USE OF ANIMAL PRODUCTS IN TRADITIONAL AGRICULTURE

A Pilot Project in Southern India

Editors

A.V. Balasubramanian, T.D. Nirmala Devi and

M. Merlin Franco

Centre for Indian Knowledge Systems, Chennai

June 2009

Title	Use of Animal Products in Traditional Agriculture *A Pilot Project in Southern India*
Publication	June 2009
Editors	A.V. Balasubramanian, T.D. Nirmala Devi and M. Merlin Franco
Editorial Assistance	R. Abarna Thooyavathy
Photographs	Compas India partners – CIKS, IDEA and FRLHT
Design and Layout	Anand Ramachandran
Layout Assistance	S. Ramesh
Financial Support	Produced as part of the COMPAS programme for Endogenous Development and Cultural Diversity supported by the ETC foundation, The Netherlands
Publisher and Copies can be had from	Centre for Indian Knowledge Systems (CIKS) No: 30, Gandhi Mandapam Road, Kotturpuram, Chennai – 600085 Ph: (044) 24471087, 24475862 Email: info@ciks.org
Printer	Unique Grafic Printers No. 87/4, Arcot Road Vadapalani, Chennai - 600 026

COVER PHOTOGRAPH

The cover photograph shows a man ploughing his field with the help of his cattle.

CONTENTS

Preface

Profiles of Compas Partners Involved in the Project

Members of the Project Team

Chapter – 1 - Introduction 1

Chapter – 2 - Survey of Literature 6

Chapter – 3 - Field Survey 14

Chapter – 4 - Field Studies 21

Chapter – 5 - Laboratory Studies 55

Chapter – 6 - Conclusions and Future Prospects 58

References 66

Additional Readings 73

Annexures

Annexure – I : Contemporary literature referred for farmers practices on the use of animal products in agriculture 75

Annexure – II : List of animal products mentioned in ITK volumes and selected practices 76

Annexure – III : List of Vrkshayurveda texts referred 78

Annexure – IV : Guidelines for survey of selected texts of Vrkshayurveda regarding use of animal products for agriculture 79

Annexure – V :	Summary of selected Vrkshayurveda texts	81
Annexure - VI :	Summary of the text of Vrkshayurveda of Surapala	88
Annexure – VII :	Report of the literature survey of Ayurvedic texts relating to animal products used in traditional agriculture	109
Annexure – VIII :	Ayurvedic practitioners comments on use of animal products in traditional agriculture	133
Annexure – IX-A :	List of villages surveyed	137
Annexure – IX-B :	Format : Survey of animal products in traditional agriculture	138
Annexure – IX-C :	Consent Form	146

PREFACE

The COMPAS Indian partners have been involved for over ten years in this programme and three of the four partners have traditional agriculture as one of their focal areas. During the last few years there has been increasing interest in the use of specific animal products such as Panchagavyam (a compound formulation with five products from the cow such as milk, cow's urine etc). There has been a virtual expansion of farmers and field groups who are trying out this formulation with varying claims and through the years academics and research institutes have also started studying this area.

Under these circumstances we decided to launch a coordinated programme involving all the COMPAS partners in this area namely - Use of Animal products in Traditional Agriculture. The COMPAS partners in India have diverse and complementary strengths - three of them are involved in field work relating to agriculture and the fourth group has high expertise in Ayurveda and a well equipped model laboratory. Hence it was decided that a coordinated programme would be taken up during a period of fifteen months from October 2005 to December 2006. The project was multi centric and was also guided by a panel of experts. The results have proven to be rich and fascinating and had also opened up further venues for investigation that are being pursued by the partners. The entire programme was funded by the ETC COMPAS programme as a coordinated effort in India. We hope that this publication would not only be communicating our experiences and results to farmers, CBOs and academics but also stimulate further thinking and research in this area.

Chennai
June 2009

A. V. Balasubramanian
COMPAS programme
Centre for Indian Knowledge Systems

PROFILES OF COMPAS PARTNERS INVOLVED IN THE PROJECT

CENTRE FOR INDIAN KNOWLEDGE SYSTEMS (CIKS)

CIKS came into existence in August 1993, when it was formed as an autonomous centre under the Academy of Development Sciences, Maharashtra. In January 1995, it was registered as an independent trust in Chennai. The thrust areas of CIKS work are

A. Biodiversity conservation: Conservation of biological resources, with emphasis on agrobiodiversity

B. Organic agriculture: Applying traditional agricultural knowledge for the restoration of rural environment and enhancing the livelihood security of farmers through organic farming.

C. Vrkshayurveda: Research, application and popularisation of Vrkshayurveda for better organic farming.

www.ciks.org

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)

FRLHT is a registered Public Trust and Charitable Society, serving the public from its inception in March 1993. The Ministry of Science & Technology, India has recognised FRLHT as a scientific and research organisation. FRLHT has also been designated as a National Centre of Excellence for medicinal plants and traditional knowledge by the Ministry of Environment and Forests, India.

The mission of FRLHT is to demonstrate the contemporary relevance of Indian Medical Heritage by designing and implementing innovative programmes related to

A. Exposition of the theory and practice of traditional systems of medicine

B. Conservation of the natural resources used by Indian systems of medicine

C. Revitalisation of social processes for transmission of the heritage, on a size and scale that will have societal impact

The work of FRLHT falls on three core areas viz.

A. Conserving natural resources used by Indian Systems of Medicine

B. Demonstrating contemporary relevance of theory and practice of Indian Systems of Medicine

C. Revitalisation of social processes (institutional, oral and commercial) for transmission of traditional knowledge of health care for its wider use and application

www.frlht.org

INTEGRATED DEVELOPMENT THROUGH ENVIRONMENTAL AWAKENING (IDEA)

IDEA is a non-governmental research and development organization, established in 1981 in Visakhapatnam of Andhra Pradesh, India. IDEA believes that for a comprehensive sustainable development of human society, human beings and their environs should be harmoniously knit with a chain of local indigenous / traditional socio-economic, cultural and ecological links. The prime concern of IDEA is "Promotion of sustainable development on sociologically acceptable, culturally ethical, economically viable and ecologically sound lines*".*

IDEA initiated its intervention in just 14 villages in 1985 in Andhra Pradesh and now it covers more than 300 tribal villages in the Eastern Ghat region of Andhra Pradesh and Orissa through development programmes and action research activities.

www.ideaind.org

KRISHI PRAYOG PARIWARA (KPP)

KPP can be loosely translated as a community of farmers involved in experimentation. It was born out of the understanding between Dr. Upendra Shenoy, a social worker and Thiru. Purushotama Rao, a farmer from Terthahalli of Karnataka that they should form a working group to study and solve some of the problems faced by the farmers of the Western Ghat region of Karnataka. KPP was later registered as a Trust under Indian Trust Act, in 1996. KPP was then aiming at designing practical development strategies which were not only based on economic objectives but also on moral, spiritual and ecological values.

KPP has the following as its three major objectives:

A. To promote indigenous, self-reliant and eco-friendly organic agriculture, which is thoroughly sustainable;

B. To revitalize local health traditions, in which safe, non-chemical agriculture plays a key role and helps to promote diversified ecosystems which provide the basis of local health traditions.

C. To provide Development Education to young people to empower them to play an important role in constructive socio-economic developmental activities.

MEMBERS OF THE PROJECT TEAM

A wide range of people from various sections were involved in this project implementation. They include experts and researchers from agricultural universities, tribal communities, farmers, expert committees, consultants, research teams, field groups and individual teams from various partner organizations namely FRLHT, KPP, IDEA and CIKS. We thank everyone for their contribution in the project.

CENTRE FOR INDIAN KNOWLEDGE SYSTEMS (CIKS)

1. A.V. Balasubramanian, Overall co-ordinator of the project

2. EXPERT COMMITTEE

Three of the experts were actively involved in planning, implementation and review of the work. They include:

- Dr. S. Arivudai Nambi and Dr. Selvamuthu Kumar, faculties from the Department of Entomology, Annamalai University and
- Vaidya. K. Gowthaman, Ayurvedic Physician, Chennai, Tamil Nadu.

3. CONSULTANTS

- Dr. V. Kurucheve, faculty from the Department of Plant Pathology, Annamalai University
- Dr. Katrien Van't hooft, Veterinary physician, COMPAS ETC programme, the Netherlands.
- Vaidya G.G. Gangadharan and Vaidya P.M. Unnikrishnan, Ayurvedic Physicians, Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore.
- Dr. Veena Ganeshaiah, Veterinary Physician, Department of Physiology, Veterinary College, Bangalore.

4. RESEARCH TEAM, AGRICULTURAL COLLEGE, ANNAMALAI UNIVERSITY, CHIDAMBARAM

- Dr. D. John Christopher, Mr. R. Udayakumar from the Department of Plant Pathology, Annamalai University

- Mr. Sathish and Ms. Nithya, Students of the Department of Plant Pathology, Annamalai University

5. FIELD TEAM, SIRKAZHI FIELD AREA, TAMIL NADU

Mrs. Subhashini Sridhar, Ms. P. Kiruthika, Mr. H. Ganesh, Mr. S. Ashok Kumar, Mr. U. Dinesh, Ms. P. Priya, Mr. R. Manikandan, Ms. P. Sobana, Mrs. B. Arokiyajaya and Mrs. M. Fathima.

6. LITERARY RESEARCH, REPORTING AND PUBLICATION TEAM, CHENNAI, TAMIL NADU

Mr. A.V. Balasubramanian, Dr. K. Vijayalakshmi, Ms. V. Geetha, Dr. A. Suganthi, Ms. T.D. Nirmala Devi, Ms. R. Abarna Thooyavathy and Mr. F. Merlin Franco

INTEGRATED DEVELOPMENT THROUGH ENVIRONMENTAL AWAKENING (IDEA)

1. Mr. K.J.N.Gowtham Shankar - Principal Investigator and Team Leader
2. Mr. N.Sanni Babu - Research Co-ordiantor, Thatipudi
3. Mr. K.S.S.V. Subrahmanyam, (Shiva), IDEA- EDRC, Araku, Andhra Pradesh
4. Mr. P. Sanjay Kumar, Research Co-ordinator, Field Experiments, Araku, Andhra Pradesh
5. Mr. M. Dobbuliu, Research Assistant, Araku, Andhra Pradesh
6. Mr. K. Arjuna, Research Assistant, IDEA, Orissa
7. Mr.V. Debo, Crop Health Healers Network, Andhra Pradesh
8. Tribal Farmers - Mrs. K.Parvathi, Mrs. K.Rambha and Mr.J.Ramachander
9. Mr. K. Subba Rao, Agricultural Demonstrator, IDEA, Araku, Andhra Pradesh
10. Dr. S.B.S. Nandh, Assistant Director (Agriculture), Govt. of A.P - Araku, Andhra Pradesh
11. Dr. K. Chakravarthi, Agriculture Officer, Govt. of A.P - Sabbavarm, Andhra Pradesh
12. Dr. K.Chakravarthi, Verterinary Officer, Viyyammapeta.

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)

1. Coordinator for Ayurvedic literature team – Dr. P.M. Unnikrishnan

2. Team Leader for laboratory research - Dr. Padma Venkat, Joint Director

3. Team Members involved in laboratory research

   - Dr. Ratnadeep Paul Choudhury, Senior Research Officer
   - Research Fellows - Ms.Shantala Y.M, Ms.Krithi.N, Ms.Deepthi Pawar, Ms. Sowmya K.

KRISHI PRAYOG PARIWARA (KPP)

1. Aruna Kumara, V. K. – Team leader – Director of KPP

2. Lakshmish Kadigere – Coordinator

3. Anand, B. K. – Member – Organic farmer and Volunteer

4. Smt. Vidya, S. S. – Documentation help.

5. Dr. Mohan, G. S. – Plant breeder at Agricultural Research station, Ponnampet, Karnataka – Helped in analyzing the experimental data.

6. Anand, A. S. – Director of KPP – helped in designing farm experiments.

CHAPTER - 1

INTRODUCTION

Traditional Agriculture has generally been considered everywhere as a joint effort between humans and cattle. More than any other part of the world in India there is a deep link between farmer and his cattle. This is not merely an act of convenience that the cattle provides the draught power and certain inputs that are important in composting, pest control and crop protection (cattle dung, urine, etc.) but the partnership is much deeper with socio-cultural and spiritual dimensions. In Tamilnadu, in Southern India the major farming festival is Pongal which occurs in the middle of January and the climax of this festival is thanksgiving to the Sun as well as to the cattle.

Inspite of the fact that tractors, tillers and mechanical implements have slowly started making inroads, cattle still remains central to traditional agriculture in India. This is also partly because of the nature of the land holdings which are small and scattered which make mechanization of agriculture quite challenging. At a deeper level cattle have always been associated with plenty and prosperity.

The COMPAS Indian partners have been involved for over ten years in this programme and three of the four partners have traditional agriculture as one of their focus areas. In recent years there has been a great deal of interest, experiments and innovations on the use of animal products in traditional agriculture. Interestingly lots more has happened in the informal sector involving individual farmers, farming groups and community based organizations than in the formal research centres and the University. For example, there has been a virtual explosion of work, field testing and innovations relating to animal products mixture called *Panchagavya* using it for crop growth and protection. There have been a lot of claims and counter claims. Under these circumstances the COMPAS partners decided to launch a coordinated pilot project on the theme of the role of animal products in traditional agriculture. In the following section, we have first provided an overview of literature on animal products in agriculture and followed this up with a description of how this project was planned by us.

Literature on Animal Products and Agriculture

During the last fifteen years there has been a spate of literature on animal products particularly with respect to their use in traditional agriculture. One of the earliest persons who popularized the use of it is Dr. K. Natarajan of Tamilnadu (1). Subsequently there have been a large number of booklets such as the more recent publication by Dr. Solaiyappan (2). There has also been a large number of newspaper articles, many of them centred around the work of Dr. Natarajan and others (3). Running parallel to this is research that is being undertaken in Universities and by Scientists. One of the

earliest detailed studies was a Ph.D. thesis of Bhaskar Padmodaya (4) who studied how seedling diseases and wilt of tomato can be controlled biologically looking at several methods including the use of *Panchagavya*. Subsequently, there have been several additional studies on *Panchagavya* and its modifications that were undertaken by many researchers (5-8)

At the Tamilnadu Agricultural University, Coimbatore, Dr. E. Somasundaram of the Department of Agronomy and some others are looking into the action of *Panchagavya* in detail (9). Dr. Kurucheve and his colleagues in the Department of Pathology in the Agricultural College, Annamalai University, Chidambaram have been looking at the use of various natural products including and especially animal products on various aspects of agriculture (10-13). Several other papers looking at traditional agricultural practices mention use of animal products in agriculture such as a paper by Dr. Nene about the agronomic concepts and practices in Kautilya's Arthasastra (14).

Recently the Indian Council for Agricultural Research (ICAR) had undertaken a mission mode project on collection, documentation and validation of indigenous technical knowledge (15). A series of over seven volumes were published as part of this effort and it is seen that these include a large number of animal products that are used by traditional communities. About twenty years ago, Professor Anil Gupta of the Centre for Management of Agriculture, IIM Ahmedabad started a publication of a journal called HONEY BEE (16). The magazine carries a large number of references to traditional agricultural practices. It is seen that there are plenty of references and products of animal origin in these practices. Subsequently, there have also been various Indian language editions and adaptations of this magazine. For example, the Tamil adaptation of HONEY BEE bearing the title *Nam Vazhi Velanmai* (17) published from Madurai also carries plenty of references to animal products.

A Nagpur based group of scientists is also said to have developed a cow's urine based disinfectant (18). Parallel to this effort there has been also a renewed interest in the nutritive value of animal products. This is including the efforts relating to probiotics (19), interest in substances such as goat's milk in which there is a renewed interest (20).

Panchagavya

While a great deal of importance is given to individual animal products a compound formulation that is widely mentioned and discussed is *Panchagavya*, which literally means a mixture of five products originating from the cow. These are - milk, cow's urine, cowdung, curd and ghee. Originally, mention of *Panchagavya* has been made in *Dharmasastras* and the texts of *Agamas* wherein it is mentioned as being a purificatory method. Traditionally *Panchagavya* has also been consumed orally by humans for purification or as an act of penance. *Dhanwantri Nigantu* has described that it purifies the body. The Ayurvedic classic *Charaka Samhita* mentions it for the treatment of

Kamala and *Panduroga*. Texts also prescribed the processes of preparation of various ingredients and also sometimes specify the exact sequence of mixing the components and the rituals to be performed. (21)

PLANNING OF THE PROJECT

The following is an outline of the work that was undertaken with the overall plan.

I. DOCUMENTATION AND SURVEY

Survey of literature relating to the subject was taken up both from literature and from the field area as follows -

A. Survey of Literature

1. Farmers' practices

In recent years, there has been a virtual explosion of literature relating to farmers practices relating to traditional agriculture. There have been a large number of newsletters and magazines in English as well as various regional languages. There have also been a compilation of these practices that have been taken up as a project in a mission mode by the Indian Council for Agricultural Research (ICAR) which has brought out a series of publications on this topic. In addition, there have also been focused studies, that are undertaken in depth in particular geographical areas in the form of Ph.D. thesis.

B. LITERATURE FROM TEXTS OF VRKSHAYURVEDA

There has been specialized literature pertaining to Agriculture as it is applicable to plants that talk about plants in health and disease. A set of eight texts of Vrkshayurveda which are available in print were taken up for detailed analysis. A format was evolved for summarizing the contents of the text as well as for selected and tested practices pertaining specifically to the use of animal products.

C. AYURVEDIC TEXTS

Based on their field experience the partners involved then shortlisted three specific animal products which they wanted to be assessed in detail and analyzed from the Ayurvedic view point. These products were - Milk, Urine and Dung. An analysis of these components from various animals was made as it was available in standard Ayurvedic texts.

II. ANALYSIS AND FOLLOW UP

The data that was compiled above was analysed and taken forward in the following manner -

1. Shortlisting and prioritisation

A set of criteria was evolved for shortlisting and prioritisation of the practices collected so as to identify those on which more detailed analysis and work should be taken up. This can be in three different ways namely - Analysis of properties as found in classical Ayurvedic texts, conducting laboratory studies or conducting field trials.

2. Field survey

In this case it was felt that extensive field survey need not be undertaken widely since there is a tremendous amount of literature that has already been compiled and available. However, one of the partners was working in a field area bordering Andhra Pradesh and Orissa which is inhabited by tribal communities that are not very well studied from this view point. Hence it was decided that a field survey would be undertaken focused specifically on this area.

3. Laboratory studies

The selected and short listed activities were subjected to laboratory studies and analysis with the help of laboratory technical team of FRLHT. This was at two levels namely-

a. Physical, chemical, organoleptic and microbial analysis. This was for the purpose of standardization to the extent possible, establishing the range of variability of specific physicochemical parameters and to some extent make an assessment of safety issues.

b. The FRLHT team also provided help to evolve Standard Operating Procedures (SOPs) with respect to the use of animal products.

4. Field trials

The practices that were shortlisted and prioritized were subject to field trials. These were carried out in three different field locations namely - in Andhra Pradesh by IDEA, in Karnataka by KPP and in Tamilnadu by CIKS. Every field group carried out experiments on prescriptions and usages that they had identified based on their own priority. Help was provided in the design of experiment, execution and analysis of results through workshops that were organized involving members of the Expert Committee.

OVERALL PROCESS

The above description gives an overview of the process wherein literature survey and field survey were undertaken initially feeding into the next level of laboratory analysis and field research. However, in practice the process was much more dynamic. Considering the limited time frame of the project (fifteen months), the field groups

started out with experimental work right from the beginning based on their preliminary previous experience and a quick preliminary analysis. The groups kept in touch throughout through project meetings and capacity building workshops. The results have been shared in a systematic manner in the following chapters.

SHARING OF RESULTS

The results of the above exercise have been shared in this publication as follows

- The second chapter provides an overview of the survey of literature, criteria used for short listing practices and practices that were selected for further examination.

- The third chapter describes the methodology and results of the field survey carried out and identifies products listed for detailed examination.

- The fourth chapter provides a summary of the results of the various field experiments carried out in all the three field locations.

- The fifth chapter provides a summary of results of the laboratory exercise.

- The sixth and the concluding chapter gives an overview of the summary of results of the programme, discusses its implications and looks at pointers for field work.

Certain detailed outputs that have been summarized or referred to briefly in the main text have been shared in a set of annexures towards the end of this book.

CHAPTER- II

SURVEY OF LITERATURE REGARDING FARMERS' PRACTICES

Prior to the commencement of the project, CIKS and FRLHT were provided with the mandate of collecting secondary information on topics relevant to the project. Various sources were referred and information collected so as to get a background idea for the project implementation and was also expected to provide with some valuable folk practices connected to our topic of interest.

Farmers' Practices

A survey of farmers' practices from Vrkshayurveda texts and other contemporary texts was planned for short listing some of the interesting practices that involve use of animal products that are non-destructive. Following this, a survey of farmers' practices from literature was carried out by Centre for Indian Knowledge Systems at Chennai and a survey of texts of Ayurveda was carried out at Foundation for Revitalisation of Local Health Traditions, Bangalore.

Two aspects of traditional agricultural practices of farmers were looked into

A. Contemporary literature on farmers' practices

B. Textual literature on Vrkshayurveda

A. Contemporary Literature on Farmers' Practices

CIKS gathered information from five different sources of texts. It meticulously went through all the volumes of the newsletter Honey Bee, *Namvazhi velanmai*, various volumes of LEISA (Low External Input Sustainable Agriculture) journals and the documents of "Inventory of Traditional Technical Knowledge" (ITK) in Agriculture. Besides, CIKS also referred the Ph.D. thesis of Dr. M. Sundaramari on the 'Adoption and Perceived Effectiveness of Indigenous Agricultural Practices in Different Farming Systems, submitted to the Gandhigram Rural University. Annexure - I provides details of various contemporary literature referred for short listing the farmers practices on the use of animal products in agriculture.

Criteria for Prioritisation of Practices

There were certain criteria adopted for short listing the practices. These include

1. Prioritisation

As there were a very large number of practices involved over a variety of crops, animals, animal products and a tremendous range of uses, they had to be prioritised based on well defined criteria. Three of the criteria that were agreed upon for priorities are listed below.

a. Single component practices: Considering the complexity and challenges of standardizing work with animal products it was felt that priority can be given to those practices that deal with the use of only one single animal product in comparison with those that dealt with complex mixtures.

b. Seed treatment: The testing and validation of practices that are meant for providing disease resistance, increasing crop yield, controlling pests etc., are relatively more time consuming since one has to go through the entire duration of a crop season to study the phenomenon and repeat it during several crop seasons to confirm the reliability of results. However when the practices are for the purpose of – "Seed treatment" the observations and experiments can be finished over a much shorter time span of just a few days wherever seed treatments are meant specifically for the purposes such as – overcoming dormancy, enhancing germination, enhancing growth of seedlings at an early stage etc. Hence this can be a priority since a large number of practices can be screened and tested over relatively short periods.

c. Commonality of practices from Vrkshayurveda literature and field reports: It was felt that wherever similar / identical practices were reported from the field as well as the literature of Vrkshayurveda a higher priority can be assigned to testing these practices.

d. Simplicity: Wherever the procedure was simpler / easier to carry out, a higher priority can be assigned.

2. Nature of Use

It has been observed that in terms of the nature of use to which animal products are put, certain uses are non-destructive in the sense that they do not cause death / damage to the animals concerned. These are practices such as usage of milk, dung, urine etc. However there are other usages which may be considered destructive such as use of flesh, blood, fat etc. In this connection it was decided that wherever the practice is picked up from literature survey alone, we would focus on those practices that are non-destructive in nature. However in terms of practices that are already prevailing in the community (as against those that are introduced by us) in case some destructive practices do exist we may choose to continue work with it provided it is identified as a priority for study based on the criteria that we have identified.

There was an ocean of knowledge available from the texts. Based on the criteria, 43 practices were finally short listed. There is a mention of about 32 animals in the Inventory of Traditional Technical Knowledge document. They include Cow, Buffalo, Goat, Sheep, Horse, Pig, Termite, Crab, Rat, Human, Camel, Duck, Pigeon, Frog, Snake, Hen, Lizard, Crow, Honey bee, Donkey, Cat, Dog, Nilgai, Farm animals, Domestic animals, Poultry birds, Livestock, Cattle, Ants, Fish and Snail. Use of several of the products of these animals has been mentioned in this 3 volume document.

Eg. In goat, recipes involving products like milk, dung or excreta or droppings, hair, urine, penning, goats (live) and in fish, use of live fish, fish washings, fish meal, fish wastes and fish scales are mentioned.

A few examples of the recipes mentioned in the ITK volumes and Honey bee journals are mentioned below.

Recipes from ITK Document

1. Fish meat, when broadcasted in cotton field, provides the necessary nutrients and helps in pest control.

2. In mango trees, when human urine is applied through irrigation channel or broadcasted, serves as manure and enhances soil fertility. It also helps in control of termites.

Recipes from Honey Bee Journal

1. Control of Leaf Curl and Fruit and Flower Abscission using Goat's Milk

Fresh goat's milk sprayed over plants like chilli *(Capsicum annuum*), brinjal *(Solanum melongen*a) and spices like black pepper *(Piper nigrum*) helps control of fruit and flower abscission and leaf curling that occurs due to cold in winter.

Farmer: Machar Babudiben, Dahod,Gujarat. Comm. Ramesh Taviyal

2. Buttermilk to Survive Against Water Stress

Buttermilk sprayed on cotton and sesamum crops helped both to survive during water stress period of about 47 days caused by the delay in the last spell of monsoon rains while the untreated ones failed completely

Farmer: Vallabhbhai Gothi, Honey Bee, 1996, 7(1): 9.

3. Control of Flower dropping in Chillies and Tomatoes

Two kg of neem seeds are ground well and diluted with water and then filtered. To this filtrate, ten kg of fresh cow dung is mixed thoroughly. This is sufficient for spraying on one acre of land by adding required quantity of water to stop flower dropping.

Farmer: Ramachandra Gounder, 2, Keelendapatti, Dharmapuri, Tamil Nadu.

The list of animal products mentioned in ITK volumes and some selected practices are provided in Annexure – II.

B. Vrkshayurveda Texts

Apart from various literatures on farmers' practices, Vrkshayurveda texts were also surveyed for short listing interesting farmers' practices on the use of animal products in agriculture. Initially, ten texts of Vrkshayurveda (Traditional Indian Plant Science) were selected for survey regarding the use of animal products for traditional agriculture. Finally, eight books were short listed from this for the survey. The list of Vrkshayurveda texts short listed for the survey is provided in Annexure – III. An ayurvedic scholar was identified as a consultant for this purpose. A set of guidelines was prepared for making the survey and the manner in which the results need to be presented. This is provided in Annexure – IV.

Based on these guidelines, eight texts of Vrkshayurveda were analysed and compiled. The summary of each text would consists of an introduction (title, author, translator, editor, publisher), an overview of the chapters and then a table which lists in detail each practice wherein the animal product is mentioned. A few interesting recipes from the selected Vrkshayurveda text is provided here:

Recipes from Vrkshayurveda Texts

a. For seed treatment: Seeds collected from naturally ripened fruit, sprinkled with milk for 5 days and smoking done with ghee mixed with Vidanga choorna.

b. Nourishment recipe: Water prepared with Ghee, milk, honey, when watered to Bilva and Kapitta trees bear big number of fleshy fruits.

c. Applying Ghee, Kunapa jala and pig's stool gives bigger and sweeter fruits in Pomegranate.

d. Application of horse gram powder along with elephant tusk yield more number of flowers in Lotus.

The summary of the selected Vrkshayurveda texts and summary of the text of Vrkshayurveda of Surapala are provided as Annexure - V and VI. This summary has

several sections such as – listing of animals mentioned, animal products mentioned as well as for each of the products the method of application, the purpose and the crops on which they are used.

A preliminary short listing of practices based on the criteria that were agreed upon between partners and experts during the meeting was also done. A workshop on "The Validation of Traditional Practices of Agriculture" was organised by CIKS on November 4th and 5th 2006 at Vaideeswaran Koil in Tamilnadu to review the results and prioritisation. The participants in the workshop included the representatives of farmers, NGOs, Scientists from agricultural Universities, traditional knowledge practitioners of Ayurveda as well as COMPAS research teams. Based on the group discussions there were comments made about the selected practices which were grouped into three types of headings namely – agronomical, mechanical and biological methods and use of rituals, mantras as well as suggested manner of involvement of experts, students and scientists from traditional and modern institutions.

Ayurvedic Texts

Based on the literature survey made by the partners on the use of animal products in agriculture, FRLHT made a survey of ayurvedic texts for sourcing information on such animal products. A comprehensive documentation of properties from Ayurvedic texts was prepared and reviewed. Traditional Ayurvedic texts such as *Dhanvantri nighantu, Bhav Prakash, Susruta Samhita* etc., were also reviewed for this purpose. Information was also gathered from related websites and other journals. Elaborate information on the properties and uses of cow's urine and panchagavyam were also gathered.

Ayurvedic properties of various animal products such as milk, urine, dung, ghee, buttermilk, meat, fat, blood, hair, hooves, feather and skin were reviewed based on parameters such as rasa, guna, virya, vipaka, prabhava, karma, dosakarma, rogaharatva, contraindications and incompatibilities. Ayurvedic texts such as *Caraka samhita, Susruta samhita, Astanga sangraha, Astanga hridaya, Dhanvanthari nighantu, Madanapala nighantu, Bhavaprakasha nighantu* and *Raja nighantu* were referred for this purpose. The ayurvedic properties of various animal products such as urine, milk, curd, ghee and dung have been analysed and the results have been produced in Annexure – VII.

For example, as per the text of *Caraka Samhita*, Horse's urine *(Asva mutra)* has the property of curing disorders in vagina and as per *Susruta Samhita*, it has the property of increasing the digestion, it is pungent, sharp and reduces *kapha* and also found to cure mental diseases. Likewise, according to *Madanapala nighantu*, Buffalo's urine is found to possess properties of curing swelling, intestinal tumours, piles, anaemic and diabetic conditions. There is a mention about use of urine of cow, dog, fox and lion in the treatment of epilepsy in the ayurvedic texts. The use of milk of cow, sheep, donkey elephant, horse and buffalo was found only in *Dhanvantari nighantu* among the texts referred. Milk is referred to as life giving, heavy, sweet, slimy, unctuous, cold, laxative and soft according to *Dhanvantari nighantu*.

The ayurvedic description of cow's urine and goat dung from various ayurvedic texts is provided as example here:

Cows' Urine

Caraka Samhita: Madhura (sweet), krimighna (wormicidal), kandughna (reduces itching), udaraghna (Reduces ascites), Kustha (reduces skin diseases).

Susruta Samhita: Sthoulya (reduces obesity), Sirovirechana (cleanses the head), Sula (clicky pain), Gulma (intestinal tumors), anaha (upper abdominal distention), virechana and asthapana (as additive in purgation, medicated enema), Katu (pungent), tikshna (sharp), ushna (hot), kshara (alkaline), vatala (increases vata), laghu (light), dipana (increases digestion).

Astanga Sangraha: Pacana (improves digestion), Bhedi (purgative).

Astanga hridaya : Mutra of cow, goat, sheep, buffalo, elephant, horse, camel and donkey aggravate pitta, rough, sharp, hot, pungent, salty and light. It cures worms, dropsy, abdominal enlargement, flatulence, colic, anaemia, reduces kapha and vata, abdominal tumors, loss of appetite (taste), poison, leucoderma, skin diseases and piles.

Dhanvantari nighantu: Katu (pungent), tikta (bitter), kshara (alkaline), ushna (hot), theekshna (sharp), laghu (light), lekhana (scarping), sara (laxative), dipana (improves digestive fire), medhya (improves intellect), pittakara (increases pitta), kaphavatahara (reduces kapha and vata), tvakdosha (reduces skin diseases).

Madanapala nighantu: Cow, elephant, buffalo, goat, donkey, camel all have same qualities. However best one is gomootra (cow's urine), Lavana (salty), tikta (bitter), ruksha (rough), srotovisodhana (removes blocks in body channels), pittala (increases pitta), katu (pungent), hridya (good for heart), bhedi (purgative), vatanulomana (facilitates downward movement of vata), pacana, dipana (improves digestion), vata (good for vata), gulma (intestinal tumors), arsa (piles), sopha (swelling), udara (ascites), kapha (good for kapha), krimi (worms), kustha (skin diseases), pandu (anaemic conditions), anaha (abdominal distention), visha (good for poison), sula (colicky pain), aruci (lack of appetite).

Bhavaprakasha nighantu: Katu (pungent), tikshna (sharp), ushna (hot), kshara (alkaline), tikta (bitter), kashaya(astringent), laghu (light), agnidpiana (improves digestion), medhya (improves intellect), pittakara (increases pitta), vatakaphahara (reduces vata and kapha), Used in sula (colicky pain), gulma (intestinal tumours), udara (ascites), anaha (abdominal distention), kandu (itching), aksi (eye diseases), mukharoga (diseases of mouth), kilasa (blackheads), vatama (rheumatic conditions), vastiruk (pain in urinary bladder region), kustha (skin diseases), kasa svasa (respiratory diseases), sotha (swelling), kamala (jaundice), pandu (anaemic conditions), mutrarodha (urine retension), krimi (worm), pliha (spleen enlargement), varchagraha (good for constipation).

Raja nighantu: Katu (pungent), tikshna (sharp), ushna (hot), kaphavatahara (reduces kapha and vata), laghu (light), pittakrit (increasing pitta), dipana (improves digestion), medhya (improves intellect), tvakdosa (skin disease), matiprada (improves memory).

Goat Dung

Caraka Samhita: Burned alkali of goat droppings is used in visucika (diarrhoea with pain and indgestion), udavarata (upward movement of vayu), vatashthila (one of the urinary disorders).

Shortlisted Practices and Comments on them from Ayurvedic Perspective

A set of twelve practices, five compiled from the currently available literature such as HONEY BEE, ITK volumes produced by ICAR, LEISA magazine and the remaining seven from selected texts of Vrkshayurveda was sent to FRLHT for detailed comments from an Ayurvedic practitioner. In the case of practices from current literature, the address of the person who has communicated the practices was also provided in places wherever available, to give an idea about the geographical location from where it is reported.

Suggestions regarding the kinds of comments and inputs required were also made. Some of the requests put forth before the Ayurvedic practitioner is as follows.

- Looking at the materials mentioned and the mode of use etc., and tell us from the Ayurvedic viewpoint if you feel that the practice is reasonable or has any theoretical foundations.
- Could you suggest ways of strengthening or expanding the practice from your perspective?
- Do you have any observations by way of precautions or thoughts about conditions under which the practices may or may not work.
- As you can see there is a difference between practices derived from contemporary reports of farmers and from Vrkshayurveda texts. In the former case we have some information or guidelines about quantities required, concentrations, precise manner of use and application etc., whereas in the case of the latter it is more sketchy and general. In such cases it will be useful if you could make some suggestions about the exact mode of use. For example, you can make some comments about the composition of certain mixtures or suggest the way in which we can start trying. Take for example, prescription no. 2. To get juicy fruits it says – "Mustard power mixed with cow dung and ghee and made into a paste by adding little honey. This paste is applied on the trunk. This process should be repeated". Do you have any suggestions in terms of –

a. What should be the proportion of the ingredients when you mix mustard powder, cowdung, ghee and honey.

b. What is the quantity that you can apply to the trunk of the tree – full grown tree, moderate sized tree or a sapling.

c. How often should we repeat the process both in terms of intervals between the applications and the total number of applications.

d. Do you have any thoughts in terms of the best period of growth / time of crop season when the application should be made, considering that the effect that we are seeking is – "to get juicy fruits".

Subsequently, the selected recipes were communicated to the FRLHT Ayurvedic team for their comments. The comments received from the ayurvedic practitioners on some of the selected practices involving the use of animal products is given in Annexure – VIII.

A couple of illustrations are given below:

1. Fish water, earthworms treated with milk gives – bigger fruits in pomegranate tree

Fish, earthworms and milk are having madhura rasa (sweet taste) and vipaka (post metabolic effect). They are having life promoting (jeevaniya), bulk promoting (brimhaneeya) functions and guru (heavy), snigdha (unctuous) and guna (qualities) properties. These properties increase the size and growth in human beings when used. These properties probably might help even in plants to get sweeter and bigger fruits in pomegranate. The above said mixture can be applied when the plant is in inflorescence, because the nutrients are supplied during the fertilization period, which enhances the growth to yield bulky fruits.

2. Grape creeper gives much number of fruits when nourished by cock excreta, sprinkled with fish fat

Meat (mamsa), fat (vasa) are sneha dravyas (unctuous substances) and beneficial in promoting the bulk of the body, growth in general. These substances provide strength to withstand adverse living conditions and resist disease. Matsya (fish) is vrishya (aphrodisiac), which enriches the generative organs and the reproductive system, there by increasing the yield.

Reference

Some of these products and recipes were selected for detailed testing. Field trials and laboratory trials were undertaken using these products. The results of those trials have been provided in chapter - IV and chapter - V.

CHAPTER -III

FIELD SURVEY

IDEA (Integrated Development through Environmental Awakening) is a non-governmental research and development organization, established in 1981 in Visakhapatnam of Andhra Pradesh, India. As a part of this research programme IDEA, Visakhapatnam, in collaboration with Centre for Indian Knowledge Systems, undertook a field survey. The objective of the survey was to document the use of animal products in traditional agriculture of the tribal and rural communities for assisting the farmers to prioritize and standardize the use for sustainable crop yield.

FIELD AREA - Surveyed districts of Andhra Pradessh and Orissa

DISTRICT MAP OF ANDRA PRADESH AND ORISSA

The survey was conducted in 25 villages, of which 22 villages belongs to Vizhianagaram and Visakhapatnam districts of Andhra Pradesh and three villages belong to Koraput of Orissa. The survey was conducted among 784 families, belonging to 14 different communities. They were mostly small and marginal farmers, though a few big farmers were also involved in the survey. The list of villages surveyed is provided in Annexure - IX-A. Prior to the commencement of the survey, IDEA conducted preliminary planning workshops with farmers, agriculture Scientists and researchers and devised a format for documentation of knowledge. A copy of the format is provided in Annexure - IX-B. The format has two sections – Sections A and Section B. Section A covers the village profile wherein primary details like name of the state, district, block and panchayat where the village is located can be recorded. Details about number of communities, number of families, the total population, number of large / marginal / small families, number of landless and marginalized families, type of water sources, crops cultivated and use of manures and pesticides in the village is also documented under Section A. Section B covers details of the various kinds of animal products used in agriculture, the nature of application, season, crop, dosage, at what stage of the crop the animal product should be applied, usage rationality, method of use - as a single product or mixed product, ratio, method of application, precautions to be followed in using the product, traditional ways to test the product efficacy, present usage situation and world views about the use of the animal product. As a part of its ethical commitment, IDEA obtained Prior Informed Consent from every village. The purpose of the survey was clearly explained to the farmers and a consent form, stating to grant consent to record their knowledge and practices, was signed by the farmers. A copy of the consent form is provided in Annexure - IX-C. IDEA also released the information in the form of Biodiversity register to the villagers, local Government body and the public.

The field survey by IDEA in the Araku region of Visakhapatnam district in Andhra Pradesh and Koraput district in Orissa was very exhaustive and yielded valuable information on the folk traditional practices where animal products were used. Information on the use of products of five different animals namely Cow and Ox; She and He Buffalo; Goat; Sheep and Chicken have been recorded through this survey. This survey has also documented the use of various animal products such as dung, urine, bones, fat, blood, droppings, skin and flesh in agriculture. These products are used both as single and mixed products. The application methods such as basal, pit application, spraying, fumigation, liquid form, paste, powder etc., have been documented. The use of these animal products in various stages of the crop, method of use and the dosage has also been documented in detail. The Ayurvedic properties of these animal products on plants have also been recorded. The precautions to be taken while using these animal products adds value to it.

The general observations on the surveyed practices are,

- Though animal manures are commonly used by all farmers, small scale farmers tend to use specific manures for specific seasons. Eg. Goat manure is applied during winter, owing to its 'hot nature'. Similarly, animal products such as blood of the black color animal / bird together with other plant products are in use during specific pest control, seed and soil testing rituals and festivals and are not used in other seasons.

- It is also observed that plant products are also mixed with animal products while application to specific *Rabi* or *Kharif* crops.

  Eg. Cow's urine is mixed with curry leaf, neem leaf and pig manure in the ratio of 2:1:1:2 and used as a foliar spray for obtaining good foliage and crop yield.

- There is also mention about the use of bones and other wild animal products such as skins of wild boar, porcupine and sloth bear in certain cases.

TRADITIONAL USE OF SELECTED ANIMAL PRODUCTS

A. Cow and Ox dung

Cow and Ox dung is always collected along with the urine by the tribal communities of Araku and Koraput region. It is applied as manure for crops such as Rice, Jowar, Niger, Finger millet, Italian Millet, Minor millet, Cowpea, Horse gram, Peas, Green gram, Black gram and fruit bearing plants. Around 5-8 cartload (4.5-5 tons) full of manure is applied to an acre of the crop. The manure is believed to impart health and vitality to the crops besides repelling most insects.

During the festival of *pottabali* (*ashad jatra*) in August, pig or chicken is sacrificed and the blood is mixed with cow's urine, turmeric, *kasturi pasupu/adavi pasupu* and sprayed on the crops during flower setting and pollen development. It is believed to control pests and aid in pollen and seed setting. The underlying philosophy is that chicken / pig blood is turned sacred due to sacrifice and thus develops cosmic powers that would control diseases and regulate crop growth and yield. The manure is also mixed with pig manure, poultry manure, wood ash, neem and *Pongamia* cake and applied as manure for a healthy crop.

B. Buffalo cow and bull dung

Like cow dung, buffalo cow and bull dung is also collected along with the urine by the tribal communities of Araku and Koraput region. It is applied for crops such as Rice, Jowar, Niger, Italian millet, Little millet, Finger millet, Chilly, Brinjal, Peas, Cowpea, Horse gram, Green gram and Black gram. It is believed to boost crop health and around 5-8 cartload (4.5-5 tons) full of manure is applied to an acre of the crop. The

tribal communities believe that buffalo dung possess nematode controlling properties. It is usually applied along with other cattle dung, dry grass and neem cake.

C. Goat droppings

Goat droppings are collected very often as mixed with urine. Around 3-4 cartloads (3.5-4 tons) of goat dung is applied as manure for vegetable crops during the first and last ploughing. It is sometimes applied along with other cattle dung. It is believed to increase soil fertility and also act as a growth regulator, when applied to winter crops. Due to its 'hot' nature, it has to be applied in lesser quantities for dry land crops.

D. Sheep droppings

Sheep droppings are applied in quantities of 3.5-4 tons/acre as manure to vegetable crops. It is believed to increase soil fertility and applied often as a mixture along with other cattle manure. Contrary to goat manure, sheep manure is believed to be good for summer crops.

E. Chicken manure

Chicken manure is believed to increase soil fertility and promote crop health. It is usually applied before hoeing, often along with cattle manure. It is considered to be 'hot' in nature and hence has to be applied lesser in quantities for dryland / summer crops and more for winter crops.

SUMMARY OF THE FIELD SURVEY

1. Sacrificed blood of pig / chicken mixed with cow urine, turmeric, wild turmeric, *kasturi* turmeric in the ratio of 3:1:1:1 is used as a foliar spray and directly applied in the pit for pest control for nematodes, insects, viral and fungal diseases.

2. Cow's urine mixed with pig manure, curry leaf and neem leaf in 2:2:1:1 ratio and used as foliar spray for good foliage and vitality.

3. Cow dung, pig manure, poultry manure, wood ash, neem cake / leaf, *Pongamia* cake / leaf are mixed in the ratio of 4:2:3:2:2:1 and directly applied in the pit for obtaining a healthy crop.

4. Cow dung mixed with jack fruit in the ratio of 1:3 and used as pit application for a healthy crop and good yield.

5. He / she buffalo dung with other cattle dung, dry grass and neem cake in the ratio of 3:2:1:1 is used as direct broadcast and in pits for plant growth and production.

6. Broadcasting and pit application of goat droppings with other cattle dung in the ratio of 1:4 helps in plant growth and production in all seasons.

7. Application of Goat droppings in powder / pellet form as broadcasting and pit application helps plant growth in specific seasons.

8. Broadcasting, pit application of sheep droppings with other cattle dung in 1:4 ratio helps in plant growth and production in all seasons.

9. Basal application of chicken manure with other cattle dung in 1:4 ratio helps in plant growth in specific seasons.

10. A practice of applying cow dung paste along with *Pongamia* cake paste on seed storage bamboo baskets has been documented.

11. Applying of rotten jack fruit together with cow dung for chilly crops was a practice found among the Konda Dora tribe of Araku valley.

12. A practice of applying pig fat to control the falling of un-ripened jack fruits was found among the communities.

13. There is a belief among the Mali community and Kondh tribe of Malisingaram and Godepador villages to nail the bones of animals on the tree trunk during new moon day or full moon day to facilitate quick yield of the crop.

14. Poraja tribe of Kodikal village has the practice of fumigation of sloth bear skin together with *Kasturi* tuber paste to control fungal diseases in finger millets and pests in the crops.

15. Nooka Dora tribe of Sariaput village has the practice of applying cow's urine in the pit around the plants to control falling of the leaves and tender fruits.

16. The practice of applying cow's urine in the holes made by stem borers on the large trees to control stem borers is found among the Kondh tribe of Godepador village.

17. Farmers of rural areas have the practice of applying cow's urine mixed with soil in the wet land paddy field and dryland crops of ground nut to control viral diseases.

18. Nooka Dora tribe of A.Kondapalli village, Orissa apply goat's urine, cow's urine together with *raj* and *batri kasturi* and *attigirli* to control the viral diseases in paddy panicles.

19. Application of sacrificed chicken blood in turmeric, vermilion and cooked rice in paddy fields to control pests is practiced by the Konda Dora tribe of Viziangaram district, Andhra Pradesh.

20. Application of mixture of cow dung, urine, milk, curd, ghee *(panchagavyam)* with turmeric and vermilion for seed and soil treatments (soaking the seed and spraying the mixture in the soil during death ceremonies) is observed in Andhra Pradesh.

21. The occasional use of *Ajapanchaka / Chagapanchaka* (goat milk, ghee, curd, urine and dung in the ratio of 2:2:2:1:1) as foliar spray for viral diseases on the crops is observed in forward castes such as Velama and Kapu communities of Vepada and Sompuram areas of Vizianagaram districts, Andhra Pradesh. It should be noted that this *Chagapanchaka* was in use in the olden days to cure the acute tuberculosis in humans.

22. Sacrificed chicken / pig / goat / sheep (male) blood is mixed with cooked rice and wrapped with palm leaf. This is fixed on the sticks in the middle of the paddy fields and allowed to decompose. This develops maggots which attract black drongos that feed on them. The drongos that come to feed on the maggots will then feed on the crop pests. This was reported by the rural farmers of Cheepuruvalasa and Cheedivalasa villages of Vizianagaram district; Andhra Pradesh.

23. Application of chicken or pig blood together with the decoction of mango*, maredu, billa* and *neredu tree barks, leaves of amla* and rhizome of turmeric as foliar spray on the mixed and monocrops for pest control during *ashada jatra* (July-August) is practiced by Gadaba, Konda dora and Kondh tribes of Andhra Pradesh and Orissa border. It was also found that there is diversity in the use of above species in different areas and communities.

24. Application of social spider (*Stegodyphus Sarasinorum* Karsch*)* to control fruit, stem borers and insects in the paddy, millets and vegetable crops is found among Nooka Doras, Konda Dora and Kondh tribes of Koraput and Visakhapatnam district.

25. Konda Dora tribe of Anantagiri mandal, Visakhapatnam district, Andhra Pradesh has the practice of releasing small domestic red ants to control black ant in maize and jower crops.

26. Konda tribe of Andhra Pradesh and Orissa apply white and dried saliva (*letha cheda pattu / kood*) collected from ant hill on nursery beds in powder form to promote healthy growth of saplings.

27. Rural farmers of Vepada, Vizianagaram district apply cow dung paste mixed with *Jilledu* (*Calotropis gigantia*) leaves on the vegetable and horticultural crops to promote good foliage and plant growth.

28. Mix of mango leaves, neem cake, cow's urine, wild turmeric, turmeric and wood ash controls blight and fungal diseases on crops

29. Application of *jeeluga, konda kasivinda, chitta dal*, marking nut, wild broomstick stems in the wet lands and paddy fields controls pest.

30. Application of cow dung mixed with the leaves of adda saaram (*Adhatoda vasica*) promotes yield in the wet and dry land crops.

31. Konda Dora and Kondh tribes of Orissa believe that seeds soaked in / sprinkled with sacrificed chicken blood during *chaitra parob* festival (March-April) get sacred powers, from deities such as *Nisani / Dharani pennu.*

EXPERIMENTS ON SELECTED PRACTICES

A few recipes / practices were selected from these and detailed experiments were carried out. The practices short listed for experiments have been listed along with the results in Chapter – IV.

CHAPTER – IV

FIELD STUDIES

The substances / recipes were short listed for the field studies based on the priorities and experiences of the field groups. Simultaneously, literature survey was also carried out and various animal products that are used in traditional agriculture were listed down. The products that were listed out, on which field studies were carried out include cow's milk, cow's urine, goat manure and *panchagavyam*. Apart from these various animal product formulations were also tested out in the field. The results of the experiments carried out on these animal products have been shared in this chapter.

I. COW'S MILK

According to Siddha, the Tamil system of medicine, cow's milk is effective in curing fever, pain, tumours, diabetes and weakness in children and elderly people (22). Ayurveda also prescribes cow's milk for various ailments, both as medicine and as a medium to administer the medicine.

Nutrient content of cow's milk (in g/100 ml)

Content	Fat	Protein	Casein 0.4	Lactose	Fatty acids (%)	Poly unsaturated fatty acids (%)
Cow's milk	3.8	3.3	2.5	4.8	6	3

Source: (23)

Besides the above mentioned, it also contains significant quantities of a-lactalbumin, lactoferrin, IgA, IgG, lysozyme, serum albumin, ß-lactoglobulin, oligosaccharides and minerals such as Calcium, Phosphorus, Sodium, Potassium and Chlorine.

Milk is also known for its fungicidal effect. In an experiment conducted by Bettiol (24), cow's milk was tested against powdery mildew (*Sphaerotheca fuliginea*) on zucchini squash (*Cucurbita pepo* L.). Plants were sprayed with milk at 5, 10, 20, 30, 40, and 50%. It was proved that high concentrations of milk fared better than the conventional fungicides tested. However, Ferrandino and Smith (25) have proved that the effect of cow's milk on powdery mildew in pumpkin can be variable. Milk can also act as an antiviral agent (26). Hare and Lucas (27) have proved the effectiveness of milk in controlling the spread of Tobacco Mosaic Virus through mechanical means. Long before Hare and Lucas, tobacco farmers in Andhra Pradesh of South India had developed the practice of dipping their hands in a pot of fresh milk at regular intervals during transplantation of seedlings to prevent transmission of Tobacco Mosaic Virus (28).

Various communities in India have been known to use cow's milk to enhance seed germination. Hence, experiments were carried out by CIKS (as a part of the COMPAS project), to verify the claims scientifically. The results are summarised below.

1. Testing the efficiency of raw cow's milk on seed germination, June 2006

This experiment was conducted on bhendi (*Abelmoschus esculentus* (L.) Moench) using simple experimental design. There were six treatments for which the germination percentage and seedling vigour were recorded.

Result

Treatments	Tap water	25%	50%	75%	100%	Control
Germination %	98	98	92	84	92	98
Normal seedlings	70	80	46	42	46	62
Abnormal seedlings	28	18	46	42	46	36

Conclusion

Raw cow's milk shows good germination percentage and vigour at 25% concentration.

2. Testing the efficiency of raw cow's milk on seed germination, July 2006

This experiment was conducted on bhendi using simple experimental design. Bhendi seeds were treated with various concentrations of cow's milk (raw) for six hours. There were nine treatments and two replications.

Result

Treatments	Tap water	5%	10%	15%	20%	25%	50%	75%	100%
Germination %	94	93	90	97	86	88	90	90	88
Normal seedlings	73	73	75	89	77	85	82	56	81
Abnormal seedlings	27	27	25	11	23	15	18	44	19

Conclusion

Cow's milk at 15% concentration shows good seed germination and seedling vigour in bhendi.

3. To know the effect of cow's milk on the germination of cucumber and ash gourd

The experiment was conducted on local varieties of cucumber (*Cucumis sativus* L.) and ash gourd (*Benincasa hispida* (Thunb.) Cogn.). The experiment was based on randomised block design with seven treatments and three replications.

Treatments

1. Control

2. Seeds dipped in cow's milk dilution with water overnight and then dried in shade for a day. The procedure was repeated for seven days after which the seeds were sown.

3. Seeds dipped in cow's milk at 1:5 dilutions with water overnight and then dried in shade for a day. The procedure was repeated for seven days after which the seeds were sown.

4. Seeds dipped in cow's milk at 1:10 dilution with water overnight and then dried in shade for a day. The procedure was repeated for seven days after which the seeds were sown

5. Seeds dipped in cow's milk at 1:1 dilution with water overnight and then sown.

6. Seeds dipped in cow's milk at 1:5 dilutions with water overnight and then sown.

7. Seeds dipped in cow's milk at 1:10 dilution with water overnight and then sown.

Result

Cucumber

The germination was observed to be the highest in the seeds dipped in cow's milk at 1:10 dilution for a day and then sown. This was followed by seeds dipped in normal water and sown. But the difference between the results of these two treatments was insignificant. Treating seeds with cow's milk continuously for a week fared poor and hence it is not advisable to do so, in practice.

The germination efficiency of seeds dipped in normal water and cow's milk at 1:1, 1:5, and 1:10 dilutions were found to be similar. Hence it is concluded that treating the

cucumber seeds with cow's milk in the above dilutions has no impact on the germination capability of seeds.

Ash gourd

The germination was highest in the seeds dipped in normal water and sown followed by seeds dipped in cow's milk at 1:1 dilution for a day and then sown. The differences in results between these two treatments were insignificant suggesting the negligible impact of cow's milk on germination of seeds.

Seeds dipped in cow's milk at 1:1 and 1:10 dilutions for a week fared poorly. The germination efficiency of seeds dipped in normal water and cow's milk at 1:1, 1:5, and 1:10 dilutions were found to be similar. Hence it is not advisable to treat ash gourd seeds in cow's milk continuously.

4. Effect seed treatment with milk in managing *Fusarial* wilt in Tomato

This experiment was conducted by Dr.V. Kuruchev of Annamalai University for CIKS in 2007, independent of the COMPAS project. The experiment results show that soaking of tomato seeds in 10ml of fresh cow's milk for eight hours and fumigation with 5g of *Sweet flag* powder for five minutes is very effective in reducing the incidence of *Fusarial* wilt besides increasing the growth and yield of tomato.

Summary

From the above experiments, it is understood that cow's milk at 15% increases seed germination and promotes seedling vigour in bhendi. Treating seeds of cucumber and ash gourd with cow's milk have no impact on seed germination. Hence it is not recommended. However, soaking of tomato seeds with 10ml of fresh cow's milk for eight hours and fumigation with 5g of *Sweet flag* powder for five minutes is very effective in reducing the incidence of *Fusarial* wilt besides increasing the growth and yield of tomato.

II. COW'S URINE

Cow's urine or *go-mutra* (Sanskrit) or *komium* (Tamil) has been known to be used by various sectors of people in India from the Vedic periods for medicinal and agricultural purposes. The following verse from the 45th chapter of *Susruta-Samhita* best explains the properties of cow's urine:

Cow's urine is pungent, sharp, hot, does not increase vata because of alkalinity, is light, promotes digestive power and intellect, increase pitta while decreases kapha and vata. In colic, gulma, udararoga, hardness of bowels, purgatives, non-unctuous enerma etc. where urine is indicated, cow's urine should be used.

Gomutram – urine of cow only and not of bull because of association of 'mahisi' (she-buffalo). Teachers say in cases of cow, buffalo, goat and sheep urine of female while in those of elephant, horse, ass, camel and man urine of males should be used. Where there is no explicit mention of gender urine of both male and female may be used, while if there is specific mention of male or female that may be followed - this is the conclusion.

Besides the above mentioned properties, cow's urine is also said to cure leucoderma, leprosy, eye diseases, amoebiasis, constipation, diarrhoea and parasitic infections. *Bhav Prakash Nigandu* also speaks about similar properties of cow's urine. Nautiyal *et al*, 2004 speak about the granting of a patent to Indian scientists on a 'Synergistic Fermented Plant Growth Regulator cum Biocontrol Composition' which employs cow's urine as one of the main ingredients. The folk traditional knowledge also recognises the importance of cow's urine in agriculture. A few practices followed by Indian farmers where cow's urine is a major ingredient are listed below.

i Vivekanandan (29) reports the use of a botanical spray made from the leaves of *Lantana camara* L. Farmers around Madurai of Tamil Nadu soak about 5 kg of *Lantana camara* L. leaves in water (5 litres) and cow's urine (10 litres) for 3-4 days in an earthern pot. This solution is then filtered, diluted with 80 litres of water and sprayed on plants to control fungal / bacterial diseases.

ii. Farmers are known to soak maize seeds in cow's urine for 12 hours before sowing to induce drought tolerance (30).

iii. In Kheda, cow's urine is sprinkled on the fennel (*Foeniculum vulgare* (L.) Miller) crop to minimize *aphid* infestation (31).

iv. Soaking the sorghum seeds in cow's urine for 2 to 3 minutes and drying them immediately under sun before sowing, controls grain smut in sorghum. (32).

v. Narayana Reddy protects his gladioli flowers from being eaten by insects using the leaves of '*vishamadhari*' (*Clerodendrum inerme* (L.) Gaertn. embrert). Three kilograms of leaves of *Clerodendrum inerme* are ground and soaked overnight in 10 litres of cow's urine. The next morning it is filtered and diluted to 200 litres. This is enough for one acre. It is sprayed on the flowers during the evening (33).

vi. Farmers of Theog in Shimla of Himachal Pradesh spray cow's urine on cabbage crop to protect it from *aphid* attack. Field trials conducted by ICAR proved that cow's urine solution at 30% and 100% concentration were effective in controlling *aphid* pests in cabbage (34).

Cow's urine samples were collected by the project partners viz., CIKS, IDEA, KPP and tested for organoleptic, physical parameters and microbial load analysis at FRLHT. The results are given below.

Quality Standards of Cow's urine

Sl.No.	**Parameters**	
1	**Organoleptic parameters**	
	Colour	Pale yellow, brown, dark brown
	Odour	Pungent
2	**Physical parameters**	
	pH	7.805 +/- 1.19
	Specific gravity	1.027 +/- 0.002
	Refractive index	1.3485 +/- 0.001
	Creatinine	0.66%
3	**Biological parameters**	
	TMC (cfu/ml)	2.51×10^4 +/- 0.82×10^4
	TFC (cfu/ml)	1.98×10^4 +/- 1.25×10^4
	E. coli (cfu/ml)	Absent
	Enterobacteriaceae	Absent
	Salmonella typhi	Absent
	Staphylococcus aureus	Absent
	Pseudomonas	Absent

TMC = Total Mold Count

TFC = Total Fungal Count

Chemical parameters showed variations while the organoleptic and physical parameters were consistent. The variations in chemical parameters could be due to the variations in cows, effect of storage, etc. Some samples were found to have *Salmonella spp., E. coli* and *Corynebacterium spp.*

Chemical analysis of cow's urine yielded the following results:

Chemical analysis of cow's urine

Urea (Average)	**Nitrogen** (Average)	**Calcium** (Average)	**Magnesium** (Average)	**Potassium** (Average)
1.17%	0.88%	0.015%	0.006%	2.51%

Anti-microbial activity

Cow's urine was tested for anti-microbial activity and was found to inhibit the growth of *Staphylococcus aureus, Salmonella typhi, E. coli* and *Bacillus sp.*

The COMPAS partners conducted various experiments with cow's urine where its effect on germination, yield etc was tested.

1. Testing the efficiency of cow's urine on seed germination in Bhendi crop, July 2006

The experiment is based on simple experimental design with 10 treatments and two replications.

Result

Treatment	**Tap water**	**5%**	**10%**	**15%**	**20%**	**25%**	**50%**	**75%**	**100%**	**Control**
Germination %	82	92	93	86	77	80	61	48	27	94

Conclusion

The results show that there is no difference among the treatments.

2. Testing the efficiency of cow's urine on the germination of bhendi seeds, July 2006

This test was conducted with an aim to determine the effect of pregnant and non-pregnant cow's urine on the germination of Bhendi seeds. Simple experimental design

was followed. There were six treatments and no replications. The seeds were treated in cow's urine for 6 hours.

Result

Concentrations	Tap water	5%	10%	15%	20%	Control
Pregnant	98	54	90	94	94	74
Non-Pregnant	92	54	90	94	94	74

Conclusion

The results show that there is not much difference between pregnant and non-pregnant cow's urine.

3. Testing the effect of cow's urine, buffalo's urine and bullock's urine on various crops

To know the effect of cow's urine, buffalo's urine and bullock's urine on growth and yield of Paddy (KMP and ES variety), *Amaranthus* (local) and Cucumber (local). Randomized block design was followed with 11 treatments and three replications each. The variables on which data was collected are plant height, number of leaves, number of branches/tillers, panicle length (paddy), 1000 seed weight and yield.

Treatments

Control

Cow's urine, water at 1:3

Cow's urine, water at 1:6

Cow's urine, water at 1:9

Buffalo's urine, water at 1:3

Buffalo's urine, water at 1:6

Buffalo's urine, water at 1:9

Bullock's urine, water at 1:3

Bullock's urine, water at 1:6

Bullock's urine, water at 1:9

Water spray

Result

1. Paddy

Result of Thirthahalli experiment

For all the parameters selected like plant height, number of leaves, number of tillers, number of productive tillers, grain yield and straw yield, the calculated F value was less than the table F value. Hence there is no significant difference among treatments.

Result of Shanuvalli experiment

For all the parameters selected, the calculated F value was less than the table F value suggesting that there is no significant difference among treatments.

4. To know the effect of cow's urine on the yield of *sannavalya* variety of paddy, 2006.

There were five treatments and four replications each in Randomized block design. Data was collected on variables such as plant height at the time of harvest, number of tillers and number of productive tillers, grain yield and straw yield per plot.

Treatments

Control

Cow's urine, water at 1:1

Cow's urine, water at 1:5

Cow's urine, water at 1:10

Water spray

Result of Thirthahalli experiment

The calculated F value is less than the table F value for all the parameters. Hence it is concluded as spray of cow's urine at 1:1, 1:5 or 1:10 does not have any impact on either growth or yield of paddy.

Result of Shanuvalli experiment

The calculated F value is less than the table F value for all the parameters selected. Hence there is no significant difference among treatments. It is concluded that the spray of cow's urine at 1:1, 1:5 or 1:10 does not have any impact either on growth or yield of paddy.

5. Determining the effect of cow's urine on the germination of paddy

This experiment was conducted on the *sannavalya* variety of paddy at Thirthahalli. The experiment used Randomised block design with seven treatments and three replications.

Treatments

Control

Paddy seeds dipped in cow's urine-water solution (1:1)

Paddy seeds dipped in cow's urine-water solution (1:5)

Paddy seeds dipped in cow's urine-water solution (1:10)

Paddy seeds dipped in pregnant cow's urine-water solution (1:1)

Paddy seeds dipped in pregnant cow's urine-water solution (1:5)

Paddy seeds dipped in pregnant cow's urine-water solution (1:10)

Result

The root growth was the highest in seeds dipped in cow's urine at 1:10 dilution, followed by seeds dipped in normal water. Seeds treated with pregnant cow's urine gave poor results. Hence it is advisable not to use pregnant cow's urine to treat seeds.

There is no significant difference between seeds dipped in normal water and cow's urine at 1:1, 1:5 and 1:10 dilutions, showing that treatments at this percentage does not have any effect on the germination or root formation in seeds.

Apart from the experiments done under the COMPAS project, CIKS had also done various experiments related to the use of cow's urine in agriculture. They are summarised below.

6. Experiment to test the shelf life of biopesticides such as *arkam, kashaayam* and *thailam*

This experiment was conducted on Paddy (IR 50) during April 2001 using simple design. There were 12 treatments and replications.

Treatments comprised of plant extracts of Garlic (*Allium sativum* L.), Malabar nut (*Justicia adhatoda* L.), Sweet flag (*Acorus calamus* L.), Vitex (*Vitex negundo* L.), *Pudhina* (*Mentha arvensis* L.), Aloe (*Aloe vera* (L.) Burm. f.), Papaya (*Carica papaya* L.), Calotropis (*Calotropis gigantea* (L.) W.T. Aiton), Ginger (*Zingiber officinale* Roscoe), Ipomoea (*Ipomoea carnea* Jacq. ssp. *fistulosa* (Mart. ex Choisy) D. Austin), Jatropha (*Jatropha curcas* L.), *Thumbai* (*Leucas aspera* (Willd.) Link), Neem (*Azadirachta indica* Adr. Juss.) and cow's urine etc.

Three sprayings (5 litre / 3 cents) were given on 48th day, 56th day, and 70th day after sowing. Pre-treatment count and post treatment count on the 4th day after each spray were taken.

Result

Experiment to determine the shelf life of biopesticides

Treatment Nos.	Treatments	% decrease over control		Yield (kg)
		BLB	HLS	
T4	Jatropha *kashaayam*	58.90	69.57	49.0
T5	Neem kernel extract	67.20	73.91	49.0
T6	cow's urine *arkam*	68.76	-	49.7
T7	*Sweet flag arkam*	54.18	28.30	60.4
T8	*Adhatoda kashaayam*	60.42	52.21	73.0
T9	Pudina *kashaayam*	66.62	82.64	68.2
T10	Garlic *arkam*	43.76	82.64	69.5
T11	Chemical check	24.98	34.80	60.0
T12	Control	-	-	55.6

Treatments T1 (Vitex, ginger, garlic *thailam*)
T2 (Aloe, papaya, garlic *thailam*)
T3 (Ipomoea, calotropis, papaya *thailam*)
have shown phytotoxic symptoms such as burning and drying of leaves due to lack of emulsification of high density nature of oil form *(Thailam)*. Hence data was not recorded for these treatments.

Neem kernel extract, cow's urine *arkam*, and *pudhina kashaayam* treatments produced a pronounced effect on BLB damage i.e. 67.20%, 68.76% and 66.62% respectively. *Pudhina kashaayam* and garlic *arkam* were found to have a profound effect (82%) on HLS. Yield was more in garlic *arkam* and *pudhina kashaayam* sprayed plots when compared to control plot.

7. Management of diseases like bacterial leaf blight and blast in a susceptible paddy variety (BPT Ponni) by seed treatment using different plant extracts

This experiment was done in paddy (BPT 5204) during August 2003-March 2004. Completely Randomised Design (CRD) was used with 13 treatments and no replications.

Result

Management of bacterial leaf blight and blast using plant extract

Treatments	DI (Mean)		Yield / cent in Kg
	Blast	BLB	
Vilvam kashaayam (T1) 5%	2.068	2.7	12.0
Vilvam kashaayam (T2) 10%	2.712	2.8	11.5
Vilvam kashaayam (T3) 15%	2.551	3.0	9.0
Prosopis kashaayam (T4) 5%	2.178	2.5	10.0
Prosopis kashaayam (T5) 10%	2.712	2.7	10.0
Prosopis kashaayam (T6) 15%	2.212	3.3	10.0
Sweet flag arkam (T7) 5%	2.602	2.9	11.0
Sweet flag arkam (T8) 10%	2.551	2.9	10.0
Sweet flag arkam (T9) 15%	1.775	2.5	10.0
Cow's urine (T10) 5%	2.551	3.8	10.0
Cow's urine (T11) 10%	2.699	2.4	12.5
Cow's urine (T12) 15%	1.483	3.1	12.0
Control (T13)	3.907	4.9	8.5
CD (P=0.05)	5.136	9.946	

Blast data were collected based on standard charts four times and blight data were collected twice during the growth period. When we compare the treatments, cow's urine 15% and *sweet flag arkam* 15% gave superior results against blast disease. Seed treatment with cow's urine 10%, *sweet flag arkam* 15% and *Prosopis kashaayam* 5% gave superior results against bacterial leaf blight.

Summary

The experiments show that treating of bhendi seeds in cow's urine does not have any impact. Similarly, there is no difference in efficiency between pregnant and non-pregnant cow's urine. However, cow's urine (15%) and cow's urine *arkam* were effective in controlling bacterial leaf blight.

III. GOAT MANURE

Goat's milk and goat manure has been accorded high importance in the Indian traditional knowledge systems. Very little information is available on the *sakrit* (dung) of goat as per Ayurveda. According to *Caraka Samhita*, burned alkali of goat droppings is useful in *visucika* (diarrhoea with pain and indigestion), *udavarata* (upward movement of *vayu*) and *vatashthila* (one of the urinary disorders).

An adult goat produces around 50-100 kg of manure annually (35). Besides feed residues, it may also contain endogenous substances from the goat's intestinal tract. It is now known that regardless of the feed type, goats excrete protein (34g), fat (8g) and carbohydrates (13g) per kilogram of dry matter feed consumed (36). Sheep and goat manure are generally considered as 'hot' and hence need to be composted before application in the field. Farmers in India are known to use goat droppings as manure to various crops, especially in the winter season. It is believed that the 'hot' nature of goat droppings suits the winter very well.

An abundant resource in rural areas, goat manure is known for its high nutrient composition, which has been proven by a good number of researches. Goat and sheep manure contain more nitrogen and phosphorous than cattle manure. It is also known to supply more nitrogen to the plant, resulting in higher crude protein percentage (37). In a research conducted by Perez *et al* (38), it was shown that vermicompost from goat manure using the earthworm *Eisenia foetida* gave superior results than the vermicompost from other animal manures.

The various crop friendly properties attributed to goat manure warrants scientific studies on them which were duly undertaken by the COMPAS partner IDEA at the Araku valley mandal of Andhra Pradesh, India. As a part of the study, goat manure samples collected by IDEA were analysed at the FRLHT lab, Bangalore for organoleptic, physical and biological parameters. The results are tabulated below.

Quality Standards of Goat manure

Sl. No.	Parameters	
1	**ORGANOLEPTIC PARAMETERS**	
	Colour	Greenish brown
	Odour	Organic manure kind of odour
2	**PHYSICAL PARAMETERS**	
	pH	7.62 ± 0.5303
	% Moisture	5.80 ± 0.47
	% Total ash	17.44 ± 4.2
	% Acid insoluble ash	6.69 ± 3.36
	%Water soluble extractive	5.70 ± 1.03
	%Alcohol soluble extractive	6.04 ± 0.67
3	**BIOLOGICAL PARAMETERS**	
	TMC (cfu/g)	$2.406 \times 10^3 \pm 0.65 \times 10^3$
	TFC (cfu/g)	$1.258 \times 10^3 \pm 0.36 \times 10^3$
	E.coli (cfu/g)	Absent
	Enterobacteriaceae	Absent
	Salmonella typhi	Absent
	Staphylococcus aureus	Absent
	Pseudomonas Sp.	Absent

TMC= Total Mold Count, TFC= Total Fungal Count

The nutrient composition was also analysed. Goat manure was found to have the following nutrient composition.

Chemical analysis of goat manure

Urea (Average)	**Nitrogen** (Average)	**Phosphorous** (Average)	**Calcium** (Average)	**Magnesium** (Average)	**Potassium** (Average)
6.04%	1.52%	0.61%	0.308%	0.166%	1.46%

In order to verify the claims regarding the nutritional properties of goat manure, a series of experiments were conducted by the COMPAS partners, which are summarised below.

1. To test the effect of goat droppings on *bhendi* crop (*Abelmoschus esculentus* (L.) Moench), October 05 – March 06

The experiment was conducted on a local variety of bhendi using Randomised Block Design (RBD). There were four replications for each of the five treatments. Entire goat droppings were applied as top dressing and in pits. Likewise, goat-dropping powder was also applied as top dressing and also in pits. There was a control treatment. The results are summarised below.

Result

Sl. No.	**Treatments**	**Dosage**	**Yield in Kg (Mean)**	**Height in cm (Mean)**
1.	Goat droppings as top dressing	2.5 Kg / Plot	457.52	11.54
2.	Goat droppings in pits	85 g / Plant	590.01	12.06
3.	Goat dropping powder as top dressing	2.5 Kg / Plot	535.43	11.84
4.	Goat dropping powder in pits	85 g/ Plant	683.73	12.35
5.	Control	--	405.63	11.15

Conclusion

The results show that application of goat dropping in powder form in pits gave superior results than the other treatments.

2. To test the effect of goat droppings on *Gonghura* (*Hibiscus cannabinus L.*) Winter crop - October 05 - March 06

The experiment was conducted on *gongura* using Randomised Block Design (RBD). There were four replications for each of the five treatments. Goat droppings were applied as top dressing and in pits. Likewise, goat-dropping powder was also applied as top dressing and in pits. There was a control treatment. The results are summarised below.

Result

Sl. No.	Treatments	Dosage	Yield in Kg (Mean)	Height in cm (Mean)
1.	Goat droppings as top dressing	2.5 Kg / Plot	3.16	14.51
2.	Goat droppings in pits	85 g / Plant	3.64	15.03
3.	Goat dropping powder as top dressing	2.5 Kg / Plot	3.30	14.79
4.	Goat dropping powder in pits	85 g / Plant	4.04	15.42
5.	Control	---	3.02	14.29

Conclusion

The results show that application of goat dropping in powder form in pits gave superior results than the other treatments. Application of goat dropping in pits ranked second.

3. To test the effect of goat droppings on *Gonghura*, Monsoon crop - October - December 2006

The experiment was conducted on *gongura* using Randomised Block Design (RBD). There were four replications for each of the five treatments. Goat droppings were

applied as top dressing and in pits likewise, goat dropping powder was also applied as top dressing and in pits. There was a control treatment. The results are summarised below.

Result

Sl. No.	Treatments	Yield in Kg (Mean)	Height in cm (Mean)
1.	Goat droppings as top dressing	7.22	70.92
2.	Goat droppings in pits	8.43	73.49
3.	Goat dropping powder as top dressing	7.63	72.32
4.	Goat dropping powder in pits	9.31	55.41
5.	Control	7.05	69.86

Conclusion

The results show that application of goat dropping in powder form in pits gave superior results than other treatments. Application of goat dropping in pits ranked second.

4. To test the effect of goat droppings on *Gonghura*, Winter crop, October - December 2006

The experiment was conducted on *gongura* using simple experimental design. There was one replication with three treatments. Twelve samples were selected at random from each plot and measurements were made.

Sl. No.	Treatments	Dosage	Yield in Kg (Mean)	Height in cm (Mean)
1.	Goat droppings as top dressing	40 g / Pit	2.78	14.21
2.	Goat dropping powder in pits	40 g / Pit	3.34	15.38
3.	Control	--	2.36	12.74

Conclusion

Goat dropping powder, applied in pits showed superior results followed by goat dropping pellets applied in pits.

5. To test the effect of goat droppings on *pala koora* (*Spinacia oleracea* L.) Winter crop, October - December 2006

The experiment was conducted on *pala koora* using simple experimental design. There was one replication with three treatments. Twelve samples were selected at random from each plot and measurements were made.

Result

S. No.	Treatments	Dosage	Yield in Kg (Mean)	Height in cm (Mean)
1	Goat dropping pellets in pits	25 g / Pit	9.20	32.58
2	Goat dropping powder in pits	25 g / Pit	9.45	35.66
3	Control	--	8.95	28.27

Conclusion

Goat dropping powder applied in pits was found to be superior to the other two treatments.

6. To test the effect of goat droppings on *Ambat chukka* (*Rumex vesicarius* L.) Winter crop, October – November, 2006

The experiment was conducted on *ambat chukka* using simple experimental design. There was one replication with three treatments. 12 samples were selected at random from each plot and the plant height and number of leaves were recorded after 21 and 40 days of planting.

Result

S. No.	Treatments	Dosage	Yield in Kg (Mean)	Height in cm (Mean)
1	Goat dropping pellets in pits	35 g / Pit	7.20	21.73
2	Goat dropping powder in pits	35 g / Pit	8.64	25.10
3	Control	--	6.12	19.53

Conclusion

Goat dropping powder applied in pits gave superior results than the other two treatments.

Summary

From the above experiments, it is understood that goat droppings when provided in powder form in pits result in better yield and growth in *bhendi, gongura, pala koora,* and *ambat chukka*.

IV. *Panchagavyam*

Panchagavyam (*pancha*=five, *gavyam*=product of cow) is a concoction of five products from the cow i.e., milk, curd, ghee, dung and urine (39). These products are fermented as per specifications and the end product is called Panchagavyam.

Panchagavyam is known to be traditionally used in agriculture, medicine and Hindu rituals. In rituals, it is used as a purifying agent for the body and the soul. It is believed to possess the ability to burn away the sins. In Kerala, the Nampoothiri community uses it to sanctify the *yantras;* Panchagavyam is consumed after bath by Samavedic Brahmins during the ritual of *upakarma*, where the holy thread is changed.

Verse 52 of *Dhanvanthari nighantu* explains the qualities of *Panchagavyam* as purifier of the body and pacifier of *kaphadosa*.

Cow's urine, cow's faeces, cow's milk, curd from cow's milk, ghee obtained by cow's milk in equal quantity mixed together is called as *Panchagavyam*.

Panchagavyam pacifies *kaphadosa* and has purificatory action on the body.

Jayashree *et al.* (40) give an account of a ritual called '*panchagavyam sevikkal*' practiced by pregnant women of Kerala during the fifth month of pregnancy. As per this practice, the pregnant women have to consume *Panchagavyam* for prosperity. This belief also forms the basis for a folk art called *kothammoorippaattu*; where this ritual is used to enhance the prosperity of livestock.

In the recent years, *Panchagavyam* has gained prominence for its potential use in organic farming. An increasing number of farming institutes and farmers are substituting chemical growth promoters with *Panchagavyam*. A good number of researches had been done to understand the potential of *Panchagavyam* in agriculture and health [(41), (42), (43), (44). (45)]. Malarkodi (46) reports that the crop friendly properties of *panchagavyam* can be attributed to the presence of many beneficial microoganisms such as *Actinomycetes, Azatobacter, Azospirillum, Rhizobium, Pseudomonas fluorescence,* and *Bacillus subtilis*. She has also reported the presence of *Escherichia coli* in some *panchagavyam* samples. The attention attracted by *panchagavyam* has also led to various modifications and improvisations done

to it. Thanks to the various on field researches done on *Panchagavyam*; we now have various forms of it such as Buffalo *Panchagavyam*, Kodumudi *Panchagavyam*, Sirkazhi *Panchagavyam*, etc.

Actual *Panchagavyam*

Actual *panchagavyam* refers to the original *panchagavyam* prescribed in the traditional texts. It is made out of five products obtained from the cow viz. cow's urine, cow's milk, cow dung, curd and ghee.

Buffalo *Panchagavyam*

Panchagavyam in which the cow's products are substituted with that of buffalo's.

Modified *Panchagavyam*

Modified *Panchagavyam* (47) consists of cow dung (5 kg), cow's urine (3 L), cow's milk (2 L), curd (2 L), ghee (1 L), coconut water (3 L), yellow banana (400g) and Jaggery (1 Kg).

Kodumudi *Panchagavyam*

This is a reportedly modified *Panchagavyam*, developed by Dr. Natarajan of Kodumudi in Erode, Tamil Nadu and hence it named Kodumudi *Panchagavyam*. It is a mixture of cow's milk, dung, urine, toddy, banana, sugarcane juice and tender coconut water.

As a part of the project, COMPAS partners conducted various experiments to determine the efficacy of *Panchagavyam* in promoting crop growth and yield. Experiments 1-7 were conducted independently by CIKS prior to the initiation of the project while the rest were conducted as a part of the project. The results are summarised below.

1. To test the effect of growth regulators on the yield of paddy, June - September 2002

This experiment was based on the simple experimental design. There were four treatments viz. *Panchagavyam* (3%), coconut milk and curd mixture (5%), cow dung, cow's urine and coconut water mixture (5%). There were no replications and parameters such as plant height, number of tillers/hill and yield were recorded.

Result

Sl. No.	Treatments	Plant height (cm)	No. of tillers (per hill)	Yield/10 cents (Kg)
1	*Panchagavyam* (3%)	68.4	9.15	210
2	Coconut milk and curd (5%)	61.2	7.30	120
3	Cow dung, cow's urine and coconut water mixture (5%)	69.4	8.60	180
4	Control	60.0	6.80	140

Conclusion

Panchagavyam (3%) followed by cow dung, cow's urine and coconut water mixture (5%) is found to give superior yield and increased number of tillers when compared with the control.

2. To test the effect of plant extracts on the yield of *Amaranthus*, September – October, 2003

This experiment was conducted on a local variety of *Amaranthus* Sp. using simple experimental design.

There were nine treatments with no replications. The treatments are,

Sweet flag extract (1%)

Sweet flag extract (2%)

Sweet flag extract (3%)

Sweet flag extract (4%)

Sweet flag extract (5%)

Modified *Panchagavyam* (1%)

Modified *Panchagavyam* (2%)

Modified *Panchagavyam* (3%)

Control

The above treatments were done at a dosage of 2 litres / plot.

Results and conclusion

Plant height was more in plot sprayed with *sweet flag* extract (5%) followed by modified *panchagavyam* (3%) when compared with the control. *Sweet flag* extract is recommended due to its higher efficiency and cheaper cost.

3. To compare the effect of modified *Panchagavyam* and other plant growth promoters on the yield of paddy, August - March 2003

This experiment was conducted on paddy (BPT Ponni, 5204) using Simple Experimental Design. There were five treatments and no replications. Growth regulators were sprayed twice: 55 days after sowing and 70 days after sowing.

Result

Treatments	Plant height in cm	No. of tillers Per hill	Yield Kg/cent	Yield Kg/acre
Actual *Panchagavyam* (3%)	45.2	10	9.0	900
Kodumudi Panchagavyam (3%)	36.6	9.6	9.0	900
Sirkazhi *Panchagavyam* (3%)	44.6	10.2	8.5	850
Coconut milk and curd mixture (5%)	39.6	11.4	10.0	1000
Control	38.4	8.0	7.5	750

Conclusion

Coconut milk and curd mixture (5%) followed by actual *panchagavyam* and *Kodumudi panchagavyam* gave superior results.

4. To test the effect of plant extracts on *Amaranthus*, February - March, 2004

The experiment was conducted on a local variety of *Amaranthus* Sp. using simple experimental design. There were seven treatments and no replications.

Result

Treatments	Plant height in cm	Yield in Kg
Sweet flag extract (2%)	12.34	1.75
Sweet flag extract (3%)	8.88	1.80
Sweet flag extract (4%)	10.08	1.45
Sweet flag extract (5%)	10.52	1.65
Modified *Panchagavyam* (2%)	9.80	1.45
Modified *Panchagavyam* (3%)	9.60	1.63
Control	10.2	1.03

Conclusion

Sweet flag extract (3%) has given the maximum yield followed by *sweet flag* extract (2%). There was no phytotoxic symptoms observed in the fields sprayed with *sweet flag* extract.

5. To test the effect of plant extracts on the yield of *Amaranthus* Sp., April - May 2004

The experiment was conducted on a local variety of *Amaranthus* Sp. using simple experimental design. There were eight treatments and no replications.

Result

Sl. No	Treatments	Plant height in cm	Yield in Kg
1	*Sweet flag* extract (2%)	26.2	17.50
2	*Sweet flag* extract (3%)	29.3	22.40
3	*Sweet flag* extract (4%)	26.1	21.00
4	*Sweet flag* extract (5%)	26.9	22.75
5	Modified *Panchagavyam* (1%)	30.06	19.25
6	Modified *Panchagavyam* (2%)	32.4	22.05
7	Modified *Panchagavyam* (3%)	30.1	26.25
8	Control	29.2	21.00

Conclusion

Maximum yield was obtained in *Panchagavyam* (3%), followed by *Sweet flag* extract (5%).

6. To compare the effect of *Panchagavyam* and other growth promoters on the yield of paddy crop, April - July, 2004

Simple Experimental Design was followed. The paddy variety used was TKM 9. There were four treatments and no replications. PGR's such as *panchagavyam*, coconut milk, and fish slurry were considered for this study. Fish slurry was prepared by fermenting 250g of chopped fishes along with jaggery in a mud pot for 15 days. The mouth of the pot was covered with a cloth and the solution was filtered and used after 15 days.

Result

Treatments	Plant height (in cm)	No. of tillers Per hill	No. of grains Per 5 ear heads	Grain weight (in g)	Yield (Kg/cent)
Panchagavyam (3%)	67.4	18.2	430	10	27
Coconut milk and curd mixture (5%)	68.5	20.3	465	15	30
Fish slurry (0.01%)	67.9	19.4	503	15	28
Control	68.3	13.4	448	10	25

Conclusion

Coconut milk and curd mixture was found to be superior to the *panchagavyam* and fish slurry.

7. To test and compare the effects of *Panchagavyam* and buttermilk on cotton, February - July 2004

The experiment followed the Simple experimental design on cotton (SVPR 3). There were three treatments and no replications. The growth promoters were sprayed twice- after 65 and 95 days. Parameters such as plant height, number of bolls per plant, boll size and yield were recorded.

Result

Treatments	Plant height in cm	No. of bolls per plant	Boll size (% bold)	Yield in Kg/plot
Panchagavyam	75.7	11	35	49
Buttermilk	80.6	13	50	53.5
Control	78.2	8	40	40

Conclusion

From the results, it could be concluded that the treatment with buttermilk gave the best result.

8. To test the effect of foliar spray of PGR on the yield of Bhendi, April -June, 2006

The experiment was conducted with plant growth regulators such as modified *panchagavyam*, buffalo *panchagavyam* and spic cytocyme. Spraying was done from the 30th day of sowing, once in 10 days until the 50th day. The plant height, number of fruits/ plant, length of fruit and yield were recorded.

Result

Sl.No	Treatments	Height in cm (mean)
1	Modified *panchagavyam* (4%)	55.50
2	Buffalo *panchagavyam* (4%)	55.69
3	Spic cytocyme (1%)	53.38
4	Control	45.69

Other parameters such as yield and length of fruit were similar for all treatments.

Conclusion

The plant height was observed to be significantly higher in buffalo *panchagavyam* sprayed plots. Hence it is concluded that buffalo *panchagavyam* is marginally superior to other treatments.

9. To test the efficiency of *Panchagavyam* on seed germination, June 2006

This experiment was done on bhendi seeds using simple experimental design. There were six treatments and no replications. There were six treatments for different concentrations.

Result

Treatments	Tap water	*Panchagavyam*				Control
		25%	50%	75%	100%	
Germination %	0	0	0	0	0	100%

Conclusion

From the experiment, it is understood that *panchagavyam* when soaked for 12 hours at concentrations of 25% to 100% inhibit seed germination.

10. To test the efficiency of *Panchagavyam* on Bhendi seed germination, July -August 2006

This test was done to determine the effect of *panchagavyam* on bhendi seed germination. The experiment followed simple experimental design. There were six treatments and no replications.

Result

Concentrations	Tap water	*Panchagavyam*				Control
		25%	50%	75%	100%	
Germination %	92	66	48	32	12	72

Conclusion

The results show that *panchagavyam* at 50 –100% concentrations inhibits germination. Tap water treatment showed the maximum germination percentage.

11. To test the effect of *Panchagavyam* on Bhendi seed germination, August 2006

Roll towel method was used. There were two replications and six treatments. Parameters such as germination percentage and seedling vigour were recorded.

Result

Concentrations	Tap water	25%	50%	75%	100%	Control
Germination %	100	80	100	80	70	100
Normal seedlings	100	80	60	20	80	90
Abnormal seedlings	0	20	40	80	20	10

Conclusion

Panchagavyam at the above tested concentrations was not found to be effective.

12. To test the effect of foliar spray of *Panchagavyam* on the yield of Paddy crop, September 06 - January 07

This test was done using paired row design. Modified *panchagavyam* (3%) was sprayed on paddy from 40 days to 85 days of planting, at an interval of 15 days. 10 samples were selected randomly from each plot and parameters such as plant height, number of tillers, 1000-grain weight and yield were recorded.

Result

ANOVA Table (for yield)

Source of variance	DF	SS	MS	F
Replication	11	3.8356	0.3487	4.8525
Treatments	1	0.0146	0.0146	0.2036
Error	11	0.7904	0.0719	-

Conclusion

In the above ANOVA table, the calculated F value for the treatment is smaller than the table F value. This shows that there is no significant difference among the treatments.

13. To determine the impact of cow and buffalo *Panchagavyam* on the yield of Paddy crop, September 06 - January 07

Three sprays of *panchagavyam* were given at an interval of 15 days, from 40th to 85th day of planting. Ten samples were selected randomly and the parameters like, plant height, number of tiller, 1000 grain weight and yield, were recorded.

Treatments

T1 Modified *panchagavyam* (2%)

T2 Modified *panchagavyam* (3%)

T3 Modified *panchagavyam* (4%)

T4 Buffalo *panchagavyam* (2%)

T5 Buffalo *panchagavyam* (3%)

T6 Buffalo *Panchagavyam* (4%)

Control

Result

Source of variance	DF	SS	MS	F
Replication	2	0.0192	0.0096	0.1400
Treatments	6	0.1113	0.0186	0.2701
Error	12	0.8244	0.0687	-

Conclusion

In the above ANOVA table, the calculated F value for the treatment is smaller than the table F value suggesting that there is no difference between the treatments.

14. To test the efficacy of *Panchagavyam* on the germination of Bhendi seeds, September – October 2006

Attempt to find the concentration of *panchagavyam* best suitable for seed treatment for germination

Result

Concentration	Tap water	5%	10%	15%	20%	25%	50%	75%	100 %	Control
Germination %	98.6	94.6	97.3	93.3	91.3	89.3	62.6	50	43.3	98.6
Normal seedlings	69.3	87.3	94	84	82	64.6	43.3	30.6	22.6	83.3
Abnormal seedlings	30.6	12.6	6	16	15.3	35.3	56.6	69.3	77.3	16.6

Conclusion

Panchagavyam at 10% gave the best results.

SUMMARY

The above experiments show that *panchagavyam* in the concentrations of 3 - 5% gives good germination percentage. However, it inhibits germination in concentrations of 25 - 100%. Buffalo *panchagavyam* and modified *panchagavyam* are marginally superior to the *panchagavyam*. It is noteworthy that a study done by Kumar (48) also recommends 3% of fortified *panchagavyam* for overall crop performance.

V. ANIMAL PRODUCT FORMULATION

IDEA's extensive field survey among the *Adivasi* communities of Araku valley region in Andhra Pradesh, India revealed that these communities have been using products of animal origin extensively and in complex formulations. A field research was undertaken to validate these processes by IDEA. The results have been summarised below.

1. To test the effect of animal product formulation on Chilli, Monsoon crop, August – November 2006

The experiment was conducted on Chilli using simple experimental design. There was one replication with three treatments. Twelve samples were selected at random from each plot and the plant height, number and yield of chillies were recorded one month after sowing.

Two practices were tested viz.

i. Plant manure (Wood ash, neem and *Pongamia* cakes, 2:2:1) in pits

ii. Animal product formulation (Cow dung, pig manure, poultry manure, wood ash, neem and *Pongamia* cakes, 4:2:3:2:2:1).

Result

Sl. No.	Treatments	Dosage	Yield in kg	Height in cm
1.	Plant manure	50g/Plant	3.17	31.84
2.	Control	-	2.44	22.98
3.	Animal product formulation	50g/Plant	3.76	39.64

Conclusion

Results show that the animal product formulation was superior to the other two treatments.

2. To test the effect of animal product formulation on Chilli, Winter crop, September - December 2006

The experiment was conducted on Chilli using simple experimental design. There was one replication with three treatments. Twelve samples were selected at random from each plot and the plant height, number and yield of chillies were recorded one month after sowing.

Two practices were tested viz.

i. Plant manure (Wood ash, neem and *Pongamia* cakes, 2:2:1) in pits.

ii. Animal product formulation (Cow dung, pig manure, poultry manure, wood ash, neem and *Pongamia* cakes, 4:2:3:2:2:1).

Result

Sl. No.	Treatments	Dosage	Yield in kg	Height in cm
1.	Plant manure	50g/Plant	3.17	31.84
2.	Control	-	2.44	22.98
3.	Animal product formulation	50g/Plant	3.76	39.64

Conclusion

The results show that the animal product formulation was superior to the other two treatments.

3. To test the effect of animal product formulation on Brinjal, Monsoon crop, August – November 2006

The experiment was conducted on a local brinjal variety brinjal using simple experimental design. There was replication with three treatments. Twelve samples were selected at random from each plot and the plant height was recorded one month after sowing. Number and yield of brinjal fruits were recorded after fruiting.

Two practices were tested viz.

i. Plant manure (Wood ash, neem and *Pongamia* cakes, 2:2:1) in pits

ii. Animal product formulation (Cow dung, pig manure, poultry manure, wood ash, neem and *Pongamia* cakes, 4:2:3:2:2:1).

Result

Sl.No.	Treatments	Dosage	Yield (in kg)	Height (in cm)
1.	Plant manure	50g/plant	2.59	27.07
2.	Control	-	1.99	19.53
3.	Animal product formulation	50g/plant	3.07	33.70

Conclusion

The results show that plant manure application yielded superior results for plant height and animal product formulation gave superior yield.

4. To test the effect of animal product formulation on Brinjal, Winter crop, September – December 2006

The experiment with plant and animal formulations was repeated again in September - December 2006.

Result

Sl.No.	Treatments	Dosage	Yield (in kg)	Height (in cm)
1.	Plant manure	50g/plant	5.69	49.85
2.	Control	-	4.16	33.58
3.	Animal product formulation	50g/plant	8.08	42.45

Conclusion

The results show that application of plant manure yielded superior results with respect to height while application of animal products yielded superior results with respect to yield.

5. Experiments on Potato as Monsoon crop, August – November 2006

The experiment was conducted on potato plant using simple experimental design. There was one replication with three treatments. Twelve samples were selected at random from each plot and the plant height was recorded one month after sowing. Number and yield of potato tubers could not be recorded due to loss of crop.

Two practices were tested viz.

i. Plant manure (Wood ash, neem and *Pongamia* cakes, 2:2:1) in pits

ii. Animal product formulation (Cow dung, pig manure, poultry manure, wood ash, neem and *Pongamia* cakes, 4:2:3:2:2:1).

Result

Sl. No.	Treatments	Dosage	Yield	Height
1.	Plant manure	50g/plant	3.94	36.17
2.	Control	-	2.91	24.37
3.	Animal product formulation	50g/plant	5.33	30.80

The crop failed due to heavy rain and hence the experiment was not completed.

Conclusion

Though the experiment could not be taken to the level of completion, the limited results available show that the animal product formulation was superior.

6. Experiments on Tomato as winter crop, September – December 2006

The experiment was conducted on tomato plant using simple experimental design. There was one replication with three treatments. Twelve samples were selected at random from each plot and the plant height was recorded one month after sowing. Number and yield of tomato were recorded after fruiting.

Two practices were tested viz.

i. Plant manure (Wood ash, neem and *Pongamia* cakes, 2:2:1) in pits

ii. Animal product formulation (Cow dung, pig manure, poultry manure, wood ash, neem and *Pongamia* cakes, 4:2:3:2:2:1).

Result

Sl. No.	Treatments	Dosage	Height (in cms)
1.	Plant manure	50g/plant	13.75
2.	Control		10.73
3.	Animal product formulation	50g/plant	16.18

Conclusion

The results show that the application of plant manure was superior with respect to height and the application of animal product formulation was superior with respect to the yield.

SUMMARY

The above experiments show that application of animal product formulation in the stated combinations gives good results in chilli, brinjal, potato and tomato crops.

CHAPTER- V

LABORATORY STUDIES

Based on the literature survey and priorities of various field groups, substances / recipes of various animal products were shortlisted for carrying out laboratory trials. FRLHT undertook the various laboratory trials using animal products. It worked towards standardizing the quality of three important animal products that are used for plant health namely cows urine, goats manure and *panchagavya*.

The purpose of standardizing natural animal products that are used for plant health is-

1. In the past, during field trials when the animal products have been used by our NGO partners, there were variations observed in the efficacy. This could be due to the batch variation in the quality of animal products. Hence keeping a tab on the basic quality would be a good initiative to obtain consistent effect.

2. Standardization is important for large scale trials and for regular use as biofertilizers / biopesticides.

3. Natural products such as dung, urine etc., are prone to contamination from animals or from outside. Some of the contaminants include harmful bacteria such as *E.coli* (causes diarrhoea), *Salmonella* (causes typhoid), *Corynebacterium ulcerans* (causes mastitis), *Clostridium tetani* (causing tetanus)etc. It is important that such organisms do not get sprayed in the fields along with the animal product biofertilizers. Contaminants can also have a bearing on the efficacy of the products.

STANDARDIZATION OF SELECTED PRODUCTS

Standardization of the quality included parameters of Physico-chemical, TLC and Microbial load analysis. The findings of the project are summarized here:

a. Cow's Urine

- The colour of the liquid samples (3 nos.) varied from pale yellow to dark brown when received from CIKS, Chennai (NGO partner).

- The odour of the samples was pungent.

- All the samples were alkaline 7.80 $\pm$ 1.19 except for one sample which was acidic with pH 5.55.

- The microbial analysis of 3 samples showed that the total microbial count was around 2.51 x 10^4 cfu/ml .The total fungal count was around 1.97 x 10^4 cfu/ml.
- *Corynebcterium spp.* has been detected in all the urine samples.
- The samples did not show the presence of *Enterobacter, Salmonella, Staphylococcus, Pseudomonas.*

b. Goats Manure

- The samples received (3 nos.) were in powder form and were greenish brown in colour when received from IDEA (NGO partner).
- The samples had organic manure kind of smell.
- The samples were in neutral pH range with the average of 7.62 ± 0.53.
- The moisture content is around 5.80% (w/w) (average of 3 samples).
- The microbial analysis of the 3 samples showed the total microbial count was approximately 2.41 x 10^3 cfu / ml. The total fungal count was approximately 1.26 x 10^3 cfu / ml. The samples did not show the presence of *E.coli, Enterobacter, Salmonella, Staphylococcus, Pseudomonas.*
- When chemical parameters where tested, the range (average of 3 samples) obtained were as follows: Urea – 4.65% - 7.35%. Nitrogen - 1.4% - 1.6%, Phosphorous – 0.58% - 0.65%, Calcium - 0.58% - 0.6%, Magnesium - 0.15% - 0.18%, Potassium - 1.46%.

c. *Panchagavya*

- The samples received from CIKS, Chennai (4 nos.) were in semi-solid state and were greenish brown in colour.
- The samples had a fermented smell.
- The samples were highly acidic. The pH of the 4 samples received was in the range of 1.36 ± 0.070
- The microbial analysis of the 4 samples showed that the total microbial count was around 6.46 x 10^5 cfu / ml. There were no fungal colonies observed other than *Yeast*s were present to the extent of 2.07 x 10^4 cfu / ml. The *yeast* was of the budding type.

- When chemical parameters were tested, the range (average of 4 samples) obtained were as follows:

Urea - 1.22% - 1.47%, Nitrogen – 0.54% - 0.65%, Phosphorous – 0.54% - 0.56%, Calcium – 0.34% - 0.38%, Magnesium – 0.12% - 0.14%, Potassium – 0.22% - 0.29%.

SIGNIFICANT FINDINGS

1. Some of the cow's urine samples when tested for microbial load showed the presence of

- *Corynebacterium* spp. *C. ulcerans*, *C. pseudotuberculosis* and *C. Urealyticum* have been implicated in mastitis of cows. (detected in samples given by CIKS).

- *Salmonella spp.* was detected in one of the samples given by KPP. *Salmonella typhi* causes typhoid when ingested by humans.

- *E.coli* was detected in most of the samples. *E.coli* causes diarrhoea when ingested by humans.

2. The *panchagavya* samples showed the presence of *yeast* (budding type) when tested for total fungal count. These can be fermenters.

CHAPTER – VI

CONCLUSIONS AND FUTURE PROSPECTS

This project was really a quick short term exercise which lasted barely for a period of fifteen months. However, the tasks attempted were very vast, ranging from collection of literature from primary and secondary sources, field surveys, laboratory testing and field testing. While ideally this could have followed a linear sequence as survey of literature, followed by short listing and prioritization, followed still later by testing and validation in the laboratory and field studies, the practical situation such as these tasks were taken up in parallel. In addition there were also attempts that were made to build the capacity of the project partners at various levels. In terms of summarizing the major conclusions and direction for taking it forward we can organize this section into the following main parts.

A. SURVEY AND COLLECTION OF INFORMATION FROM LITERATURE AND FROM THE FIELDS

B. TESTING AND VALIDATION OF SHORTLISTED PROPERTIES RECIPES AND TECHNIQUES THROUGH FIELD STUDIES AND IN THE LABORATORY

A. SURVEY AND COLLECTION OF INFORMATION FROM LITERATURE AND FROM THE FIELDS

The details of the efforts have been spelt out in the earlier chapters. Thoughts and reflection on the limitations of these efforts and possibilities for future efforts are summed up in the following three main kinds of activities -

1. Survey of literature from classical sources

We start here with the reflection that only a tiny fraction of the classical literature pertaining to Vrkshayurveda is available in printed form. Today we do not have even an estimate of the total corpus of manuscripts in this subject in any Indian language. However, based on the prevailing literature one can state the following-

a. There is a corpus of manuscripts running into at least a few thousand individual texts on subjects of Vrkshayurveda in Sanskrit. This is based on a preliminary overview of the New Catalogus Catalogorum (NCC) program of the Madras University which is compiling a master catalogue of all Sanskrit manuscripts throughout the World (49).

b. There are a large number of manuscripts in several Indian languages such as Tamil, Malayalam, Kannada and other languages such as Persian (50 - 53). The Asian Agri - History Foundation at Hyderabad has done outstanding work in this area and in recent years has brought out a high quality journal as well as series of publications on Vrkshayurveda (54).

Future work on this subject can start with a more thorough study of published literature in Indian languages. Beyond this, attempts have to be made to use the manuscripts in Sanskrit and other Indian languages.

2. Published literature on farmers' practices based on field work and from secondary sources

In the past, literature pertaining to farmers' practices was largely in the purview of the Anthropologist and Social Scientist. However in the last twenty years or so, there is a growing breed of researchers of a different kind. A large number of farmers practices are being documented and discussed from the point of view of their contemporary relevance and importance. A few examples of such sources are cited below.

- The Asian Agri-History Journal cited earlier continues to publish a large number of high quality articles on the subject (55 - 58). They have also brought out a compilation of articles (59) and a very interesting volume on the ancient science of animals and birds (60).

- Honey Bee network that was started by Professor Anil Gupta in the Indian Institute of Management, Ahmedabad started as an English language newsletter in 1990 (61). During the last few years this newsletter is being published in various other languages including - Tamil, Telugu, Malayalam, Kannada, Oriya and Gujarati (62).

- Another scholarly journal that is being published by the National Institute for Science, Communication and information References (NISCAIR) is the Indian Journal of Traditional Knowledge (63). It has been publishing many articles in many areas of traditional knowledge with major contributions in the area of medicine and agriculture. For example, a recent issue carries articles about Indigenous traditional knowledge in agriculture on topics such as - Dairy enterprise in coastal Tamilnadu, traditional tools, tribal pest control drugs, indigenous storage structures, indigenous methods of rat proof grain storage by tribals in Arunachal Pradesh and traditional water management (64 - 69).

- The Indian Journal of History of Science published by the Indian National Commission for History and Science of the Indian National Science Academy has also been producing literature in this area (70). A recent issue of the journal

for example contains a discussion of methods of biodiversity conservation that are mentioned in the ancient text called *Usana Samhita* (71).

- There are also a category of magazines that serve as a medium of exchange of information on this topic between Non-Government Organisations (NGOs) and Community Based Organisations (CBOs) and farmers, such as the magazine produced by the AME Foundation, Bangalore called LEISA India - Magazine on Low External Input Sustainable Agriculture (72).

- With the recent rise in interest in organic farming there is a virtual explosion of articles on this subject in popular magazines and sometimes entire magazines are dedicated to this topic. A good example is the Tamil magazine *Pasumai Vikatan* (73) which is widely circulated in Tamilnadu.

B. TESTING AND VALIDATION OF SHORTLISTED PROPERTIES RECIPES AND TECHNIQUES THROUGH FIELD STUDIES AND IN THE LABORATORY

1. FIELD STUDIES

MAJOR FINDINGS

This is perhaps the most challenging part of the whole effort. A quick overview of the results achieved can be a starting point to reflect on the follow up.

- Cow's milk was seen to increase germination as well as vigor for specific seeds. It is also found to be effective in managing *fusarial* wilt in tomato and offers promise for seed borne diseases.

- Cow's urine has no specific effect on crop yield. Cow's urine *arkam* was found effective in controlling bacterial leaf blight as well as blast in paddy.

- Experiments with goat manure were extremely promising. In general it was found that the use of goat droppings in powder form is superior and the use in pits is superior to the use as top dressing. These experiments have been carried out in Bhendi and Gongura as both monsoon and winter crops. Experiments have also been carried out with two other vegetables namely Palakoora and Ambatchakka (*Rumex vesicarius* L).

- *Panchagavya* is in general found to increase yield of paddy and experiments were carried out also with modified *panchagavya* of which many versions prevail. The exact impact depends on the specific modifications. It increases germination percentage but in higher concentrations inhibits germination. Buffalo based *panchagavya* and modified *panchagavya* are as good or superior to normal *panchagavya* for specific uses for which it has been tested.

- An animal product formulation that was tested - a formulation that included components such as cow dung, pig manure and poultry manure along with neem and *pongamia* was found to be much superior to treatments that just use plant products as manure. Further experiments were carried out on chilli and brinjal crops both in monsoon and winter seasons. Experiments carried out on tomato as winter crop also confirmed this finding.

ISSUES FOR FURTHER STUDY AND DISCUSSION

Among questions that need to be still resolved and challenges are the following -

a. Extreme variability and low reproducibility. Natural products in general have great deal of variation and a plant may have varied properties depending on place and time of harvest, the immediate surroundings and the parts harvested and processing. It may be considered that in the case of animals this variation is an order of magnitude larger. For example, if we take a product from the cow's milk or urine, even this single product may have varying properties depending on breed of the cow, its diet and stage (including stages of pregnancy, lactation etc.). The problem is of course much higher in the case of compound formulations.

b. Since many animal products also naturally host certain microbial flora, it is difficult to ascertain clearly as to what constitutes a natural component, what is picked up during the process of collection and handling (and is it desirable or undesirable or indifferent to the effect of interest) and possible dangers that could be associated in terms of toxicity to humans and cattle.

c. In terms of the above factors, there are also many versions which are in the nature of farmers innovations. For example, if we take a compound formulation like *panchagavya*, farmers use varying proportions of the ingredients. In addition there are modified forms where substitutes were found to be in use for specific ingredients. For instance, many farmers have experimented with substituting ghee which is expensive with groundnut oil or castor seed oil. There are also modifications wherein a variety of extra ingredients are added such as banana, toddy, tender coconut water and various combinations of these.

Given the above facts it seems unlikely that experiments carried out on crops with animal products will ever have the kind of repeatability that one may be seeking ideally in a chemical or even a biochemical system. The best that may be attempted may be a description of formulations as Standard Operating Procedures (SOPs) and an observation of results in terms of the overall impact and range.

2. LABORATORY STUDIES

During the laboratory trials, composition and properties of the selected animal products and their combination from the biochemical and microbiological approach were studied. The study indicated that all the animal products have characteristic organoleptic parameters. The content of nitrogen, urea, phosphorus, potassium, calcium, magnesium and ascorbic acid were high in goat manure when compared to cows' urine and *panchagavya*. The creatinine value was higher for fresh cow's urine samples than stored samples. The quality of goats manure and *panchagavya* was tested using HPTLC. Microbial load analysis of some of the cow's urine samples showed the presence of *Corynebacterium, Salmonella* and *Proteus*. Presence of *E.coli* was also reported in most of the samples from KPP. Microbial load analysis of goat manure and *panchagavya* did not show the presence of pathogens.

Assessment of the safety of these combinations in the context of its use for plant, animal and human health based on the microbial quality was also carried out. The laboratory trial has come out with the following recommendations:

- Care should be taken before spraying cow's urine in the field to ensure that they lack pathogens.
- Safety of the product can be maintained by filtering or pasteurizing samples before application on the crops.

Trials to standardize the source material and preparations indicated that even after standardization of each of the three animal product samples, the physical and organoleptic characteristics within the product type were consistent. Reason and sources behind the tremendous variation in performance of some of the products in the field was also analyzed. The following reasons were understood as the reasons for variations in the standards:

- Storage period
- Temperature of storage
- Conditions of storage
- Physiology / breed / age of the animals
- Feed of the animals
- Method of collection

RECOMMENDATIONS FOR FIELD WORK

Based on the laboratory trials, a few suggestions were also made to the field partners working with these animal products. These include,

1. Standard Operating Procedures has to be prepared for each of the product preparation and application in the field.

2. Some quality parameters of the products need to be monitored and record of the same has to be maintained.

3. Observations need to be documented and the results have to be analyzed as against batch numbers of prepared products.

4. Possible correlation of the results with the nature of the animal products, conditions etc.

TOWARDS STANDARDS FOR SELECTED PRODUCTS

The Organoleptic, Physicochemical, TLC and Microbial quality standards have been developed for cow's urine, goat manure and *panchagavya* samples.

Cow's urine: By comparing the values it can be noted that the organoleptic and physical parameters showed inherent consistent values while the chemical parameters showed variation in cow's urine samples. This may be due to variability in cows, effect of storage time etc.

- All the urine samples contained bacterial and fungal counts.

- *Corynebcterium spp.* was detected in all the urine samples given by CIKS. *C. ulcerans*, *C. pseudotuberculosis* and *C. urealyticum* have been implicated in mastitis of cows.

- *Salmonella* was found in one of the samples. *Salmonella typhi* causes typhoid when consumed by humans. *E.coli* was found in most of the samples sent by KPP, Shimoga, *E.coli* is known to cause diarrhoea.

- Cow's urine samples showed antimicrobial activity against *Staphylococcus aureus, Salmonella typhi, E.coli* and *Bacillus sp.* has potential use as a good biopesticide.

Goat Manure : The microbial analysis of the three goat manure samples showed the total microbial count was about 2.41 x 10^3 cfu/ml. The total fungal count was about 1.26 x 10^3 cfu/ml.

- The values of chemical parameters (urea, nitrogen, phosphorous, calcium and potassium) for goat manure are the highest when compared with the other

animal products tested. Nitrogen: 1.52%, Phophorous:0.61% , Urea: 6.04%, Calcium: 0.30%, Magnesium: 0.16% (Refer Fig:4-7)

- Goat manure samples did not show any antimicrobial activity against the organisms tested. Hence it can be used as a good biofertilizer.

***Panchagavya* :** The microbial analysis of the 4 samples showed that the total microbial count was around 6.46 x 10^5 cfu/ml. There were no fungal colonies observed other than *Yeast*s which were present to the extent of 2.07 x 10^4 cfu/ml. The *yeast* was of the budding type.

Panchagavya showed antimicrobial activity against *Staphylococcus aureus, Salmonella typhi, E.coli* and *Bacillus sp.* and also showed fairly good values for the chemical parameters. Hence it can be said that it is a good biopesticide and a good biofertilizer.

RECOMMENDATIONS

The following need to be explored in the future as separate projects:

1. Research into preparing (I) Safe products (Eg. Cow's urine) that are free from pathogenic microflora. (II) Effect of the treatment on plant growth.

2. Study of microflora in the products and their role on plant growth/ protection.

3. Test the Antimicrobial activity of the products against selected plant pathogens.

4. Bioassay of the samples by Brine Shrimp Bioassay and Anti Tumour Assay as biotool for quality control.

5. Effect of storage of the products on efficacy.

CONCLUDING REMARKS

In conclusion we would like to sum up the following as the salient features of the achievements of this project during the first phase of fifteen months.

1. We now have an excellent overview of the literature on this subject as regards classical knowledge, largely with respect to the published sources and also some indications with respect to the unpublished manuscripts.

2. We have access to substantial amount of published literature from secondary sources and major sources that report documentation and field survey including journals, popular magazines have been identified.

3. Very good progress has been made towards shortlisting and prioritisation of practices starting from survey of literature in a comprehensive framework that includes various criteria such as priorities of the field group, specificities of the ecosystem, simplicity of the suggested recipe or practice, time frame required for the procedure and ethical considerations such as destructive / non-destructive use of animals and animal parts.

4. Field studies have resulted in a good set of preliminary results and more importantly has built up the capacity of the field teams in the design and execution of experiments and sensitized us to various factors and parameters that need to be taken care of and controlled.

5. A very good beginning has been made with laboratory studies - preliminary standards have been established for selected products and areas of concern and topics for future research have been flagged.

6. Standard Operating Procedures (SOPs) are now being developed for the preparation of a variety of products and formulations to carry out procedures.

7. Most importantly it has been a capacity building exercise at varied levels. The field groups and partners have enhanced capacity to design and execute experiments in the field level. Moreover, a good interdisciplinary team has been formed with representation from field groups, traditional scholars of Ayurvedic medicine, Agricultural scientists and laboratory scientists who have been in the process of continuous mutual discussion and engagement.

This has led to the foundation for a more long lasting programme and work continues to be done on these topics even after the end of the formal project period.

References

1. Natarajan, K. 2003. *Panchakavya* – A Manual. Other India Press, Mapusa, Goa, India

2. Dr. Aru. Solaiyappan. 2003. *Payirkakkum Panchagavya* (Tamil). Chengai Pathipagam, Chengalpet, Tamil Nadu, India

3. *Modified Panchakavya to boost plant and animal productivity.* 2003. Article published in The Hindu, Indias' National News Paper, June 05, 2003

4. Bhaskara Padmodaya. 1994. Biological Control of Seedling disease and wilt in Tomato *(Lycopersicon esculentum* Mill.*)* Caused by *Fusarium oxysporum* Schl. F. sp. *Lycopersici* (Sacc.) Snyder and Hansen. *Thesis submitted in partial fulfillment of the requirements for the award of the degree of Doctor of philosophy in Plant Pathology to the University of Agricultural Sciences, Bangalore*

5. Kumar, S.V. 2003. Effect of Fortified Panchagavya on Phytopathogen and its efficacy as Biostimulant in the Context of Sustainable Agriculture. *Thesis submitted to the University of Madras for the partial fulfilment of the requirements for the award of the degree of Master of Science in Applied Microbiology*. Prince Shri. Venkateshwara Arts and Science College, Chennai

6. Malarkodi, S.M. 2003. Isolation and Identification of Microbes from Panchakavya and its Utility Value in Biotechnological and Agricultural Fields. *Thesis submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Biotechnology to the Bharathidasan University, Trichi.* JJ College of Arts and Science, Pudukottai.

7. Nene, Y.L. 2006. *Utilising Traditional Knowledge in Agriculture*. In A.V. Balasubramanian and T.D. Nirmala Devi (eds), *Traditional Knowledge Systems of India and Sri Lanka.* Centre for Indian Knowledge Systems, Chennai. PP. 32-38.

8. Subramaniam, A. 2005. Effect of *Panchagavya* on *Escherichia coli* in procured milk. *Indian Veterinary Journal.* Vol. 82 (7) PP. 799-800

9. Somasundaram, E. *Panchagavya.* Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, India. Available online at http://www.tana.ac.in/scms/agronomy/somasundaram.htm

10. Wani, M. A., Gincy Devasia and V. Kurucheve. 2004. Effect of Paddy Seed Treatment with Natural Products on Inoculated Fungal Spores of *Aspergillus niger* and *A. flavus* under different storage Structures. *Journal on Environment & Ecology* 22 (2): PP. 287-292

11. Wani, M. A. and V. Kurucheve. 2005. Invitro Evaluation of Fungitoxicity of some Natural Products on Heavy Inoculum and Conidial germination of *Aspergillus* spp. *Journal on Advances in Plant Sciences*, 18(II): PP. 597-600, 2005

12. Raja, J., C. Suganthi and V. Kurucheve. 2005. Use of Animal Excrements for the Management of Sheath Blight of Rice. *Journal of Archives of Phytopathology and plant protection,* 2005

13. Wani, M. A. and V. Kurucheve. 2004. Toxicity of Farm livestock Excreta against Fungi. *Journal on Environment & Ecology* 22 (1): PP. 234-236, 2004

14. Nene, Y. L. 2002. Modern Agronomic Concepts and Practices Evident in Kautilya's Artha-sastra (c.300 BC). *Journal of Asian Agri-History,* 6(3): PP. 231 – 241, 2002

15. Das, P., G. Subba Reddy, S. K. Das, R. Geetha., *et al.* 2003. *Validation of Indigenous Technical Knowledge in Agriculture,* Document 3. Indian Council of Agricultural Research, New Delhi

16. *Honey Bee* Volumes. Anil K. Gupta (Ed.), Sristi Innovations, Ahmedabad.

17. *Namvazhi Velanmai* Volumes. P. Vivekananthan (Ed.), Veratypathu, Madurai, India.

18. Mandavgane, S. A., A. K. Rambhal and N. K. Mude. 2005. Development of Cow's urine based Disinfectant. *Journal of Natural Product Radiance*, 4(5): PP. 410 – 412, Sep – Oct 2005

19. Suvarna, V. C. and V. U. Boby. 2005. Probiotics in Human Health: A Current Assessment. *Journal of Current Science* 88(11): PP. 1744 – 48, 2005

20. Palani Dorai, R., N. Akila, H. Gopi and T. Sivakumar. 2005. Nutritive Value of Goat Milk. *Journal of Kisan World*, November 2005, PP. 29.

21. *Abhithana Sindhamani*. (Tamil) A. Singaravelu Mudhaliyar, corrected by A. Sivapragasa Mudaliyar. 1910.

22. Sowrirajan, M. 2006. *Padhartha Gunapadam* (Tamil). *Thanjavur Maharaja Sarabojiyin Saraswati Mahal Noolagam,* Thanjavur. P. 67.

23. Prentice, Ann. 1996. Constituents of Human Milk. *Food and Nutrition Bulletin.* Volume 17, Number 4. Available online at http://www.unu.edu/unupress/food/8F174e/8F174E04.htm# Constituents%20of%20human%20milk

24. Bettiol, W. 1999. *Crop Protection.* Vol. 18(8), September 1999, PP. 489-492

25. Ferrandino, J. Francis and Victoria L. Smith. 2007. The effect of milk-based foliar sprays on yield components of field pumpkins with powdery mildew. *Crop Protection.*Vol. 26(4), PP. 657-663

26. Beekwilder, K. M. 1999. The Inheritance of Resistance to Tobacco Mosaic Virus in Tobacco Introductions. *M.Sc. thesis submitted to Virginia Polytechnic Institute and State University*, Virginia.

27. Hare, W. W., and G. B. Lucas. 1959. Control of contact transmission of Tobacco Mosaic Virus with milk. *Plant Dis. Report* 43: PP. 152 - 154.

28. Gupta, A. K. 1992. Structural adjustments: Looking outward, forward and beyond!. *Honey Bee.* Vol 3(2).

29. Vivekanandan, P. 1999. Is pruning in Neem trees needed? *Honey Bee.* Volume 10(2)9.

30. Balasubramanian, P. 1994. Scaring the crows and trapping the rats: Learning from the farmers of Palladam Block, Coimbatore District, Tamil Nadu. *Honey Bee* Vol 5(3).

31. Parmar, P. 1992. *Keshavsinh.* Honey Bee, Vol. 3(1)

32. Prakash, T. N. 1995. Keeping Monkey, Striga and Fruit Borers away. *Honey Bee.* Vol. 6(3).

33. Reddy, N. 1998. Bell the rat and do away with the cat. *Honey Bee.* Vol. 9 (2). 1998.

34. ICAR. 2004. *Validation of Indigenous Technical Knowledge in Agriculture,* Document 3. Mission Unit, Division of Agricultural extension, Indian Council for Agricultural Research, New Delhi. PP.179

35. Andreasen, L. and Helle Qwist-Hoffmann. 1997. Inter-Regional project for participatory upland conservation and development (Field Document 6/97) - NEPAL - A framework for a participatory economic evaluation of improved goat production by women groups in the Bhusunde Khola watershed. Food and Agriculture Organization of the United Nations, Gorkha. Available online at http://www.fao.org/docrep/x5676e/x5676e08.htm

36. Anonymous. 2004. *National Goat Handbook*. University of Maryland, USA. Available online at http://outlands.tripod.com/farm/national_goat_ handbook.pdf

37. Muyekho, F. N. and L. Mose. 2000. Economic evaluation of Tumbukiza as an alternative method for increasing Napier grass (*Pennisetum purpureum*) productivity on smallholder farms in North Rift Valley Region of Kenya. Participatory Technology Development for Soil Management by Small Holders in Kenya. *Proceedings of the 2nd Scientific Conference of the Soil Management and Legume Research Network Projects,* June 2000 Mombasa, Kenya.

38. Perez-H, Elimar, Pina *et.al.* 2005. Different compost fertilizations on growth, yield and quality of Organic Melon in Venezuela. Paper presented at Researching Sustainable Systems - *International Scientific Conference on Organic Agriculture, Adelaide, Australia*, September 21-23, 2005. Available online at http://orgprints.org/4443

39. Vijayalakshmi, K., T. D.Nirmala Devi, Subhashini Sridhar and S. Arumugasamy. 2007. *Organic Paddy Cultivation*. Centre for Indian Knowledge Systems, Chennai. PP. 22

40. Jayashree, M. P., F. M. H. Khaleel and Ranjan S. Karippai. 2005. Influence of Farming Culture on Rituals of North Malabar Region of Kerala State. *Ethnobotanical Leaflets*. Available online at http://www.siu.edu/~ebl/leaflets/kerala.htm

41. Jayasree, P. and Annamma George. 2006. Do Biodynamic Practices Influence Yield, Quality and economics of cultivation of chilli (*Capsicum annuum* L.)?. *Journal of Tropical Agriculture* 44 (1-2): PP. 68-70, Available online at http://www.jtropag.in/index.php/ojs/ article/viewFile/173/161

42. Subramaniam, A. 2005. Effect of *Panchagavya* on *Escherichia coli* in procured milk. *Indian Veterinary Journal.* Vol. 82 (7) PP. 799-800

43. Mathivanan, R., S. C. Edwin, R. Amutha and K. Viswanathan. 2006. Panchagavya and *Andrographis paniculata* as Alternatives to Antibiotic Growth Promoter on Broiler Production and Carcass Characteristics. *International Journal of Poultry Science.* 5 (12): PP. 1144-1150. Available online at http://www.pjbs.org/ijps/fin749.pdf

44. Somasundaram, E., M. Mohamed Amanullah, K. Vaiyapuri, K. Thirukkumaran and K. Sathyamoorthi. 2007. Influence of Organic Sources of Nutrients on the Yield and Economics of Crops under Maize Based Cropping System. *Journal of Applied Sciences Research*, 3(12): PP. 1774 - 1777. Available at http://www.insinet.net/jasr/2007/1774-1777.pdf

45. Sanjutha,S., S. Subramanian, C. Indu Rani and J. Maheswari. 2008. Integrated Nutrient Management in *Andrographis paniculata*. *Research Journal of Agriculture and Biological Sciences*, 4(2): 141-145. Available at http://www.insinet.net/rjabs/2008/141-145.pdf

46. Malarkodi, S.M. 2003. Isolation and Identification of Microbes from Panchakavya and its Utility Value in Biotechnological and Agricultural Fields. *Thesis submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Biotechnology to the Bharathidasan University, Trichi*. JJ College of Arts and Science, Pudukottai.

47. Arumugasamy, S., K. Subramanian and Subhashini Sridhar. 2007. *Enhancing Soil Fertility in Organic Farming*. Centre for Indian Knowledge Systems, Chennai. PP. 7

48. Kumar, S. V. 2003. Effect of Fortified Panchagavya on Phytopathogen and its efficacy as Biostimulant in the Context of Sustainable Agriculture. *Thesis submitted to the University of Madras for the partial fulfilment of the requirements for the award of the degree of Master of Science in Applied Microbiology*. Prince Shri. Venkateshwara Arts and Science College, Chennai

49. New Catalogus Catalogorum: An alphabetical Register of Sanskrit and allied work and authors. Ongoing project of the Madras University Sanskrit Department during the period 1949 -1988, twelve volumes had been published.

50. *Velala Puranam* by Mahavidvan Kandasamy Kavirayar. 1999. Published by Mahalingam Mariyammal Manivizha Trust, Coimbatore, India. PP. 636.

51. *Krishi Gita* (For the benefit of People). Translated from Malayalam by B. Mohan Kumar. Published by Asian Agri – History Foundation, Secunderabad, Andhra Pradesh, India. PP. 120.

52. *Lokopakara* (For the benefit of People). Translated from Kannada by Valmiki Sreenivasa Ayangarya. Published by Asian Agri – History Foundation, Secunderabad, Andhra Pradesh, India. PP. 140.

53. *Nuskha Dar Fanni falahat* (The Art of Agriculture). Translated from Persian by Prof (Dr) Razia Akbar. Published by Asian Agri – History Foundation, Secunderabad, Andhra Pradesh, India. PP. 136.

54. *Asian Agri – History journal,* Published by Asian Agri – History Foundation, Secunderabad, Andhra Pradesh, India. http://www.agri-history.org/lokopakara.asp

55. Nalini Sadhale and Y.L. Nene. 2009. *Ancient Indian Traditional and Scientific thought on plants: Sir JC Bose and Vrkshayurveda. Asian Agri – History Journal,* 2009 13(2). PP. 101 - 112.

56. Hmingthanzuali and Rekha Pande. 2009. *Womens' Indigenous Knowledge and Relationship with Forests in Mizoram. Asian Agri – History Journal,* 2009 13(2). PP. 129 – 146.

57. Shantanu Kumar Dubey and Uma Sah. 2009. *Indigenous Nur Bun Method of Potato Cultivation in Meghalaya Hills. Asian Agri – History Journal,* 2009 13(2). PP. 147 – 153.

58. Raj Pal Meena, R. P. Meena and B. S. Bhimavat. 2009. *Moisture Use ofFunctions and Yield of Rainfed Maize as Influenced by Indigenous Technologies. Asian Agri – History Journal,* 2009 13(2). PP. 155 – 158.

59. *Glimses of the Agricultural Heritage of India*. Y. L. Nene (Ed.). Published by Asian Agri – History Foundation, Secunderabad, Andhra Pradesh, India. PP. 912.

60. *Mirga Pakshi Shastra (The Science of Animals and Birds).* Nalini Sadhale and Y. L. Nene (Eds.). Published by Asian Agri – History Foundation, Secunderabad, Andhra Pradesh, India. PP. 400.

61. *Honey Bee* volumes. Anil K. Gupta (Ed.). Published by Sristi Innovations, Ahmedabad.

62. Regional names of Honey Bee Volumes: *AAma Akha Pakha* (Oriya), *Hittalagida* (Kannada), *Ini Karshakan Samsarikatte* (Malayalam), *Loksarvani* (Gujarati), *Suji – Bujh Aas Paas ki* (Hindi), *Num Vazhi Velanmai* (Tamil*) and Palle Srujana* (Telugu).

63. *Indian Journal of Traditional Knowledge.* Published by National Institute of Science communication and Information Resoureces, CSIR, New Delhi, India. http://www.niscair.res.in

64. Ponnusamy, K., Jancy Gupta and R. Nagarajan. 2009. *Indigenous Technical Knowledge (ITK) in dairy enterprise in coastal Tamil Nadu. Indian Journal of Traditional Knowledge.* 2009, 8 (2). PP. 206 – 211.

65. Karthikeyan, C., D. Veereregevethatham, D. Karpagam and S. Ayisha Firdouse. 2009. *Traditional Tools in Agricultural Practices. Indian Journal of Traditional Knowledge.* 2009, 8 (2). PP. 212 - 217.

66. Purusottam, M., N. Ponnurasan and P. Narayanasamy. 2009. *Tribal pest control Practices of Tamil Nadu for sustainable agriculture. Indian Journal of Traditional Knowledge.* 2009, 8 (2). PP. 218 - 224.

67. Karthikeyan, C., D. Veereregevethatham, D. Karpagam and S. Ayisha Firdouse. 2009. *Indigenous Storage Structures. Indian Journal of Traditional Knowledge.* 2009, 8 (2). PP. 225- 229.

68. Sarangi S. K.,, R. Singh and K. A. Singh. 2009. *Indigenous method of rat proof grain storage by Adi tribes of Arunachal Pradesh. Indian Journal of Traditional Knowledge.* 2009, 8 (2). PP. 230- 233.

69. Ajay S. Rawat and Reetesh Sah. 2009. *Traditional Knowledge of Water management in Kumaon Himalaya. Indian Journal of Traditional Knowledge.* 2009, 8 (2). PP. 249- 254.

70. *Indian Journal of History of Science.* Published by Indian National Science Academy New Delhi, India.

71. Priyadarsan Sensarma. 2009. *Biodiversity: Methods of Conservation in the Usanah Samhita. Indian Journal of History of Science.* Published by Indian National Science Academy New Delhi, India. 2009, 44 (1). PP. 21 – 28

72. *LEISA (Low External Input sustainable Agriculture) India.* Published by AME Foundation, Bangalore, India. http://www.amefound.org

73. *Pasumai Vikadan* - A bimonthly magazine. Published by Vasan Publications Pvt. Ltd., Chennai, India.

ADDITIONAL READINGS

1. C. Lal and Verma, L.R., 2006, *Certain bio-products for insect-pest control,* Indian Journal of Traditional Knowledge, Vol.5 (1)

2. Choudhury R.P, Kumar A & Garg A N, 2006, *Analysis of Indian Mint (Mentha* spicata) *for essential, trace and toxic elements and its antioxidant behaviour, J.* Pharm. Biomed Anal., 41

3. http://pmep.cce.cornell.edu/facts-slides-self/facts/mod-ag-grw85.html (*Impacts of Intensive Farming on Soil and Water Resources)*

4. http://www.ias.ac.in/currsci/ju110/articles0.htm

5. Krishna Prasad G., 1999, *Cow's urine treatment for red gram (against storage pest*), Honey Bee Journal Vol 10(2).

6. Nautiyal *et al,* 2004, *A synergistic fermented plant growth promoting, bio control composition,* CSIR, New Delhi, International Publication No. WO 2004/087618.

7. Sahu S.K., Samant P. K., *2006, Micronutrient Management Through* Organic *Farming,* Orissa review

8. The Indian cow, The scientific and economic journal (2004), Year 1, Issue 1.

9. The Indian cow, The scientific and economic journal (2005), Year 1, Issue 3.

10. Vinayagam *et al.*,2006, Indian journal of Traditional Knowledge Vol.5, No.1

WEBSITES REFERRED

1. www. shaktifoundation.org

2. www.cowurine.com/research-paper.html

3. www.ecochem.com/t manure fert.html

4. www.epa.gov/pesticides/biopesticides/whatarebiopesticides.htm

5. www.fao.org

6. www.google/cowsurinemanual.com

7. www.Govigyan Bharati.htm

8. www.lndian coffee board/- monthly magazine- Planters World - PANCHAGAVYA - An organic formulation for Bio-composting of farm wastes in coffee plantation.htm 19. www.manipur.nic.in/rbdc/Farmerlnfo.htm

9. www.megapib.nic.in/fertilizer inorgfert.htm

10. www.organiGfarming.com

11. www.pubmed.gov Cows *urine concoction; its chemical composition, pharmacological* actions *and mode of lethality(Afr J* Med Med Sci. 1983 Mar, 12(1) 23. www.sciencediect.com

12. www.scirus.com

13. www.Urine testd\gorathna.htm.

14. http://h2-pv.us/ecocity/Links/My_Links_Pages/rabbit_manure01.html

15. http://tdpnampoothiri.com/eng_yantrangal.html

16. http://www.pradosham.com/panchagavyam.php

17. http://usagardener.com/breaking_ground/composting_manure_and_fertilizer.php

18. http://tdpnampoothiri.com/eng_yantrangal.html

19. http://www.pradosham.com/panchagavyam.php

Annexure – I

CONTEMPORARY LITERATURE REFERRED FOR FARMERS PRACTICES ON THE USE OF ANIMAL PRODUCTS IN AGRICULTURE

1. Inventory of Indigenous Technical Knowledge in Agriculture – ITK volumes", Mission mode project on collection, documentation and validation of indigenous technical knowledge. Published by The Indian Council of Agricultural Research (ICAR), New Delhi.

   a) Document 1 – compilation of ITK practices gathered from various literature sources (Books, Thesis, Journals etc). 2002. PP. 411.

   b) Document 2 and a Supplementary Edition [2 (1)] – compilation of ITK practices collected from primary sources. 2003. PP. 906.

   c) Document 3 – compilation of validated Indigenous Technical Knowledges. 2004. PP. 505.

2. Honey Bee Journal volumes from 1996 – 2005. Anil K. Gupta (Eds.) Published by SRISTI Innovations, Ahmedabad.

3. *Namvazhi velanmai* volumes. P. Vivekananthan (Ed.). SEVA, Verattypathu, Madurai, India.

4. LEISA journal (Low External Input Sustainable Agriculture) volumes 1984 – 2005. AME Foundation, Bangalore, India.

5. Dr. Sundaramari. 2001. Adoption and Perceived Effectiveness of Indigenous Agricultural Practices in Different Farming System. Thesis submitted in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy to the Gandhigram Rural Institute - Deemed University, Tamil Nadu, India. 2001. PP. 261.

Annexure – II

LIST OF ANIMAL PRODUCTS MENTIONED IN ITK VOLUMES AND SELECTED PRACTICES

List of Animal Products

1.	Cow	-	(a) Milk, (b) Buttermilk, (c) Curd, (d) Dung à cake and Ash, (e) Urine, (f) Ghee, (h) Horn
2.	Buffalo	-	(a) Urine, (b) Buffalo (live)
3.	Goat	-	(a) Milk, (b) Dung or excreta or droppings, (c) Hair, (d) Urine, (e) Penning, (f) Goats (live)
4.	Sheep	-	(a) Milk, (b) Dung or excreta, (c) Penning, (d) Sheep (live)
5.	Horse	-	(a) Excreta or droppings
6.	Pig	-	(a) Excreta
7.	Termite	-	(a) Termite hill soil
8.	Crab	-	Dead crab
9.	Rats	-	Dead rats
10.	Human	-	(a) Urine, (b) Excreta, (c) Hair
11.	Camel	-	(a) Dung, (b) Bones
12.	Animals	-	(a) Dung, (b) Bone, (c) Urine, (d) Bone meal, (e) Penning
13.	Cattle	-	(a) Dung, (b) Urine, (c) Horns, (d) Bones
14.	Poultry birds	-	(a) Excreta, (b) Eggshells
15.	Ants	-	(a) Ant hill soil
16.	Fish	-	(a) Fish (live), (b) Fish washings, (c) Fish meal, (d) Fish wastes, (e) Fish scales

17.	Nilagai	-	(a) Excreta
18.	Duck	-	(a) Duck (live), (b) Excreta
19.	Pigeon	-	(a) Excreta
20.	Frog	-	(a) Dead frog
21.	Snake	-	(a) Dead snake
22.	Hen	-	(a) Blood
23.	Lizard	-	(a) Dead lizard
24.	Crow	-	(a) Dead crow
25.	Livestock		
26.	Donkey	-	(a) Dung
27.	Honey bee	-	(a) Honey
28.	Domestic animals	-	(a) Urine
29.	Snail fish	-	(a) Dead snail fish
30.	Cat	-	(a) Dead cat
31.	Dog	-	(a) Dead dog

Selected Practices from the Practices Short Listed on the use of Animal Products

1. Control of mites using cow dung

Cow dung is dissolved in water, which is sprayed on the paddy crop. This is very effective in controlling the mite like pests. Besides this the water that is usually present in the plot can also be treated with cow dung or goat droppings, which is equally effective in repelling insects.

Farmer: Diju Kuma Bhuyan, Assam

2. Fish smoke to control leaf curl

The smoke of properly burnt dried fish helped in controlling the leaf curl disease of chillies.

Farmer : Gangaben Somabhai Pandod, Royani village in Meghraj taluka of Gujarat.

Annexure – III

LIST OF VRKSHAYURVEDA TEXTS REFFERED

1. Ayachit, S.M. (Tr.). 2002. *Kashyapiya Krishisukti* (A Treatise on Agriculture by Kashyapa). Agri-History Bulletin No.4, Asian Agri-History Foundation, Secunderabad, India. PP. 158.

2. Girija Prasanna Majumdar. 1935. *Upavana-Vinoda* (A Sanskrit Treatise on Arbori – Horiculture). The Indian Research Institute, Calcutta, India. PP. 127.

3. Kangle, R.P. 2000. *The Kautiliya Arthasastra* Part I, III. Motilal Banarsidass Publishers Private Limited, Delhi, India.

4. Nalini Sadhale (Tr.) 1996. *Surapala's Vrkshayurveda* (The Science of Plant Life by Surapala). Agri-History Bulletin No.1, Asian Agri-History Foundation, Secunderabad, India.

5. Nalini Sadhale (Tr.) 1999. *Krishi – Parashara* (Agriculture by Parashara). Agri-History Bulletin No.2. Asian Agri – History Foundation, Secunderabad, India. PP. 94

6. Nalini Sadhale (Tr.). 2004. *Vishvavallabha* (Dear to the World : The Science of Plant Life). Agri-History Bulletin No.5. Asian Agri-History Foundation, Secunderabad, India. PP. 134.

7. Ramachandra Rao, S.K. 1993. *Vrkshayurveda* (Excerpt from *Sarngadhara – Samhita*). Kalpatharu Research Academy, Bemgolore, India. PP. 80.

8. Ramakrishna Bhat, M. 1997. *The Brhat Samhita of Varahamihira,* Part – II & III. Motilal Banarsidass Publishers Private Limited, Delhi, India.

Annexure - IV

GUIDELINES FOR SURVEY OF SELECTED TEXTS OF VRKSHAYURVEDA REGARDING USE OF ANIMAL PRODUCTS FOR AGRICULTURE

I. GUIDELINES TO THE PERSON READING THE TEXT

The overall summary of the text can have three parts

A. Introducing the Text – A brief introduction to the text

- Title
- Name of the original author
- Translator if any
- Editor
- Publisher
- Year in which the original book was published (sanskrit / source)
- Year in which the current book has been published
- Whether the original text is available
- Language in which the original text is available
- Language in which the text has been translated into
- Total number of chapters with the number of slokas in each chapter and title of each chapter with a one sentence description of content.

B. Guidelines for the Summary

- A table that lists all instances of mention of animal products giving – serial number, sloka, page numbers, description of the practice
- The word animal product is used in a very wide sense. It includes –

- Products derived from – cattle, poultry, fish, insects, birds etc.
- Products in which animal products are present singly or in combination with other animal products or plant or mineral products.

- A summary regarding the whole text covering the following points

a. List of all animals mentioned in it giving the Sanskrit, technical and local names

b. List of all animal products mentioned

c. Summary of the kinds of uses that have been suggested in the text on agricultural (seed treatment, pest control, increasing plant growth....etc), products, crops etc.

C. Overall Summary

After the survey of all the text has been completed an overall summary should be prepared covering the following areas –

a. List of all animals and animal products mentioned in the entire set of texts

b. A summary regarding the various uses to which animal products are being put

c. Comparison of various kinds of products listed and uses suggested in the various texts

d. Comments regarding the most prominently and frequently mentioned animal products and the suggested uses.

These details are provided in Annexure - V.

Annexure – V

SUMMARY OF SELECTED VRKSHAYURVEDA TEXTS

Provided here is the overall summary of the survey of selected texts of Vrkshayurveda regarding use of animal products for agriculture.

List of Animals mentioned

1. Cow	2. Buffalo	3. Goat	4. Sheep	5. Horse
6. Pig	7. Termite	8. Crab	9. Rat	10. Human
11. Pigeon	12. Snake	13. Hen	14. Lizard	15. Honey bee
16. Donkey	17. Horse	18. Elephant	19. Fish	20. Cat
21. Dog	22. Tortoise	23. Monkey	24. Rabbit	25. Jackal
26. Cock	27. Ants	28. Deer	29. Boar	30. Monkey
31. Tiger	32. Parrot			

List of Animal products mentioned

1.	Cow	a) milk b) curd c) buttermilk d) ghee e) butter f) cow dung g) urine h) blood i) flesh j) bone k) bone marrow l) hair m) horn n) fat
2.	Buffalo	Milk, skin, horn, flesh, fat, marrow, urine, stools
3.	Goat	Milk, flesh, fat, marrow, blood, skin, dung
4.	Elephant	Ivory, intoxicated secretion, flesh, bones, fat (sweat), meat, milk, skin
5.	Snake	Flesh, fat, skin
6.	Fish	Flesh, fat, bones
7.	Honey bee	Honey, beewax
8.	Cock	Excreta, flesh
9.	Cat	Flesh, fat, marrow, excreta

10.	Deer	Flesh, fat, marrow, excreta
11.	Dog	Flesh, fat, feces
12.	Horse	Hair, bone, dung, milk, flesh
13.	Pigeon	Flesh, blood, feces
14.	Tiger / Leopard	Flesh
15.	Crab	Bones / bones with flesh
16.	Monkey	Bones
17.	Human being	Flesh, stool, blood
18.	Pig / Boar	Stool, meat, bone
19.	Hen	Stool
20.	Mice / Rat	Fat, blood, feces
21.	Boar	Meat
22.	Parrot	Fat
23.	Monkey	Head bone
24.	Rabbit	Meat, blood
25.	Donkey	Dung
26.	Tortoise	Meat, blood
27.	Peacock	Feather
28.	Ant hill	Hill mud

Various Kinds of Animal products and their uses

Sl. No.	Animal Product	Method of Application	Purpose	Crops
1.	Cow dung, Ghee, Honey, Cow's urine, Milk, Kunapa Jala	1. Dusting 2. Bait 3. Soil application 4. Seed treatment • Smearing • Soaking • Dusting • Smoking 5. Preparation of the pit 6. Watering (alone or mixed with water)	1. Seed treatment 2. Growth promoter 3. Increase yield 4. General vitaliser 5. Sweeter fruits 6. Bigger, healthy fruits 7. Good smelling flowers 8. Pesticide	1. Jambu – நாவல் 2. Panasa – பலா (seed treatment) 3. Tinduka - புளி 4. Mango - மா 5. Pomegranate – மாதுளை 6. Vilva - வில்வம் 7. Kapitta - விலாமரம் 8. Maduka - இலுப்பை 9. Badara - இலந்தை 10. Cotton – பருத்தி 11. Coconut - தென்னை 12. Plantain - வாழை 13. Matulunga – மாதுளை 14. Karjura - ஈச்சை 15. Kadamba - கடம்பம் 16. Nagakesara - நாககேசரம் 17. Brinjal – கத்தரி

Sl. No.	Animal Product	Method of Application	Purpose	Crops
2.	Cow's flesh Bone Fat Bone marrow and other body parts (Application by boiling with water or milk or any other liquid and watered to plants) In pit preparation these are put and burned.	1. Increase fruits and flowers 2. Pit preparation 3. Growth promoter 4. Nourishment for plants 5. Preparation of Kunapa Jala 6. Treatment for dryness 7. Treatment for external insects 8. Cow's Horn : used for fumigation for external insects 9. Treatment for fire burn		1. Naranga – நாரத்தை 2. Kataki – கேதகி பூ 3. Maduka – இலுப்பை 4. Amra – மாமரம் 5. பூசணி 6. These parts usually used for growth of all plants
3.	Goat milk, blood, fat, bone, bone marrow, skin, hair (Application by mixing with water)	1. Watering 2. Paste application on the trunk 3. Seed treatment 4. Preparation of Kunapa Jala.		1. All creepers to grow better. 2. Shorter trees to grow higher, unfruiting to give fruit. 3. Pomegranate – மாதுளை 4. Champaka – செண்பகம் 5. Naranga - நாரத்தை 6. Mango - மாமரம் 7. Cotton – பருத்தி

Sl. No.	Animal Product	Method of Application	Purpose	Crops
4.	Goat dung	1. As a compost dried and spreaded 2. General fertilizer recipe 3. Fumigation		1. General preparation of land with cow dung 2. Clear worms in all plants 3. Increase fruits and flowers
5.	Skin of goat	Application on the trunk	Non ripen of fruits on a particular branch	General for trees
6.	Skull of monkey	Pierced in the trunk	Non ripen of fruits on a particular tree	General for trees
7.	Buffalo urine and stools	Seed treatment (Botanical marvel) (Lily – Karavira)	Rubbed with seeds & dried	Karaveera - அரளி
8.	Buffalo horn	Fumigation	Insecticide	
9.	Fish – meat	1. Seed treatment 2. Preparation of Kunapa-jala 3. Smoking 4. Watering 5. Land-pit preparation 6. Fumigation	Insecticide	1. General for all plants 2. Mango 3. Pomegranate 4. All creepers 5. Grape

Sl. No.	Animal Product	Method of Application	Purpose	Crops
10.	Pig fat, Pig blood	1. Seed treatment 2. Botanical marvel (Caster seed to give Karanja fruits) 3. Preparation of Kunapa Jala 4. Watering		1. Mango 2. General high yielding fruits
11.	Pig bones	Pierced in trunk	Trunk never dries	General
12.	Horse dung, Ass dung	Paste	To get bigger fruits	Plantain
13.	Horse flesh	Watering	Sweeter fruits	Grape
14.	Parrot - Blood	Watering	Good sweeter fruits	Mango
15.	Cock - Excreta - Blood	1. Manure 2. Seed treatment	Good sweeter fruits	1. Grape 2. Pomegranate
16.	Dog flesh	Watering	Good sweeter fruits	Mango, Naranga
17.	Jackal blood, Meat	Watering	Good sweeter fruits	Mango, Naranga
18.	Deer flesh, Fat, Blood	Watering	Good sweeter fruits	Mango, Naranga

Sl. No.	Animal Product	Method of Application	Purpose	Crops
19.	Elephant tusk Intoxicated secretion Flesh, Bones, Blood	Powdering	Increase flowers	Lotus Pomegranate
20.	Bee's wax	Pasting	Treatment for wind	General
21.	Human blood, Fat, Flesh	Watering	Botanical Marvel (Mango fruits in plantain tree)	General
22.	Human flesh	1. Seed treatment 2. Watering	Bigger fruits	General plantain tree
23.	Hen's blood	Seed treatment	-	General
24.	Blood of any animal	Watering	-	1. General 2. Asoka - அசோகம்
25.	Cat's meat	Watering	-	Arimeda (Babbool)
26.	Tortoise meat	Watering	Increase smell	Jati – ஜாதி Malli – மல்லி
27.	Anthill mud	Pouring around the root	Make the tree taller	General
28.	Horse urine	Watering	-	Pomegranate
29.	Rabbit's blood	Seed treatment	-	Mango
30.	Calf dung	Application on trunk	Seedless fruits	General

Annexure - VI

SUMMARY OF THE TEXT OF VRKSHAYURVEDA OF SURAPALA

A. INTRODUCTION

1. **Title :** Vrkshayurveda [Science of plant life]

2. **Name of the original author:** Surapala

3. **Translator:**

   1] English translation by Mr. Nalini Sadhale, commentaries by K.L. Mehra, S.M. Virmani and Y.L. Nene.

This book is published by Asian Agri-history foundation, Andhra Pradesh, India. This book was published in 1996 with original Sanskrit text with English translation and commentaries from various authors.

Original text is purely of Sanskrit language. Some poems in the original text are missing.

2] Tamil translation by Mr. R.S. Narayanan. Edited by Mr. P. Vivekanandan, Mr. T. Ranganathan, Mr. P. Anbarasu, Mr. S. Gunasekaran.

This book was published by PRA [ADP], in 1999. This book consist only the Tamil translation part of the original Sanskrit text.

Total No. of Chapters etc.

No.	English	Tamil
1.	**Introductory – composition** Which consists of three poems [slokas]. It explains about the importance of a garden.	- Do -
2.	**Importance of trees** This chapter consists of about 20 poems [slokas]. It explains about the importance of trees.	- Do -

No.	English	Tamil
3.	**Merits and Demerits of plants / trees planted in Residential Area** This chapter consists of 11 poems and explains about what are all the plants can be planted in which direction and what should be avoided.	- Do -
4.	**Soil** It consists of 10 poems. Explains types of soils and which soil is suitable for plantation, merits and demerits of various soil etc.	- Do -
5.	**Propagation** Consists of 18 poems explains types of plants and their propagation techniques.	- Do -
6.	**Method of planting** 38 poems explains about various types and methods of planting of trees, creepers etc.	21 poems explain about various plantation methods. For 17 poems separate chapter mentioned in the name of "worship" explains about worship mantra at the time of planting.
7.	**Nourishment** 64 poems explain about various nourishment techniques. "Kunabam" a fertilizer / nourisher production methods etc.	- Do -
8.	**Ailments** Consists of 20 poems of which 20th poem is missing. Explains about two major types of disease, their symptoms etc.	- Do -
9.	**Treatment** Consists of 37 poems of which 17th poem is missing completely and a part of 1st poem is also missing. Explains about various treatment methods with animal and vegetable products.	Text consists of 37 poems but from 23rd poem to 34th poem is missing in the text [Translation left out]

No.	English	Tamil
10.	**Horticultural wonders** Consists of 69 poems explains about types of changes / wonders, their techniques etc.	- Do -
11.	**Pleasure gardens** Consists of 8 poems explains about construction of ponds and purification techniques for well water.	- Do - Translations of six poems are completely missing.
12.	**Natural indications of groundwater – for construction of well** Consists of 19 poems explains about various signs and symptoms where groundwater is available.	- Do -
13.	**Plant indication for Animal & crop production** Consists of 6 poems explains where which crop can be planted etc.	- Do -

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
1.	52 / V	45	9	Seeds collected from riped dried fruits is sprinkled with milk and dried for 5 days. Smoked with *Sarshapa* and *vidanga* **Commt :** In the original text it is meant only the word *kheera* – milk. It is not clear, which animals milk is to be used. Usually the word *kheera* means cow's milk.
2.	53 / V	46	9	Seeds sprinkled with milk, smeared with ash of *tila* [sesame] and [*bruhati*] rubbed with [*Gomaya*] – cow dung, smoked with lemon sprouts soon. **Commt :** In this poem also meant general word *Kheera* – milk. The other word is clearly mentioned cow dung – *Gomayam*

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
3.	54 / V	46	9	Seeds sprinkled with milk [*kheera*], rubbed with cow dung [*Gomayam*], dried. Profusely smeared with Honey [*Makshika*] and vidanga definitely sprout. **Commt :** The use of honey [*Makshika*] is mentioned.
4.	55, 56 / V	46	10	Seeds soaked in milk, dried well in shade and rolled out into powders of *brhati, tila* and *nala* mixed with mustard is good for sprouting. The seeds before drying, the above treatment should be done for *Makanda , Jambu , Panasa* seeds of *ksrika , Bakula* should be treated after proper drying.
5.	60 / V	46	11	After sowing the seeds should be covered with grass and sprinkled with water mixed with milk. Water should be sprinkled after they sprout.
6.	67 / VI	46	12	Preparation of pit. They should be properly dried, filled with cowdung and cow bones – *Go-kikasam* [*Kikasam* – Bones, chest bones] and burnt. **Commt ;** The word *Kikasam* literally means bones with flesh. The prefix go-means cow. *Gokikasam* means cow – bones with flesh. In humans *kikasa* means chest, in this context, we can consider this as cow's chest bones with flesh.
7.	68 / VI	47	12	After the ash is naturally cooled and removed, *Kunapa Jala* should be sprinkled and pits should be filled with good earth. **Commt :** The preparation of *Kunapajala* is mentioned at poem 101-106 / Chapter 8. The word literally *Kunapa* means "Dead Body".

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
8.	73 / VI	47	13	Seeds of *Phanjiihaka* should be mixed with earth and then water mixed with cow dung should be sprinkled.
9.	76 / VI	47	13	The stalk should be smeared to half of it with plenty of cow dung and then should be planted.
10.	79, 80 / VI	47	14	The branches of *Dadima* and *Karavira* should be bent and planted applying enough cow dung at the root.
11.	82 / VI	47	14	*Kadali* should be planted after smearing its roots profusely with cow dung and then planted.
12.	83 / VI	47	14	Small trees before planted; the roots should be smeared with *Makshika* [honey], *nala*-l[otus fiber], *grutha* [ghee] and *vidnga*. They should be planted at daytime.
13.	84 / VI	47	14	Above recipe also good for big trees, but, should be done at evening time.
14.	100 / VII	48	17	The plants should be treated with sesame oil cake and *vidanga* as insecticide sprinkling mixture of milk and water, *Kunapa jala* as fertilizer and by smoking with *grutha* [ghee].
15.	101 / VII	48	18	Excreta, marrow of the bones, flesh, brain and blood of *varaha* [boar] mixed with water and stored underground is called as "*Kunapa*".
16.	102 – 106 / VII	48, 49	18	Fat, Marrow, flesh of fish, ram, goat and other horned animals should be stored and saved. Then this mixture should be roasted in an iron pan with sesame oil cake and honey. Then good quality soaked black gram with little milk should be added.
17.	107 / VII	49	19	For growth of young saplings a cold mixture prepared out of fish, flesh and sesame should be given every seventh day.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
18.	112 / VII	49	19	In Rainy season and autumn or when the soil becomes dry, juice of medicinal plants mixed with urine, marrow and milk should be given. **Commt :** The original Sanskrit text says *Rasa, – Mutra, – vasa, – paya.* *Rasa* – concentrates prepared from meat; also means fresh juice from plants. *Mutra* – urine *Vasa* - fat – flesh *Paya* – milk But, the English / Tamil commentaries says *Rasa* means juice from medicinal plants.
19.	113 – 114 / VII	49	19	Kunapa Jala, excreta, flesh are the ingredients to be mixed with water, previously treated seeds for produce flowers and fruits in abundance.
20.	116 / VII	49	20	Impurities of the trees can be prevented by fumigation done with mixture of mustard seed, flowers of arjuna tree, flesh of hare [Rabbit], *vidanga*, turmeric powder. **Commt :** *Shasha mamsa* - – flesh of hare
21.	117 / VII	49	20	Trees yield faster when smoked with the mixture of plantain leaves, white mustard seeds, shining variety of fish. **Commt :** *Lavanti taravaha* Name of the fish.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
22.	118 / VII	49	20	The trees bear abundant fruits and flowers quickly, if watered with the mixture of marrow of stag and hog, honey, ghee, and tender leaves of *Nicula*. **Commt :** *Harina* – Stag *Kola* – Hog
23.	119 / VII	49	20	Smoking done with mixture of ghee, *Vidanga*, milk, water and honey will result in excessive flower and fruits.
24.	120 / VII	49	20	When watered with marrow of Python and Dhammina snake flesh will result in abundance of fruits and flowers.
25.	121 / VII	49	20	A creeper bears fruits and flowers when pierced with a sharp instrument, smoked with the fat of saphari [tiny, shining fish] and sprinkled with marrow of a hog and mouse.
26.	122 / VII	49	21	Grape creeper bends down with flowers and fruits if the roots are nourished with powdered excreta of cock and sprinkled with the water mixed with fish fat.
27.	123 / VII	50	21	Mango trees are nourished well and are becomes sweeter, larger when treated with water mixed with ripe fruits of ankola, ghee, honey, marrow of boar.
28.	124 / VII	50	21	Trees of coconut type bear fruit if watered by the decoction of flesh of cow, hog, gangetic porpoise with manured with powder of "Sarshapi" fish mixed with sesame.
29.	125 / VII	50	21	Coconut trees gives big fruits and becomes free from all disease disturbance if smeared at night with mixtures of fermented liquor, sesame, black gram, wine, mixed with honey, salt and *vidangam*.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
30.	128 / VII	50	22	Flesh of cat, blue jay, deer, elephant and boar and plenty of marrow mixed with buffalo milk when mixed with water and poured the pomegrante trees produce fruits with bigger, sweeter, juicer seeds.
31.	129 / VII	50	22	When properly saturated with the treatment of being manured with flesh of fox, flesh of cattle mixed with crystalline sugar mixed with water, pomegranate tree yields bigger, sweeter fruits.
32.	130 / VII	50	22	Honey mixed with fresh ghee and saphari fish and when smoked with *Triphala* powder mixed with ghee gives pomegranate tree bears bigger fruits.
33.	131 / VII	50	22	Fish water and earthworms treated with milk gives the pomegranate tree produces sweet-big fruits.
34.	132 / VII	50	22	Pomegranate when yields lot of fruits, the tree ornamented with the skull of the blue jay or ring of the neck of the earthen jar.
35.	133 / VII	50	22	Watered with *Triphala kashayam* and covered immediately with husk, jack fruit tree bears fruits of a bigger size, very sweet.
36.	134 / VII	50	22	Kola, when watered with mixture of *yashtimadhu*, sesame and honey with "*Kunapam*" at the roots, gives attractive big fruits like "*Vilva*" and tastes like nector.
37.	135 / VII	50	23	Karkandu, Badara, Lakucha, ahadri and Jambu trees when smeared with ghee, honey, krsara, [spiced food preparation with sesame, rice and peas] and lodhra, enriched with the thick paste of barley or when smeared and smoked well with sesame, honey and barley for 12 days and watered with milk-water at blossoming time bear good fruits.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
38.	137 / VII	51	23	*Bilva, kapittha* trees when sprinkled with mixture of ghee, honey, jaggery, milk bear plenty of juicy fruits.
39.	138 / VII	51	23	Plantain trees bear many fat fruits when covered fully at the offshoots of the roots by plenty of ash of rotten straw and cow-dung and when watered with kasa and flesh water.
40.	140 / VII	51	23	*Matulangi* when fed well with fermented water mixed with milk, flesh, cow dung, rice and the thick water of sesame cakes gives sweet, soft, fleshy big fruits.
41.	141 / VII	51	24	*Bijapuraka* trees when watered with a mixture of flesh of fox [Dog] gives good quality of orange fruits.
42.	142 / VII	51	24	Orange trees gives big and many number of fruits when they are watered with *vidanga*, black gram, sesame, mustard and bilva with flesh of rabbit, turmeric powder and when smoked with rabbit's flesh.
43.	143 / VII	51	24	Maduka trees bear flowers, which are fragrant like camphor dust, when smoked with lumps of flesh, mixed with *kalaya* [ground nut] and powdered bark of *ankola* and treated with the fiberous roots and leaves of *jalini.*
44.	144 / VII	51	24	i. *Sauvira [Badara]* when nourished with curd, hog fat, and sesame with country liquor – big tasteful fruits. ii. Same *kunapa* can be used for *ksheerika* – big fruits. iii. Shyama, *kadamba* – gives fragrant flowers
45.	145 / VII	51	25	*Ketaki* blossoms richly when watered well with the fragrant things like cardamom and fed with the decoction of flesh.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
46.	147 / VII	51	25	Ketaki blossoms well when nourished with excreta water.
47.	154 / VII	52	26	a) Cotton plant when nourished with water mixed with fish flesh, b) Yuti fed well with water mixed with milk, sesame, and dry cow dung c) *Sapthachata* when fed with flesh and fish flesh yields better blossoms.
48.	155 / VII	52	26	*Bruhati*, *Alabu, Karkaru, Trapusha*, produce rich yields when smoked in summer with bones of hog.
49.	186 / IX	53	31	Diseases of *vata* type can be treated quickly by fumigation of the mixture of the fat of the hog, oil of the gangetic porpoise, ghee, hemp, hair of horses, cow's horn – boiled and used as decoction.
50.	191 / IX	54	32	*Pitta* diseases can be treated with decoction of milk, honey, *yashtimadhu, madhuka.*
51.	192 / IX	54	32	*Triphala*, ghee, honey decoction as watered *pitta* diseases can be cured.
52.	194 / IX	54	32	Worms can be removed by the paste of milk, "*Kunapa*", cow dung with water.
53.	195 / IX	54	32	Worms can be removed by smoking the tree with the mixture of white mustard, *ramatha, vidanga, vacha, usana*, and water mixed with beef, horn of buffalo, flesh of pigeon and powder of *Ballataka* [poisonous nut – smoking may be danger humans].
54.	196 / IX	54	33	Anoiting with *vidanga* mixed with ghee, watering for seven days with salt water and applying paste made out of beef white mustard and sesame destroy worms, insects.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
55.	198 / IX	54	33	Wound caused by insects heals if sprinkled with milk after being anointed with a mixture of *vidanga*, sesame, cow's urine, ghee and mustard.
56.	199 / IX	54	33	Trees suffering from frost or heat, sprinkling with "*Kunapa*" and milk is advisable.
57.	200 – 201 / IX	54	33	Broken trees should be smeared with paste of bark of *plaksha* and *udumbara* mixed with ghee, honey, wine and milk and broken parts should be firmly tied together with a rope of a rice stalk. Fresh soil should be filled, sprinkled with buffalo milk mixed with water.
58.	203 / IX	54	33	If branches fall off. Particular spot should be anointed with the mixture of honey and ghee and sprinkled over milk.
59.	204 / IX	54	33	If, the branches burnt off, they should be cut and the spots should be sprinkled with water, milk. Smoking done with shells of crab leads to fresh sprouts.
60.	205 / IX	55	34	If, the whole tree is burnt, then it should completely be smeared with mud from lotus creeper and then watered with "*Kunapa*".
61.	209 / IX [209 – 218 verse missing in Tamil translation	55	34	Drying of trees due to lack of water. They should be watered with milk – water and properly fomented by the smoke of crab shells.
62.	210 / IX	55		Wounds of trees healed by paste of bark of *Nyagrodha* and *Udumbara*, cow dung, honey, ghee.
63.	212 / IX	55		Diseases caused by wrong treatment can be cured by sprinkling the mixture of water and milk and also applying a paste of *vidanga* mixed with thick mud.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
64.	230 / IX	55		Jaundice can be brought under control by application of powder of barley and wheat added to honey and milk.
65.	214 / IX	55		Non productive trees bear fruits and flowers when watered with milk and "*Kunapa*".
66.	216 – 217 / IX	55		a) Sesame, dung of goat, sheep – one *Adhaka* [256 handful] b) Barley – one *prastha* [64 handful] c) Water – one *drona* [1024 handful] and corresponding quantity of beef mixed and allowed to set for 7 days and then used for watering, trees put forth flowers and fruits.
67.	218 / IX	55	34	They produce fruits when watered with thick mixture of flesh of Tiger, Leopard and fox with milk of Elephant and Buffalo.
68.	220 / IX	55	34	Cucumber types of vegetables can be treated with smoking done with the mixture of bones of cow, dog and mixed with excreta of cat.
69.	227 – 228 / X	56	36	Seed of ripened Mango soaked in the blood of tortoise and a hare and then dried in direct sunlight of sun. Then it is planted and showered with goat's milk.
70.	229 / X	56	36	This tree yields fruits throughout the year. Trees watered with buttermilk, sugarcane juice mixed with powder of beef, *vidanga*, oil cake produces fruits and flowers out of season for a period of one month.
71.	230, 231 / X	56	36	*Varahi, Jeera* and Sugarcane juice should be kept for a month in a pot containing ghee. Then sugarcane juice should be profusely sprinkled and the trees should be smoked with honey and "*Kunapa*".

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
72.	234 / X	56	37	*Kushmanda, vartaka, patolaka* etc., produced from healthy seeds cultivated with marrow of a female boar and nourished with sprinkling by marrow mixed with water yields seedless fruits.
73.	240 / X	57	37	White flowers turn into golden colour if it is smeared at the roots with the mixture of *manjishta, darada*, milk. *Kanksi* and flesh of a pigeon.
74.	245 / X	57	38	*Bakula* trees yields *champaka* flowers when continuously fed with flesh water after filling the bottom with plenty of mud mixed with *kalaaya* and skin of snake.
75.	246 / X	57	38	Plantain trees yields pomegranate fruits if fed by water mixed with the urine of hog and ankola.
76.	250/X	57		To intensify the natural fragrance of blossoms of *punnaga, naga, battula* etc. Base of the plant is pilled with their own flowers and then fed with *musta, mura, nata* leaves, wine, fat, milk, blood and *kusta* during evening time.
77.	247 / X	57	38	Caster tree produced from a seed cultured by the marrow of boar, treated like above recipe yields karavella fruit.
78.	251 – 252 / X	57	39	Big strong earthen pot should be filled with plenty of beef and mud and *karavira* is planted and watered regularly with water, cow dung, beef. This plant is replanted to a pit, [preparation of a pit already mentioned] so treated, it is transformed into a creeper to blossom profusely and perennially.
79.	254 – 258 / X	58	40	Seed of *kapitha* should be treated hundred times with the milk boiled along with roots of *dhatri, vaca, abaya, asphota, asmapa, vetasa, simsapa, suryavalli, atimukta* and *palasini.* Then planted in a pit keeping water mixed with ghee, honey, ashes of cow dung, *vidanga*, sesame, flesh of boar. This watered with decoction of barley, black gram, sesame, honey, fish and flesh. Then grows into a creeper, without fail.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
80.	273/X	58		Bulb of various types of lotuses are uprooted tied together firmly with threads, smeared with melted butter and honey and then planted. This will produce respective coloured lotuses in bunches.
81.	259 – 260 / X	58	40	Seed of any variety, freely rubbed with the Mango, creeper, jasmine, *dhataki, madhavi* mixed with goat's milk. This seed is watered with curd and milk grows into the respective creeper.
82.	262 – 263 / X	58	41	Plant, which is not too tender, should be cut at the stem and slightly burnt. Thereafter it should be smeared with the mixture of ghee, cow dung, salt, honey and flesh. A nail should be slantingly driven at the root. Then this should be milk watered. This produces fruits even in a dwarf state.
83.	267 / X	58	41	Ripening of fruits of a tree can be delayed by one year by piercing their roots with long bones of monkey dipped in the ichor of intoxicated elephant.
84.	268 / X	58	42	Ripening of fruits of a particular branch can be delayed by covering that branch firmly by the skin of the hunch of a bull that is just been killed.
85.	269 / X	58	42	Particular branch of a tree do not ripen if it is covered seven times with the skin from the dewlap of a black bull.
86.	270 / X	58	42	Plantain tree with its root pierced with a golden rod beated with dust ivory, turns into a creeper and yields fruits for long time.
87.	271 / X	58	42	Plantain creeper produces fruits that in the size of elephant's teeth when pierced with an iron needle which is heated in fire made of dry cow dung and bones of pig, elephant and horse.
88.	272 / X	58	42	Plantain tree definitely produces fruits like a pestle if the hollow tooth of boar or monkey filled with icor is carefully kept in the core of the root.

Sl. No.	Sloka [Poem] No / Chapter No	Page No. [English]	Page No. [Tamil]	Description of Practise
89.	273/X	59		Payaesya, arjuna and tarquari get destroyed if profusely smeared with salt water and if scratched by the bone of a hog all over the skin.
90.	275 / X	59	43	Ash guard and cucumber dies if profusely smoked with bones of crabs.
91.	278 / X	59	43	A seed cultured several times with the oil of ankola and fat of pig, dried up, sown and sprinkled with coconut water grows instantly without fail.
92.	280 / X	59	44	Pomegranate seed several time processed with blood of cock and dried up in the sun, then sown. Immediately bears fruits if watered and smoked with human flesh and marrow.
93.	281 / X	59	44	Seed cultured with ankola oil, flesh of fish, human, hog and crocodile, down in good soil, nourished by coconut water, sprouts immediately
94.	282 / X	59	44	Riped Madukartaka is kept in an earthen jar and buried underground and nourished by water of oil cake, flesh, it grows to the size of the jar.
95.	283 / X	59	44	Pomegranate tree transplanted seven times bears fruits as big as coconut if nourished with water containing triphala, butter, and marrow of hog.
96.	284 / X	59	44	Mulaka planted in a pit, which is prepared earlies, will grow instantly.
97.	285-286/X	59		If the stems of cucumber and ashgourd plants are smeared with honey and melted butter, tied together with straw rope and covered with cow dung becomes one. Later if the stem is cut keeping the order of the root and the tip, cucumber too bears fruits of ash gourd size.
98.	290 / X	60	45	*Utpala* seed is rubbed with the mixture of urine and dried drug of buffalo for 7 days will grow as karavina when nourished with coconut water.

LIST OF ANIMALS MENTIONED

Sl. No.	Sanskrit Name	English Name	Local Name	Product Used	Ref. No.
1.	Go – [Sanskrit] [Sanskrit]	Cow	பசு மாடு	Milk – *ksheera* [Sanskrit]	53/V
2.	Go – *Keekasaka* [Sanskrit]	Cow	பசு மாடு	*Keekasaka* – chest Bone with flesh [Sanskrit]	67/VI
3.	*Gomaya* toyenae [Sanskrit]	Cow	பசு மாடு	Cow dung [Sanskrit]	73/VI
4.	*Ajyaha* [Sanskrit]	Cow	பசு மாடு	Ghee [Sanskrit]	83/VI
5.	*Makshika* [Sanskrit]	Bee	தேனீ	Honey [Sanskrit]	83/VI
6.	*Varaha* – Vit – *Vasa* – Mamsa – *Majja* – Masthishka – Sonita… Sumoo [Sanskrit]	Boar, Cow	ஆண் பன்றி பசு	*Vasa* – fat [Sanskrit] *Mamsa* – flesh [Sanskrit] *Majja* – Marrow [Sanskrit] *Masthishka* – Brain [Sanskrit] *Sonita* - Blood [Sanskrit] *Sumoo* – Milk [Sanskrit]	101/VII
7.	Turanga… Masthya, - Chaga, Srungi… [Sanskrit]	Turanga – Boar Masthya – Fish Chaga – Goat Srungi – Horned animals	ஆண் பன்றி மீன் வெள்ளாடு கொம்புள்ள பிராணி	Mamsa – flesh Medas – Fat Majja – Marrow	102 – 106/VII
8.	Matsya – mamsa [Sanskrit]	Masthya – Fish	மீன்	Mamsa – flesh	107/VII

Sl. No.	Sanskrit Name	English Name	Local Name	Product Used	Ref. No.
9.	*Rasa* – *mutra* – *vasa* – *paya* [Sanskrit]	No specific animal name is mentioned		*Rasa* – *Kashayam* [Sanskrit] *Mutra* – urine [Sanskrit] *Vasa* – fat [Sanskrit] *Paya* – milk [Sanskrit]	112/VII
10.	Shasha Mamsa …. Lavanti Taravaha [Sanskrit]	Shasha – Rabbit Taravana – Fish Harina – Stag Kola – Hog	முயல் மீன் கலைமான் பன்றி	*Vacha* – fat [Sanskrit]	117/VII
11.	Harina – Kola – vacha - Sarpisha	Harina – stag [Sanskrit] – hog Kola	கலைமான் பன்றி	*Vacha* – fat [Sanskrit]	119/VII
12.	Sadajagara – Dhammeena vasa…. [Sanskrit]	Sodajagara – Always crawling Dammeena-?	பாம்பு / ஊர்வன	*Vasa* – Fat [Sanskrit]	120/VII
13.	Vruchika kandena…[Sanskrit] Saphari gruthee…[Sanskrit] Kola mukha [Sanskrit] Sipha [Sanskrit]	A type of yantra or scorpion sting A type of fish Varaha – pig mouse	 மீன் பன்றி எலி	 Ghee Fat Fat	121/VII
14.	[Sanskrit] Ustrakaha	Fox – dog	ஓநாய் - நாய்	Fat	141/VII
15.	[Sanskrit] Uru Mamsa	Rabbit	முயல்	Flesh	142/VII

Sl. No.	Sanskrit Name	English Name	Local Name	Product Used	Ref. No.
16.	Vyagra – Chitraka – Go – Mayu Mamsa …. Karenu… Mahishi Ksheera… [Sanskrit]	Tiger, Leopard, Fox, Elephant, Buffalo	புலி, சிறுத்தை நரி யானை எருமை	Flesh Milk	218/VII
17.	Go – Kukurua – Chimma… Marjara pureesha…229/VII	Cow, dog Cat	பசு, நாய் பூனை	Bones Dung	229/VII
18.	Paravatha… Amishii… [Sanskrit]	Pigeon	புறா	Mamsa – flesh	240/X
19.	…. Sahita Jagara… [Sanskrit]	Snake	பாம்பு	Skin [Sanskrit] sahita	245/X
20.	Matangaja Madoktena…. [Sanskrit]	Intoxicated Elephant	யானை	Ichor - தந்தம்	267/X
21.	….. Sadhyahata vrusha…. Skanda charma [Sanskrit]	Skin of the Hunch	எருது	Skin - அடிவயிற்றுத் தோல்	268/X
22.	…Nrupam sameda… [Sanskrit]	Human being	மனிதன்	Fat	280/X

LIST OF ANIMAL PRODUCTS MENTIONED

Sl. No.	Name of the Animal	Product meant
1.	Cow, Boar	[1] milk, [2] Butter, [3] Curd, [4] Ghee, [5] Bones, [6] Urine, [7] Dung, [8] Horns, [9] Hairs, [10] Flesh, [11] Fat, [12] Marrow
2.	Buffalo	[1] Milk, [2] Skin, [3] Horn, [4] Flesh, [5] Fat, [6] Marrow, [7] Urine
3.	Goat	[1] Milk, [2] Flesh, [3] Fat, [4] Marrow
4.	Elephant	[1] Icor, [2] Intoxicated secretion, [3] Flesh, [4] Bones
5.	Snake	[1] Flesh, [2] Fat, [3] Skin
6.	Fish	[1] Flesh, [2] Fat
7.	Honey Bee	Honey
8.	Hog	[1] Flesh, [2] Fat, [3] Marrow
9.	Kola	[1] Flesh, [2] Fat, [3] Marrow
10.	Cock	[1] Excreta, [2] Flesh
11.	Cat	[1] Flesh, [2] Fat, [3] Marrow, [4] Excreta
12.	Deer	[1] Flesh, [2] Fat, [3] Marrow, [4] Excreta
13.	Fox [Dog]	[1] Flesh, [2] Fat
14.	Horse	[1] Hair, [2] Bones
15.	Pigeon	Flesh
16.	Tiger	Flesh
17.	Leopard	Flesh
18.	Crab	Bones
19.	Monkey	Bones [Teeth]
20.	Human being	Flesh

VARIED USES OF ANIMAL PRODUCTS

S. No.	Description of the Preparation	Used for	Reference
1.	01	Seed Treatment	52 / V
2.	02	Seed Treatment	53 / V
3.	03	Seed Treatment	54 / V
4.	04	Seed Treatment	55, 56 / V
5.	06	Explains about preparation of the pit	67 / VI
6.	08	Seed Treatment	73 / VI
7.	10	Implanting methods [Small trees]	80 / VI
8.	11	Implanting methods [Small trees]	82 / VI
9.	12	Implanting methods [Small trees]	83 / VI
10.	14, 15, 16	Nourishment methods	100-107 / VII
11.	17	Insecticide	107 / VII
12.	20	Insecticide / Nourisher	113 – 114 / VII
13.	21	Nourisher	117 / VII
14.	22	Nourisher	118 / VII
15.	23	Nourisher	119 / VII
16.	24	Nourisher	120 / VII
17.	25	Nourisher	121 / VII
18.	26	Nourisher	122 / VII
19.	27	Nourisher	123 / VII
20.	28	Nourisher	124 / VII
21.	29	Nourisher	125 / VII
22.	30	Nourisher	128 / VII
23.	31	Nourisher	129 / VII
24.	32	Nourisher	130 / VII

S. No.	Description of the Preparation	Used for	Reference
25.	33 – 48	Nourisher	131 – 155 / VII
26.	49	Treatment for vata dosha	186 / IX
27.	50	Treatment of	187 / IX
28.	53	Pesticide	194 / IX
29.	52 – 55	Pesticide	195, 196 / IX
30.	56	Treatment for Heat, Cold	199 / IX
31.	57 – 63	Treatment for Broken, Burnt trees	200, 212 / IX
32.	64 – 70	Nourisher	212 – 231 / X
33.	71	Treatment to get seedless fruits	234 / X
34.	72	Treatment to change the flower colour	240 / X
35.	73	Treatment for one tree to give different type of flower	245 / X
36.	74	Treatment for plantain tree to give pomegranate fruits	246 / X
37.	75	Seeds treatment : for produce different fruits in castor	247 / X
38.	76	Seed Treatment	251 – 252 / X
39.	77	Seed Treatment	254 – 258 / X
40.	78	Seed Treatment	259 – 260 / X
41.	79	Implanting method one root treatment [Bonsoy Technique]	262 – 263 / X
42.	80 – 82	Avoid / Delay to Ripening of Fruits / Flowers	267 – 269 / X
43.	83	Treatment to get more fruits for long time	270 – 274 / X
44.	86	Treatment to get more fruits for long time to kill plants *Pitta*	275 / X
45.	87 – 91	Treatment to get bigger size fruits for long time	278 – 283 / X
46.	92, 93	Seed Treatment	284, 290 / X

Annexure - VII

REPORT OF THE LITERATURE SURVEY OF AYURVEDIC TEXTS RELATING TO ANIMAL PRODUCTS USED IN TRADITIONAL AGRICULTURE

Following are the details collected during the literature Survey of Ayurvedic texts related to animal products used in traditional agriculture by KPP, IDEA and CIKS.

Animal products

KPP – Cow's urine, buffalo's urine, ox's urine

IDEA – Goat's droppings

CIKS - 1. Cow's, bull's and bullock's products - variation

2. Buffalo, goat, sheep, pig, camel, donkey, rabbit, horse, elephant, dog

3. Chicken, common birds

4. Fishes, turtle, tortoise, crab

Materials

1. Milk, urine, dung, ghee, buttermilk

2. Meat, fat, blood

3. Hair, hooves, feather, skin

Parameters

Rasa, guna, virya, vipaka, prabhava, karma, dosakarma, rogaharatva, contraindications and incompatibilities

Texts referred

Carakasamhita, Susruta samhita, Astanga sangraha, Astanga hridaya, Dhanvanthari nighantu, Madanapala nighantu, Bhavaprakasha nighantu, Raja nighantu

General qualities of animal parts and products

Parameters	Pitta (bile)	Rakta (blood)	Mamsa (flesh)	Meda (fat)	Asthi (bone)	Majja (marrow)	Stanya (breast milk)	Mutra (urine)
Rasa (taste)	Katu (pungent)	Madhura (sweet), lavana (salty)	Madhura	Madhura	Madhura	Madhura	Madhura	Katu (pungent) lavana (salty)
Guna (quantity)	Snigdha (unctuous), tiksna (sharp), drava (fluid), sara (spreading), laghu (light)	Laghu (light), snigdha (unctuous)	Guru (heavy), snigdha (unctuous)	Guru (heavy), snigdha (unctuous)mrdu (soft)	Laghu (light), ruksa (rough), kathina (hard)	Guru (heavy), snigdha (unctuous)	Guru, snigdha, mrdu, pichila (slimy)	Laghu, ruksa ,tiksna
Virya (potency)	Usna (hot)	Usna	Usna	Usna	Usna	Usna	Sita (Cold)	Usna
Vipaka (post digestive effect)	Katu (pungent)	Madhura (sweet)	Madhura	Madhura	Madhura	Madhura	Madhura	Katu
Karma (action)	Lekhana (scraping), Mutrala (diuretic)	Balya (promoting strength), hrdya (good for heart), sonitasthapana (haemostatic)	Snehana (uncting), balya (promoting strength), tarpana (saturating), brmhana (bulk promoting)	Sandhaniya (uniting), balya , brmhana, snehana	Lekhana, svasahara (releiving asthma), mutrala (diuretic)	Snehana, vrsya (aphrodisiac), balya	Ropana (healing), balya, hrdya, tarpana (saturating)	Sothahara (reducing swelling) visaghna (anti poisonous), lekhana

Dosakarma (action on dosa)	Kaphavata hara (pacifying Kapha, vata)	Kaphavatahara	Vatapittahara (pacifying vata, pitta)	Vatahara (pacifying vata)	Kaphavata hara	Vatasamaka (pacifying vata)	Vatapittahara	Kaphava tahara
Rogaghnata (action on disease)	Svitra (leucoderma), kustha (skin condition), apasmara (epilepsy), bhutonmada (mental disorder), Arsas (piles)	Raktapitta (bleeding disorder), artavadosa (menstrual disorder), jivadana (life saving)	Grahani dosa (disorder of grahani), sosa (emaciation), arsa (piles), mandala-kustha (a type of skin disease)	Ksataksina (weakness due to chest injury), arsas, mudhavata (confounded vayu), bhagna (fracture), yonikarnasiroruja (pain in vagina, ear, head), asrgdara (utirine bleeding)	Svitra, hikka (hiccoughs), svasa (breathing difficulty), visa (poison)	Vatavyadhi (rheumatic conditions), sukra dourbalya (seminal weakness), pandu (anaemic conditions)	Raktapitta, svasa , kasa (cough), pandu, amlapitta (gastritis), sosa, udara (abdominal enlargement), netrarog (eye disease)	Sotha (swelling), visarpa, kusatha visa (snake poison), udara, arsas, pandu
Examples	Go (cow), srgala (jackal), varaha (pig), godha (Iguana), marjara (cat), rksa (bear)	Mrga (deer), aja (goat), avi (sheep), varaha (pig), sasa (rabbit), ena (fawn deer) , marjara, mahisa (buffalor), kukkuta (hen)	Barhi (peacock), tittiri (patridge), daksa, hamsa (swan), sukara, ustra (camel), khara (ass), go, mahisa, aja, godha	Varaha, Lelitaka (python), kukkuta, ustra, sukara	Sunaka (dog), khara, gaja (elephant), khura, sikhi, barhi, krounca (demoiselle crane), ustra, rasabha	Dhanva, oudaka (water animals), anupa (wet land animals)	Aja, go, avi, mahisa, ustra, asva (horse), manusya (human), karabha	Go, asva, nara (human) aja, avi, mahisa, khara, ustra, karabha

MUTRA (URINE)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Cow's urine (Go mutra)	Madhura (sweet) krimighna (wormi cidal), kandughna (reduces itching) udaraghna (Reduces ascites) Kustha (reduces skin diseases)	Sthoulya (reduces obesity) Sirovirechana (cleanses the head) Sula (clicky pain), Gulma (intestinal tumors), anaha (upper abdominal distention, virechana & asthapana (as additive in purgation, medicated enema), Katu (pungent), tikshna (sharp), ushna (hot), kshara (alkaline), vatala (increases	Pacana (improves digestion), Bhedi (purgative)	Mutra of cow, goat, sheep, buffalo, elephant, horse, camel and donkey aggravate pitta, rough, sharp, hot, pungent, salty and light. it cures worms, dropsy, abdominal enlargement, flatulence, colic, anaemia, reduces kapha and vata, abdominal tumors, loss of appetite (taste), poison,	Katu (pungent), tikta (bitter), kshara (alkaline), ushna (hot), theekshna (sharp), laghu (light), lekhana (scarping), sara (laxative), dipana (improves digestive fire), medhya (improves intellect), pittakara (increases pitta), kaphava tahara (reduces kapha and vata), tvakdosha	Cow, elephant, buffalo, goat, donkey, camel all have same qualities. However best one is gomootra (cow's urine) Lavana (salty), tikta (bitter), ruksha (rough), srotovisodhana (removes blocks in body channels), pittala (increases pitta), katu (pungent), hridya (good for heart), bhedi (purgative), vatanulomana (facilitates downward movement of	Katu (pungent), tikshna (sharp, ushna (hot), kshara (alkaline), tikta (bitter), kashaya (astringent), laghu (light), agnidpiana (improves digestion), medhya (improves intellect), pittakara (increases pitta), vatakaphahara (reduces vata and kapha), Used in sula (colicky pain) gulma (intestinal tumours), udaraA (ascites), anaha (abdominal distention), kandu (itching),	Katu (pungent), tikshna (sharp), ushna (hot), kaphavatahara (reduces kapha and vata), laghu (light), pittakrit (increasing pitta), dipana (improves digestion), medhya (improves intellect), tvakdosa (skin disease), matiprada (improves memory)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
		vata), laghu (light), dipana (increases digestion), medhya (improves intellect) pittala (increases pitta) kapha vatahara (reduces kapha and vata)		leucoderma, skin diseases, piles.	(reduces skin diseases)	vata), Pacana, Dipana (improves digestion), vata (good for vata), gulma (intestinal tumors), arsa (piles), sopha (swelling) udara (ascites), kapha (good for kapha), krimi (worms), kustha (skin diseases), pandu (anaemic conditions), anaha (abdominal distention), visha (good for poison), sula (colicky pain), aruci (lack of appetite)	aksi (eye diseases), mukharoga (diseases of mouth), kilasa (blackheads), vatama (rheumatic conditions), vastiruk (pain in urinary bladder region), kustha (skin diseases), kasa svasa (respiratory diseases), sotha (swelling), kamala (jaundice), pandu (anaemic conditions), mutrarodha (urine retension), krimi (worm), pliha (spleen enlargement, varchagraha (good for constipation)	

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Elephant's urine (Hastimutra)		Tikta (bitter), lavana (salty), bhedi (purgative), vataghna (reduces vata), pittakopana (reduces pitta), tikshna (sharp), kshara (alkaline), kilasa (a skin condition)				Visha (good for poison), arsa (piles), kushtha (skin diseases), gulma (intestinal tumors), krimi (worms)		Tikta (bitter), Kashaya (astringent), ushna (hot), lavana (salty), vata (rheumatic diseases), sula (pain) hikka (hiccough), svasa (respiratory disease)
Buffalo's urine (Mahisha mutra)		Durnama (piles), udara (ascites), sula (colic), pandu (anaemic condition)				Sopha (swelling), gulma (intestinal tumors), arsa (piles, pandu (aneamic conditions), meha (diabetic conditions)		Katu (pungent), ushna (hot) Anaha (abdominal distention), sopha (swelling), gulma (intestinal tumors), aksi (eye diseases), kustha (skin diseases), kandu (itching), atisula (excess pain) udara (ascites), ruja (pain)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Horse's urine (Asva mutra)	Yoni roga (disorders of vagina)	Dipana (increases digestion), katu (pungent), tikshna (sharp), ushna (hot), kaphahara (reduces kapha), vata (vata), chetovikara (mental diseases), krimi (worms), dadru (a skin condition)				Bhedi (purgative), kapha (reduces kapha), dadru (a type of skin condition), krimi (worms)		Tikta (bitter), ushna (hot), tikshna (sharp), visha (relieves poison), vata (pacifies vata), pittakari (increases pitta), dipana (improves digestion)
Goat's urine (Aja mutra)	Kashaya (astringent), madhura (sweet), pathya (good for the body), dosahara	Katu (pungent), tikta (bitter), ishat maruta kopana (slightly increases vata) Kasasvasa (respiratory		Lavana (salty subtaste), katu (pungent), ruksha (rough), tikshna (sharp), ushna (hot), laghu (light), pittala (increases pitta) Used in krimi		Gulma (intestinal tumors), visha (poison), svasa, kasa (respiratory conditions), kamala (jaundice), Pandu		Katu (pungent), ushna (hot), ruksha (rough), laghu (light) nadi (disease of nadi), visha (poison), pleeha (spleen enlargement), udara (ascites), kapha (kapha),

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
	(reduces dosa)	conditions), sopha (swelling), kamala (jaundice), pandu (anaemic conditions)		(worms), sopha (swelling), udara (ascites), anaha (abdominal distension) sula (colic), pandu (anaemia), kaphaanila (reduces kapha and vata), gulma (intestinal tumors), aruci (lack of taste/ appetite), visha (poison), svitra (leucoderma), kustha (skin diseases), arsa (piles)		(anaemic conditions)		kapha (kapha), svasa (respiratory diseases), gulma (intestinal tumors), sopha (swelling)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakas ha nighantu (BPN)**	**Raja nighantu (RJN)**
Sheep's urine (Avi mutra)		Kshara (alkaline), tikta (bitter), katu (pungent), ushna (hot) vataghna (reduces vata), svasa (respiratory diseases), sosha (emaciation), varchagraha (constipation)				Sopha (swelling), kustha (skin diseases), arsa (piles), meha (diabetic conditions), varcagraha (removes constipation)		Tikta (bitter), katu (pungent), ushna (hot), kustha (skin diseases), durnama (piles), udara (ascites), sula (colicky pain), asra (blood diseases), sopha (swelling), meha (diabetic conditions), visha (poison)
Donkey's urine (Gardabha mutra)	Apas mara (epi-lepsy), unmade (mental diseases), graham (evil afflict tions)	Tikshna (sharp), dipana (improves digestion), grahani (sprue like condition) gara (poison) chetovikara (mental diseases), krimi (worms), vatakapha (reduces vata and kapha)	Krimi (worms), meha (diabetic condi tions)	Krimi (worms), meha (diabetic condi tions)		Grahani (irritable bowels/ sprue), meha (diabetic conditions), kushtha (skin diseases), unmade (mental disorders), krimi (worms)		Katu (pungent), ushna (hot), kshara (alkaline), tikshna (sharp), kaphahara (reduces kapha), mahavata (major vata diseases), bhuta (evil afflictions), kampa (tremor), unmade (mental diseases)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhan vantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Camel's urine (Ushtra mutra)	Tikta (bitter), Svasakasa (respiratory conditions), arsa (piles)	Arsas (piles), sopha (swelling), kustha (skin diseases), udara (ascites), unmade (mental diseases), maruta (reduces vata), krimi (worms)				Unmade (mental diseases), sopha (swelling) arsa (piles), krimi (worms), sula (colicky pain), udara (ascites)		Katu (pungent), tikshna (sharp), ushna (hot), lavana (salty), pittakopana (increases pitta), balya (tonifying), jathararogaghna (good for abdominal disorders), vatadosanasana (pacifies vata)
Human urine (Manushya mutra)			Vishapaha (reduces poison)			Gara (a type of poison), rasayana (rejuvenative)	Teekshna (sharp), kshara (alkaline), lavana (salty), Gara (a type of poison), rasayana (rejuvenative), rakta (good for blood), pama (a type of skin disease)	Tikta (bitter), ushna (hot), lavana (salty), ruksha (rough), bhuta (evil afflictions), tvak (skin diseases), vata (pacifies vata), Amaghna (removes ama), krimi (worms), vrana (heals wounds), visha (pacifies poison),
Reference	CS, Su, 1/100-109 CS, Su, 3/13 CS, C,10/49	SS, Su, 5/32 SS, Su, 39/6 SS, Su, 45/217-227	AS, Su, 6/143 AS, Su, 6/148)	AH, Su, 5/ 82-83	DHN, 6/488	MPN, 210	BPN, mutravarga, 1-7	RJN, Kshiradi varga, 98-107

It is told that in *Apasmara* (epilepsy) *kapila*, *go* (cow), *sva* (dog), *srigala* (fox), *bidala*, *simha* (lion) *mutra* are used (CS,C,10/49). For preparation of mercurial medicines *mahisha mutra* (buffalo's urine) is used.

Note: There are nine types of urine mentioned in the classical texts of Ayurveda. General qualities of all the types of urine are mentioned in the texts. Individual qualities are not mentioned. Though the qualities are same their activities are different in the body and there are different disease conditions in which they are prescribed according to Ayurveda. So it has to taken that there is no much differences between various types of urine. It is told in *Susruta samhita* (Dalhana commentary), *Madanapala nighantu* and *Bhavaprakasha nighantu* that when urine of cattle (cow, goat, sheep and buffalo's urine) are used it should be taken from the female. When taken from donkey, camel, elephant, human, horse it should be from male.

KSHIRA (MILK)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Cow					Snigdha (unctuous), guru (heavy), madhura vipaka (madhura in taste and post digestive effect) Pathya (wholesome), rasayana (rejuvenative), balya (tonifying), hridya (good for heart), medhya (improves intellect), ayushya (good for longevity of life) pumstva (good for fertility), vatarakta (arthritic conditions), raktapitta (bleeding conditions) White cow's milk is vata hara (pacifying vata). Black one is pittahara (reduces pitta). Red one is kaphaghna (reduces kapha)			

	Caraka samhita (CS)	Susruta samhita (SS)	Astanga sangraha (AS)	Astanga hridaya (AH)	Dhanvantari nighantu (DHN)	Madanapala nighantu (MPN)	Bhavaprakasha nighantu (BPN)	Raja nighantu (RJN)
Elephant					Madhura (sweet), vrishya (aphrodisiac), kashaya (astringent subtaste), guru (heavy), snigdha (unctuous), sheeta (cold), caksusya (good for eyes), balavar-dhana (increases bala)			
Buffalo					Abhishyandi (creates abhishyanda in the body), madhura (sweet), vahnisadan (reduces digestive fire), nidrakara (induces sleep), sheetakara (produces cold), snigdhatara (very unctuous)			

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Horse					Amla (sour), lavana (salty), dipana (increases digestion), laghu (light), sthairyakara (body strengthening), balya (tonifying) gaurava (increases heaviness), kanti (increases lusture)			
Goat		Good for emaciated, for improving digestion, is light, slightly constipating, reduces respiratory diseases, bleeding diseases			Kashaya (Astringent), madhura (sweet), Sheeta (cold), grahi (constipative), raktapitta (bleeding disorders), atisara (diarrhoea), kshaya (emaciation), kasa (cough), jvara (fever), due to the light nature of the body, variety of food, more drinking of water and high movement goat's milk is very good.			

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Sheep					Madhura (sweet), snigdha (unctuous), ushna (hot), tikta (bitter), kaphahara (reduces kapha), guru (heavy), suddhanile (to be used in pure vata), sopha (swelling), vatasonita (arthritic conditions)			
Donkey					Madhura (sweet), amla (sour), ruksha (rough), lavana (salt subtaste), guru (heavy), kasasvasa (respiratory disorders), balaroga (child disorders)			

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Camel	Swelling	Reduces vata, kapha, distension of abdomen, worms, ascites, skin diseases, intestinal tumors, respiratory diseases	Ascites, swelling	Slightly hot, rough, light, increases digestion	Ruksha (rough), ushna (hot), ishatlavana (slightly saltish), laghu (light), vatakapha (reduces vatakapha), anaha (distension) krimi (worms) sopha (swelling), udara (ascites) arsa (piles)			
Human					Snigdha (unctuous), sthairya (strengthening), caksusya (good for the eyes), balavardhana (increases strength), jivana (wholesome), brimhana (bulk promoting), satmya (wholesome), snehana (unctuating), raktapitta (good for bleeding disorders), tarpana (nourishing), aksisula (eye pain)			

In Sanskrit milk has synonyms such as svadu, rasayana, soumya, prasravana, stanya, balasatmya, jivita. Due to the variety in the diet of milk producing animals they are having many medicinal properties, it is life giving, heavy, sweet, slimy, unctuous, cold, laxative and soft. (DHN, 149) Milk of the cow which has lost sibling is not good and increases dosa. Milk of the cows that eats pinyaka and sour food is not good. Anoopa desa cow's milk is more heavy that jangala desa. The black cow which has black calf will have milk which is kapha vata pacifying when hot and also pitta pacifying if made cold after heating. Milk taken immediately after milching can cause amavaa, but is very nourishing like nectar. If boiled more milk will be heavy. Milk having bad smell, sour, discolouration, distaste should not be used. After 5 muhurta milk becomes bad. Then it becomes like poison.

DADHI (CURDS)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Cow		Sweet in post digestive effect, unctuous, increases digestive fire, strength, taste, reduces vata			Snigdha (unctuous), madhura is post digestive effect, dipana (increasing digestive fire), balavardhana (increases strength), vatahara (reduces vata) ruciprada (increases taste)			
Elephant					Light, reduces kapha, hot, reduces appetite, astringent in sub-taste, constipating			
Buffalo					Increases kapha, unctuous, increases abhishyanda, sweet, increases strength, fat, and digestive fire.			

	Caraka samhita (CS)	Susruta samhita (SS)	Astanga sangraha (AS)	Astanga hridaya (AH)	Dhanvantari nighantu (DHN)	Madanapala nighantu (MPN)	Bhavaprakasha nighantu (BPN)	Raja nighantu (RJN)
Horse					Improves digestion, not good for eyes, increases vata, rough, hot, astringent, reduces kapha and urinary disorders			
Goat		Reduces kapha and pitta, is light, reduces vata and emaciation, piles, respiratory diseases, increases digestion			Kaphavatahara (reduces kapha and vata), laghu (light), kshaya (used in emaciation) durnama (piles), svasakasa (respiratory diseases), agnidipana (increases digestive fire)			
Sheep					Increases kapha and vata, piles, it is sweet in post digestive effect, aphrodisiac, good for rakta and pitta.			

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Donkey					Rough, hot, light, increases digestion, sweet, sour, increases taste, reduces vata			
Camel		Sweet, sour, slightly alkaline, heavy, pungent in post digestive effect, purgative, reduces vata, piles, skin diseases, worms, ascites, colicky pain			Pungent in post digestive effect, alkaline, sour, reduces vata, piles, skin diseases, worms and ascites			
Human					Unctuous, sweet, strengthening, nourishing, heavy, good for eyes			

Generally curds is sour, sweet, constipative, heavy, hot and reduces vata. It increases fat, semen, strength, kapha, rakta and pitta disorders, increases digestive fire and swelling. Curds should not be used in autumn, summer, spring. It can be used in early and late winter and rainy seasons.

When butter is taken by churning curds becomes buttermilk. Buttermilk is astringent, hot, increases digestion, reduces kapha and vata. It is good for swelling, ascites, piles, sprue like syndrome, urinary disorders, intestinal tumors, spleen enlargement, anaemic conditions.

GHRITA (GHEE)

	Caraka samhita (CS)	Susruta samhita (SS)	Astanga sangraha (AS)	Astanga hridaya (AH)	Dhanvantari nighantu (DHN)	Madanapala nighantu (MPN)	Bhavaprakasha nighantu (BPN)	Raja nighantu (RJN)
Cow					It is sweet, cold, reduces vata pitta, poison, good for eyes, strength, improves intellect, memory, digestive fire, gives longevity of life, increases semen, good for eyes, good for young and old, emaciated.			
Elephant					Astringent, obstruction of urine, bitter, increases digestion, light, reduces kapha, skin diseases, poison, worms			
Buffalo					Sweet, reduces rakta and pitta, heavy, increases kapha, reduces vata and pitta, cold			

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Horse					Pungent, sweet, astringent, slightly increases digestion, good for unconscious patients, heavy and increases vata slightly			
Goat		Digestive, good for eyes, increases strength, good in respiratory diseases, emaciation, and is light to digest			Improves digestion, good for eyes and strength, good for respiratory conditions, emaciation and is light to digest.			
Sheep					Light, does not increase pitta, good for kapha and vata, vaginal disorders, swelling, tremor			

	Caraka samhita (CS)	Susruta samhita (SS)	Astanga sangraha (AS)	Astanga hridaya (AH)	Dhanvantari nighantu (DHN)	Madanapala nighantu (MPN)	Bhavaprakasha nighantu (BPN)	Raja nighantu (RJN)
Donkey					Strengthening, increases digestive fire, good for urinary disorders, light, hot, astringent and reduces kapha.			
Camel		Sweet, cold, pungent in post digestive effect, digestive, reduces kapha and vata, swelling, worms, poison, skin diseases, intestinal tumors, ascites, unconsciousness, diabetic conditions, mental diseases, poison, fever, epilepsy.			Pungent, good for swelling, worms, poison, increases digestion, reduces kapha and vata, good for skin, intestinal tumours, ascites, unconsciousness			
Human					Good for eyes, increases digestion, light and reduces poison			

Old ghee is used in variety of conditions. If it is 10 years old it is very good.

SAKRIT (DUNG/FEACAL MATTER)

	Caraka samhita (CS)	**Susruta samhita (SS)**	**Astanga sangraha (AS)**	**Astanga hridaya (AH)**	**Dhanvantari nighantu (DHN)**	**Madanapala nighantu (MPN)**	**Bhavaprakasha nighantu (BPN)**	**Raja nighantu (RJN)**
Cow	Used in raktapitta	Used in rat poison, cleanses head (nasya), scorpion poison						
Elephant	-----							
Buffalo	-----							
Horse	Used in raktapitta							
Goat	Burned alkali of goat droppings is used in visucika (diarrhoea with pain and indgestion) udavarata (upward movement of vayu), vatashthila (one of the urinary disorders)							
Sheep	----							
Donkey		Used in diabetic conditions						
Camel		Dry dung is used in diabetic conditions						
Human	----							

*Very less information available on sakrit (dung)

Annexure – VIII

AYURVEDIC PRACTITIONERS COMMENTS ON USE OF ANIMAL PRODUCTS IN TRADITIONAL AGRICULTURE

1. Iron rod heated red hot, put into dung of horse, ass and pierced into the trunk of plantain tree, will bear fruit as big as elephant trunk.

Iron has *madhura rasa* (sweet), *tikta* (bitter), *rasa* (taste), *madhura* (sweet), *vipaka* (post metabolic effect), *guru* (heavy), *guna* (quality), *pitta vardhaka* (increases pitta). Information regarding the properties of faeces of donkey and horse is not available. Probably when the rod is heated, the heating process might enhance in better absorption of the nutrients present in the faeces. These qualities might help in getting large plantains.

This can be done during the flowering and fruiting season especially when the plant requires more nutrients.

2. To get juicy fruits – Mustard powder mixed with cow dung and ghee made into paste by adding little honey. This paste is applied on the trunk. This process should be repeated.

Ghee is life promoting and bulk promoting *dravya* (substance) due to its *madhura rasa* (sweet taste) and *vipaka* (post metabolic effect) having *guru guna* (heavy). Honey also possesses *guru guna madhura rasa* and *vipaka*. Therefore these qualities enhance the sweet taste. According to Ayurveda both ghee and honey are having *rasayana* (rejuvenating) effect i.e. to nourish the dhatus or body tissues to bring forth longevity, health vigour and vitality. While cow dung is having *katu rasa* (pungent taste) and *vipaka rooksha* (dry) and *teekshna* (sharp), *guna* (properties). It acts as a *krimighna* (insecticide) there by protecting the tree while mustard is also having *katu rasa* (pungent taste) and *vipaka*, *snigdha* (unctuous) *guna*. This enhances the unctuous content of the fruits.

In the quantity wise ghee must be prominent, half of this must be quantity of honey, half of honey must be the quantity of cow dung and mustard.

The application must be applied from the time of saplings but the frequency must be increased during flowering, as the plants require more nutrients for fertilization and for fruiting.

3. Fish water, earthworms treated with milk gives –bigger fruits in pomegranate tree.

Fish, earthworms and milk are having *madhura rasa* (sweet taste) and *vipaka* (post metabolic effect). They are having life promoting (*jeevaniya*), bulk promoting (*brimhaneeya*) functions and *guru* (heavy), *snigdha* (unctuous), *guna* (qualities). These properties increase the size and growth in human beings when used. These properties probably might help even in plants to get sweeter and bigger fruits in pomegranate. The above said mixture can be applied when the plant is in inflorescence, because the nutrients are supplied during the fertilization period, which enhances the growth to yield bulky fruits

4. Recipe for vartaka –Seeds are smeared with honey and ghee, dried in sun and watered with juice of green guard, yields much number of fruits.

Ghee, honey and green gourd are having *madhura rasa* (sweet taste) and *vipaka* (post metabolic effect). Due to its *guru* (heavy), *snigdha* (moisture), *guna* (quality), *karma* (function) such as *brimhaneeya* (bulk promoting), *balya* (strength promoting), *medhya* (intellect promoting). Probably these qualities enhance growth and may initiate in the production of fruits. Watering the seeds with the juice of green guard might be more beneficial because it is *vrishya* (aphrodisiac) which enhances the production of inflorescence ultimately yielding in many number of fruits. The quantity of ghee and honey must be equal. Watering with the juice must be frequent and care must be taken during the flowering season .The seeds after smearing and drying must also be protected from insects.

5. Grape creeper gives much number of fruits when nourished by cock excreta, sprinkled with fish fat.

Meat (*mamsa*), fat (*vasa*) are *sneha dravyas* (unctuous substances) and beneficial in promoting the bulk of the body, growth in general. These substances provide strength to withstand adverse living conditions and resist disease. *Matsya* (fish) is *vrishya* (aphrodisiac), which enriches the generative organs and the reproductive system, there by increasing the yield.

6. Insecticide –*Vidanga* powder and *sesamum* powder mixed with water and applied as paste in the trunk.

According to Ayurveda for the treatment of krimi (worms), drugs possessing *katu* (pungent), *tikta* (bitter) and *kashaya* (astringent), *rasa* (taste), *teekshna* (penetrating), *guna* (quality), *ushna veerya* (hot metabolic activity) and those, which are antagonistic to *kapha dosha*, are recommended. *Vidanga* and *sesamum* are having same qualities. These are also used as deworming in human beings. Owing to these qualities it acts, as an insecticide there by preventing the adverse action of the insects and protecting the plant. The quantity of both the ingredients can be equal. The mixture has to be applied periodically and care has to be taken during inflorescence and fruting period.

7. To get seedless fruits –For *kushmanda*, *vartaka* and *patola* seeds treated with fat and sown in purified ground will yield fruits that have no seeds.

Owing to the application of fat it helps in yielding big fruits because of its *snehana* (unction) and *brihmana* (bulk promoting) property. But there is no reason according to Ayurveda as to what property of this fat helps to get seedless fruits.

8. Increasing the fragrance of *Murraya Koenigii* (curry leaves) by using buttermilk.

Butter milk (*takra*) is having *kashaya* (astringent), *madhura* (sweet) taste, *madhura* (sweet) *vipaka* (post metabolic effect), *laghu* (light), *guna* (property), *ushna* (hot), *veerya* (potency), *agnideepaka* (stimulates digestion), *veerya vardhaka* (increases virility), and *vatahara* (reduces vata). But we do not find direct reference as to what quality of buttermilk enhances the fragrance.

9. Human hair as fertilizer.

Reference w.r.t. hairs are explained in 2 contexts: 1. While describing the source of drugs, hair is considered that which is derived from animal source. 2. Hairs are the waste products of *asthi dhatu* (muscle tissue).

The properties of hair in both the context are not explained. Hence from the ayurvedic point of view it is difficult to explain as how the hair acts as a fertilizer.

10. Dipping of seedlings of Solanaceous vegetable crops in cow dung, urine slurry.

Cow's urine (*gomutra*) is having *katu* (pungent), *tikta* (bitter), *kashaya* (astringent) taste, *ushna veerya* (hot potency), properties like *pittakara* (increases pitta) *krimighna* (wormicidal), *kandughna* (reduces itching), *udaraghna* (reduces ascites), *kusthaghna* (reduces skin diseases). Cow dung is used in treating *raktapitta* (blood disorders), in treating rat, scorpion poison. In general cows urine has the properties of increasing pitta, which is necessary for growth and development. This quality initiates new growth, the wormicidal and anti poisonous property of dung and urine protects the sprouts from worm infestation.

11. Seed storage using goat dung.

Burnt alkali of goat droppings is used in *visuchika* (diarrhoea with pain and indigestion), *vatasthila* (one of urinary disorders). Since it is having an alkaline action it does not pave way for any kind of fungal infection, while puga leaves are having *kashaya* (astringent), taste, *laghu* (light), *rooksha* (dry), *guna* (quality). Therefore it absorbs the extra unctuous and the *krimighna* (wormicidal) property helps to overcome the pests and protects the crops.

12. Fruit preservation using cow dung.

Cow dung is used in the treatment of *raktapitta* (bleeding disorders). There is no direct reference regarding the qualities of cow dung in Ayurveda except the mention in *panchagavya* and its use in treating in *raktapitta*. Basically *raktapitta* is a pitta disorder and in order to treat pitta generally drugs having sweet, bitter, astringent taste and cold potency is used. Probably the cold potency of the cow dung might help in preservation of the fruit from worm infestation.

ANNEXURE – IX-A

LIST OF VILLAGES SURVEYED

Sl. No.	State	District	Mandal	Panchayat	Village
1.	Andhra Pradesh	Visakhapatnam	Araku Valley	Bondam	Karakavalasa
2.					Rampuduvalsa
3.					Ninnimamidivalasa
4.				Chinalabudu	Malisingaram
5.					Godupoduru
6.					Malivalasa
7.					Manjaguda
8.				Padmapuram	Dummaguda
9.					Pradhaniput
10.					Pimpalaguda
11.					Bhimuduvalasa
12.					Sirlamamidi
13.					Gattorguda
14.				Sunkarametta	Thotavalasa
15.					Beddaguda
16.			Dumbriguda	Korrai	Boriyakal
17.					Kaguvalasa
18.			Ananthagiri	Rompilli	Marrivalasa
19.					Pasini
20.		Vizianagaram	Vepada	Vepada	Vepada
21.				Veeluparthi	Borravalasa
22.			Gantyada	D.Kondaparthi	Rabapalem
23.	Orissa	Koraput	Nandapur	Chatwa	Musapar
24.					Kodikal
25.					Narigrav

ANNEXURE – IX-B

FORMAT

Code No.

SURVEY OF ANIMAL PRODUCTS IN TRADITIONAL AGRICULTURE

By IDEA
Integrated Development through Environmental Awakening
Flat No. 4-C, Maharaja Towers, R.K. Mission Road, Visakhapatnam-530 003.
Regd. 308/81 – Visakhapatnam

(COMPAS UC Topical Research)

Section - A : VILLAGE PROFILE

State	:	Panchayat	:
District	:	Village	:
Mandal / Block	:	Village location	: ☐ Hill top / ☐ Slope ☐ Forest / ☐ Plain

1. No. of Communities (name) :
2. No. of Families :
3. Total population :
4. Large farmers (above 5 acres) :
5. Marginal farmers (3-5 acres) :
6. Small farmers (upto 3 acres) :
7. Landless families :
8. Marginalized families (BPL) :
9. Water sources : ☐ River ☐ Tank ☐ Irrigation facility
10. Total dry land farmers : a) Mountain land: _____ b) Plain land : _____
11. Total wet land farmers : a) Mountain land: _____ b) Plain land: _____

12. Farmers with both types of land : (Dry and Wet lands)

13. Types of soils in the village :

14. Major crops in the village

    a) Traditional crops :

    b) Hybrid crops :

15. Major usage of manures and pesticides (ranking)

    a) Chemical : Manure: ☐ Pesticides: ☐

    b) Botanical : Manure: ☐ Pesticides: ☐

    c) FYM/Animal products : Manure: ☐ Pesticides: ☐

Signature of the Researcher

Section B : ANIMAL PRODUCTS FOR AGRICULTURE

S. No.	Animal	Product / Part	Form of application	Specific type of land	Season	Crops
1	2	3	4	5	6	7

S. No.	Specific stages		Dosage					
	Stage	Purpose	Per acre	Per plant	Per nursery bed	Per seed production bit	Per unit of seed store granary / basket
1	8	9	10	11	12	13	14

S. No.	General reasons for usage	Usage rationality							
		Health / Vitality	Disease preventive	Disease curative	Expected effects		Tridoshas rectification / treatment		
					Endogenous	Exogenous	Vatha	Pitha	Kapha
1	15	16	17	18	20	21	22	23	24

S. No.	Usage method		If mixed product, what is/are the other products	Ratio	Method of application	Special precautions for usage and application	Reason
	Single product	Mixed product					
1	25	26	27	28	29	30	31

S. No.	Traditional methods of testing the product efficacy	Do you share this knowledge with others	Present usage situation	Future plan on the usage of this product	World views belief, if any
1	32	33	34	35	36

S. No.	How do you want to test the efficacy of the product in your crop by using modern scientific tools	Do you want to improve and standardize the product formula / dosage for better results	Do you know / have any other special animal product formulation for crop health (yes / no)	If Yes, Details
1	37	38	39	40

Signature of the Researcher **Signature of the Respondent**

ANNEXURE – IX-C

CONSENT FORM

Village consent form for documentation and field trials

To

The Chairman
IDEA – Visakhapatnam.

We, the representatives of _____ Village _____ district _____ state, have been informed by IDEA's research staff on the purpose of documentation / experimentations (field trails) of animal products in agriculture under the programme "Use of animal products in traditional agriculture" (UC Topical Research), which is understood by us.

We hereby given our consent to disclose our knowledge (individual / community) and practices and also agreed to take up field trials (individual / group), as decided by IDEA on this subject. The consent is also given to document the knowledge and practices through village surveys, household surveys, workshops, meetings, field visits, audio and video documentation and literature search exercises and to publish the material with due acknowledgement and references to our communities.

Date:

Place:

Signature / Thumb Impression of village representative