hardly document their experience. Factors include lack of time and resources along with expertise in articulation. To some extent this can be overcome with a little support by an NGO, who works in that area. The staff of the NGO could document farmer’s experiences while acknowledging the source. This will serve as an inspiration and encouragement to the farmer.

NGO staff with agricultural background and interest could also document the traditional knowledge of aged people, about their early cultivation practices. Old women, particularly are a rich source of information on seed selection, preservation and also local traditional use of herbs in maintaining the health of humans and livestock.

Audio documentation during discussions at the seminars, workshops and farmer’s groups could be very good in disseminating knowledge on good practices.

The critical issues that plague Indian agriculture at present are the knowledge deficit and infrastructure deficit, especially in the rural areas. Problems related to irrigation infrastructure, market infrastructure and transport infrastructure add significant cost to farmers’ operations. There are a number of schemes aimed towards developing agriculture. We don’t have effective delivery mechanisms that can translate those into effective facilitation at the ground level, in terms of increasing productivity or
decreasing cost or increasing price realization. Inadequate government support exacerbates these issues. Thus government facilitation is essential for sound agricultural development.

Earlier every area would have one or the other food crop but because of the popularization of rice and wheat we may have lost many coarse cereals and therefore the ability to produce these coarse cereals. There should be a socially acceptable production technology introduced which should have inclusiveness of taking into account the development of the rural poor at first, by providing food security with good quality of product.

As indigenous knowledge is stored in culture in the form of traditions, customs, folk stories, folk songs, legends, dramas, proverbs, myths, superstitions, sayings, etc, it should be included in the formal educational curriculum in order to keep this knowledge alive keeping in mind the potential of the knowledge for the present as well as of future generation.

More and more agricultural extension programmes should be organised in more and more agricultural extension organisations in order to identify, document, validate and implement IKS.

National policies should be made in support of IK in order to promote the use of IK by sensitizing and conceptualizing.

The critical issues in Indian agriculture are related to knowledge and infrastructure. Although there is not a lack of initiatives and institutions to tackle these issues, we have to become better at managing big systems to achieve success in our endeavors. At the same time, we should look into new approaches like private sector participation and harnessing of indigenous knowledge to improve performance. Small farmers who are especially vulnerable to the monsoons should be focused upon and services like credit and crop insurance should be made more accessible. This will ensure that agricultural sector remains viable and caters to the country's needs.

It is high time to find accelerated growth, reduce poverty and hunger and fear of growing food gaps by paying attention towards agriculture and rural
development. In this strategy, agriculture should be the key for development facilitating the mobilisation of otherwise idle labour.

There should be a strategy that relies on cost reducing, income raising technological change in agriculture to give an initial boost to real national income.

Although the evolution of different cropping patterns are concerned with the agronomist, the adoption by farmers needs a co-ordinated approach involving crop management research and farm management economics research.

Besides there is the need for farmer involvement and scrutiny so as to evoke an alternate cropping pattern with economic viability. There is need to consider the resource base of farm family and community that governs adoption potential.

It is not possible to feed more than one billion people in India with the help of old traditional method only but it also should not be the destructive, unsustainable agricultural modern technique. The research findings suggests there should have economically greater viability for wide scale adoption.

There should be a balance of production in between export oriented goods and goods for local needs. Government's inclination towards the production of export oriented goods should be changed.

The new agricultural production technique should give emphasis on small scale farming, leading to employment generation as the farm size in India is very small and there is abundant labour force.

It would not be capital intensive which leads the farmer to vicious circle of poverty resulting in thousands of suicide. Through a little modification in traditional practices it is possible to get a economically viable production system.

The indigenous technical knowledge evolved in a location on practical experiences over centuries should be given its due importance when new methodologies are tried on the basis of the old one.
As the research needs in all these activities require a large number of human resources, the limited supply of qualified research personnel have to be taken into account.

The national agricultural research system (ICAR, Agricultural universities and others) by and large has focussed its attention on agribusiness only, i.e., on resource rich farmers. This is very unfortunate.

Agricultural research and technology development programmes can assure responsiveness to gender-equality issues by:

1. recognizing women farmers as forming a constituency for agricultural research;
2. recording from women the husbandry and utilization information on indigenous plant varieties that would provide insight into performance characteristics;
3. giving due attention to the multiple uses of plants for food and other uses;
4. studying domestic processing, storage and cooking technology and linking them to plant breeding programmes.

Despite the current resurgence of interest and global demand for herbal medicines, traditional medicines are still viewed with a certain amount of scepticism, since the public is not sure of the quality (safety and efficacy, for example) of the traditional preparations available in the market. Time has come to look deeper into the context of Indian Medical Heritage, to create a respectful crosscultural dialogue, to understand the knowledge systems, to develop meaningful methods using contemporary tools and to try and interpret traditional knowledge. It may not only be difficult to have direct interpretations of the Indian medical knowledge in terms of modern language but may at times not be possible. However, it has to be attempted since this would not

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4 Adapted from J. Jiggins Gender-related Impacts and the Work of the International Agricultural Research Centres, World Bank, Washington, DC, 1986.
only demonstrate the contemporary relevance of traditional medicines but also build wider public confidence in Indian Medical Heritage.

Finally, it has become evident that research and development efforts must also aim to identify and address the challenges and threats faced by traditional health knowledge systems, in Orissa. The ultimate goal is to strengthen and improve this vast knowledge base for the benefit of the great majority of the developing world who have survived on it for centuries and will continue to do so into the foreseeable future.
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34. Intellectual property By P. Narayanan.


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49. Rice Tec. Patent for Basmati grain and rice lines


54. Secretariat of the Convention on Biological diversity, 2001; Wilson, 1988

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Annexures
QUESTIONNAIRE

Your kind response (in the form of tick marks) is invited in this questionnaire which is of great value for me in conducting the research on "Indigenous traditional knowledge in Agriculture".

(Nota: The unwritten knowledge/ wisdom continually used by generations, coming out of our experience through tradition, heritage, culture and/or family or social setup is called Traditional Knowledge.)

UMME HANI

Indicate your personal profile please:

(a) Age: (years)  
- 15-25 ( )  
- 25-35 ( )  
- 35-45 ( )  
- Above 45 ( )

(b) Profession:  
- Business ( )  
- Service ( )  
- Professional ( )  
- Farmer ( )  
- Student ( )  
- Retired/ Housewife ( )

(c) Home Town:  
- Rural ( )  
- Urban ( )  
- Semi-urban ( )

1. Mark the level of use of the traditional knowledge in the following areas:  
(Tick the appropriate level, as you feel, for each of the given areas)

(a) Agricultural Practices: food grains & cereals
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(b) Agricultural Practices: Horticulture
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(c) Agricultural Practices: Floriculture
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(d) Fast Foods
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(e) Beverages/ Health Drinks
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(f) Soil conservation practices
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(g) Water management
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(h) Forestry
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(i) Fisheries
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(j) Herbal Medicine
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )

(k) Alternative Health Packages/ Services
- Very high ( )  
- High ( )  
- Average ( )  
- Low ( )  
- Very low ( )
2. Identify the top five areas from the list above in order of the contribution of traditional knowledge in the enrichment of those areas in India.

(1) Alternate Energy Sources
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(m) Handicrafts
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(n) Architecture
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(o) Metallurgy
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(p) Tourism Industry
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(q) Education/ Training
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(r) Social Service/ Welfare Activities
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(s) Games and Sports
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(t) Music/ Drama/ Film/ Fine Art
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(u) Entertainments/ events/ festivals
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

(v) Any Other (please specify) ..................................
Very high ( ) High ( ) Average ( ) Low ( ) Very low ( )

Thank you for taking part in our research
Structured Questionnaire for the farmers filled through PRA (Participatory Rural Appraisal) technique

1. What are the traditional tools you use in the ploughing process?
2. Why do not you substitute this ploughing tools with the modern tools?
3. What are the tools used by you in the intercultural process of agriculture?
4. What are the traditional tools generally used by you in the post harvest period?
5. What are the measurement and other traditional processing tools used by you?
6. What are the types of land you found in your agricultural field.
7. How do you select the seed for the next harvesting.
8. What is the criteria of selecting field and high yield seeds.
9. Does finance play a role in selecting the seeds and method of production.
10. What is the relationship between the use fertilizer, pesticides and the seeds i.e. traditional and high yielding.
11. What are the traditional techniques do you use for pest management?
# Respondent's Profile

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