Chapter I

INTRODUCTION

Traditional agriculture was initiated in Indian civilization, when tribal communities learned knowledge of agriculture from Rushi or Sage lived in forest areas by constructing their shelters known as Ashram. Rushies possessed more practical experience and they encouraged natives to cut and burn forest area and cultivate crops on lands, which gave them high crop yield for their sustenance and also useful for improving their living standards (Lohi, 1993).

The Atharvaveda, the fourth Veda, describes the life of the ancient Indian agriculturist community. It is interesting to note that in Vedic times, agriculture was considered the most honourable human activity. According to the Atharvaveda, the farmer is an authority in the knowledge and acquirement of food and is therefore highly respected. The common people choose their king from amongst the agriculturists, and the king is given the honour of being the first to plough the land. Everyone must cultivate the land and grow nutritious food. The farm is compared to the divine cow fulfilling all the desires of the hard working farmer.

There are two famous collections of Vedic hymns: the Bhoomi Sukta or Earth Hymns and the Anna Sukta or Food Hymns. In the Anna Sukta, food is equated to God. Great emphasis is laid on growing food in plenty and sharing it. In the Bhoomi Sukta, Earth, Prithvi, the divine mother is worshiped by the farmer, her son. She is worshiped because she sustains all plants and animals. She is the best owner of food. When cultivated, she provides all necessities of life. That is why every agricultural activity has to be accompanied with rituals that remind us of the divine quality of Mother Earth and the sacredness of all life forms. Divinizing Mother Earth ensures that man lives in partnership with nature rather than to exploit it. Vedic people were wise when they overlapped the agricultural calendar with the ritual calendar. Agriculture has to be first of all a spiritual activity, not just a materialist, mechanist activity.

Ancient India's farmers evolved nature friendly farming systems and practices. Agricultural activities were designed to ensure ecological sustainability, impregnated with the Vedic thought that every life form, living or non living, is sacred. India developed its own holistic scientific knowledge. It has a number of classical texts related to agricultural science.
Kautilya's Arthashastra, Patanjali's Mahabhasya, Krishi-Parashara, Varahmihira's Brhat Samhita, and Surapala's Vrikshayurveda are some of the manuscripts that contain valuable information about selection of seeds, land preparation, pest control, storage, plant nutrients, grafting, soil selection, plant propagation, diseases and plant protection, crop rotation, intercropping etc. (Nene, 2009).

Walker (2007) a Major General in British regime (1820) recorded several aspects of Indian agriculture. He visited different places in India like Malbar, Gujrat, Kolkata, Mysore and observed the different agricultural practices such as manuring, animal husbandry, agricultural implements, soil fertility, etc. India's traditional agriculture has proved to be sustainable by maintaining the country's fertility and biodiversity over centuries. The Green revolution couldn't be sustained for more than three decades. There is therefore an urgent need to rediscover India's traditional ecological agricultural knowledge.

A very important feature of traditional knowledge is that the theories and principles are not meant to rest in a small number of experts, but are created and shared widely, also by the ordinary people who are the daily practitioners of the science. In Indian tradition, there is no qualitative difference between scholars and folk practitioners. The scientific texts stress that the truth of the Sastras ultimately lies in the concrete particulars and their use in a real situation. There was close interaction between scholars and farmers. Text and practice are linked through proverbs in all Indian languages which express the folk wisdom and are as much a collection of scientific information as the texts themselves.

In the ancient Vedic texts, much attention is paid to agriculture, which was considered a noble occupation. Agricultural implements mentioned include several types of plough. Oxen teams of up to 12 animals provided draught power and repeated ploughing was done. Cow dung was used as manure and dried cow dung was considered superior. The cow was deeply respected and equated to Mother Earth. The ancient farmers knew how to maintain soil fertility by rotating crops e.g. rice in summer and pulses in winter in the same field. The Vedic texts also reveal that the farmers knew how to select and treat seeds and to irrigate by channels and water-wheels.

The instruction in the Vedic texts, "Scatter the seeds in the prepared ground", reveals a basic feature of traditional Indian agriculture. The word commonly used for field is Ksetra,
which also means the human womb. This indicates the paramount importance of soil preparation and maintaining soil fertility. Healthy crops can be obtained only by taking good care of the soil. Manuring, intercropping and crop rotation are designed to maintain or improve the fertility of Ksetra. Disease outbreaks or pest attacks are viewed like epidemics in humans. The basic understanding is that outbreaks occur because of imbalances in the ecosystem. A major cause of this is human error, leading to wrong interventions in natural processes. The main protection against disease outbreak is to have a thorough knowledge of nature so as to avoid causing serious imbalances in the ecosystem.

Indian science understands disease in terms of imbalance in the system and sets about restoring the balance to cure the disease. The traditional Indian approach is to grow sturdy plants in healthy soil by selecting soils and crops properly, treating seed before sowing, sowing in proper seasons, using manure, watering properly and maintaining a fine balance between plants, soils, human beings, animals and insects.

Insect pest management for stored grains are pre-harvest pest management. The current emphasis upon integrated pest management is in effect, a reassertion of the need to put traditional good husbandry in place as the fundamental basis of pest control. In grain storage, as with other durable agricultural products, it is good commodity management and good store management which are the major prerequisites. Control of the storage environment is thus an essential element in grain storage pest management. It involves primarily the controls on in-store climate and infestation-pressure which can be achieved by technically sound store design and construction. However, the climatic control attainable by scientific management of the commodity to ensure that the stored grain is itself both dry and cool when loaded or, in ventilated stores and bins with aeration equipment, that the storage procedure achieves drying and sufficient cooling rapidly. In a fully loaded store, the stored grain itself largely determines and stabilises the temperature and humid conditions in the store. Pest losses in traditional agriculture range from 10 to 40 %. This is similar to modern agriculture which relies on pesticides (Brown and Marten, 1988)

Scientific approaches to grain storage pest management, having regard to grain storage as a part of the food production and distribution management system, have sometimes referred to the biological ecosystem concept as a means of comprehending grain storage processes and
problems. There are quite a large number of pests that damage the grains and other food products. They can be classified as major and minor pests/insects. They are further distinguished as major beetles, minor beetles, major moths, minor moths and rodents. The important ones that particularly damage the grains is pulse beetle (*Callosobruchus chinensis* Linnaeus). It is also known as *gram dhora or Sondkida* commonly. This belongs to the family *Bruchidae*. The main hosts of this pest are gram, peas, cowpeas, lentil, arhar and the alternative hosts are chick pea, maize, soybean and other pulses. This is very destructive pest of various pulse crops in India, both in field as well as in stored grains.

The pest attacks leguminous pods in the field from where they are carried to storage godowns. The larvae bore into the pulses, feeds and develop inside. The infestation on case of grains in early stages cannot be detected since the hole through which the larvae enter is very minute. The damaged grains are hollow inside, bearing small holes and are unfit for human consumption. The pupation occurs within the grain or grain dust and takes about 7 days to complete. The adult emerges from the grain after cutting a small, round hole. About six to seven generations a year of the pest are common in India.

In many parts of the world the roots, leaves, fruits and flowers of local plants are known to act as an insect-pest repellent. The notable examples are neem leaves, Karanj leaves or oils, Derries and pyrethrum. A study of traditional agricultural science in general and food grain management in particular has been illuminating, not only because it shows us ways to devise ecologically safe methods in modern agriculture. Sustainable systems of agriculture can be evolved only if they are firmly based on the traditional agriculture of that particular culture. (T.M. Mukundan, *PPST (see also Networking, page 33).

It is very essential and important to document traditional agriculture knowledge from local people. Local population is ignorant about the art of writing and reading, they have scrupulously preserved their traditions, customs, rituals, ceremonies through folklores. Conventional norms for traditional agriculture are associated with their society. Basically useful ethno-botanical in general and traditional agriculture knowledge in particular associated with local inhabitants/tribals for conserving diversity of natural wealth. (Arora, 1997). Vartak and Gadgil (1980, 1981) recorded several such folklores depicting various values of life and culture of the local people or aborigines.
Jain (2001) classified branches of ethno-botanical studies for modern India like ethnomedicines, ethno-agriculture, ethno-veterinary, ethno-gynecology, ethno-pharmacy, etc. This traditional knowledge will be useful to find out bio-pesticides, traditional farming system for sustainable agriculture, for selecting genotype for resistance or tolerance to a wide range of biotic and abiotic stresses. (Jackson and Ford-Lloyd, 1991, Swaminathan, 1996,).

The average farm size in Southeast Asia is 1.8 ha. 80% of the farmers depend solely on their own labour (Marten, 1986). It is estimated that 20% of current world food production is still produced from traditional multi-cropping systems (FAO, 1996). Small farmers provide as much as 70% of the food production in many tropical countries (Govinden, 1984). In India, 60% of the population is employed in agriculture, 2 ha is the national average farm size (Green, 1987). Small farmers own 50% of the land in India (Nellithanam and Samiti, 1998). Thus documentation of heritage of traditional agriculture is required as early as possible before it is lost forever.

Documentation of traditional agricultural practices from different parts of the country has been made such as agricultural biodiversity heritage in Himalayan region (Singh and Varaprasad, 2009), Farming systems of Orissa (Mishra, 2009), Traditional method of rice cultivation in Uttarakhand hills, (Kediyal and Dimri, 2009), Himachal Pradesh (Singh et al., 2005), Meghalaya (Sharma, 1997), Bengal (Sen, 2008). This indicates that few pockets in hilly regions in the country are still aware of traditional methods of agriculture which are useful for their soil fertility, sustainability, food security, etc.

In Maharashtra ethno-botanical work in general and ethno-agriculture in particular tribe was covered under ‘Ethnobotanical survey of Mahadeokoli tribe’ (Kulkarni, 1992) and published several papers in edited books and journals (Kulkarni and Kumbhojkar, 1993, 2002, 2003, Kulkarni and Upadhye, 2006). There was not given much attention on documentation of traditional agriculture system existed in other regions of Maharashtra. Recently, ethno-medico-botanical studies on Bhor region was carried out by Kamble (2011). However, traditional agriculture approach was not considered and hence present work is related to Bhor and Mahad regions. These regions are close to each other and agricultural practices are more or less similar.
Bhor and Mahad talukas are covering an area of 892.0 Sq. Km and 810 Sq. Km. The forest cover of both talukas is about 60% of total area. Bhor and Mahad talukas are hilly areas of Western Ghat and main occupation of local/tribal people is agriculture.

Bhorsansthans was under the control of Britishers and Pant Sachiv had formed an expert committee for taking review of agriculture on aspects like soil development and improvement, modern methods of agriculture, usage of improved varieties, animal husbandry and small scale industry, control of insect and pests and market rates for grains, etc. Committee was formed under the leadership of Mr. K.V. Joshi, Retired Deputy Director of Rural Development, Poona, Mr. V.K. Kogekar, Retired Divisional Superintendent of Agriculture, Poona and Mr. H. Paranjpe, Retired Assistant Horticulturist, Poona. Committee was established on 16 February, 1942 and survey work was carried out in Bhor sansthans with appropriate questionnaire. There recommendation submitted to Councillor, Mr. V.G. Ranade and Divan, Mr. K.V. Naik. (Additional Gazette, 1942).

In recent years, changing living pattern of local people as well as developmental activities like dams - Bhatghar and Nira Devghar are major threats to forest cover and indigenous knowledge. Majority of the people are depended on their farm produce and depending on forest for day-to-day needs in relation to agriculture. The major component of the present work is documentation of traditional agricultural practices and store food grain management practices on following objectives:
Objectives:

1) To study Ethno-agricultural practices from Bhor and Mahad region.
2) To collect baseline data on following points.
   a. Agricultural implements used for different operations.
   b. Fertilizer application
   c. Seed treatment before sowing- in Kharif and Rabi seasons.
   d. Methods of weed control and pest control
   e. Harvesting methods
   f. Storage methods of food grain.
3) Laboratory evaluation of plant resources to control store grain pests by using traditional knowledge.

The thesis is composed of following chapters:

I. **Introduction** – This chapter gives historical background of traditional agriculture and its correlation to modern agriculture.

II. **Review of Literature** – This chapter gives relevant studies carried out at International, National and Regional levels on traditional agriculture and pest management of food grains.

III. **Materials and Methods** – This chapter includes description of the study area, climatic conditions, vegetation, traditional agricultural data collected from local informants. Herbarium prepared as per standard method and deposited in AHMA at Agharkar Research Institute, Pune-411 004. Data collected on various wood parameters are mentioned and methods used to control food grain pest at laboratory level has been reported.

IV. **Traditional agricultural practices** – All observations related to agricultural practices carried out by local people of Bhor and Mahad regions pertaining to agricultural implements, farmyard manuring, sowing, weeding, pest control, harvesting practices, storing of food grain, etc. are reported in this chapter.

V. **Food grain Management Practices for pest control** – This chapter discusses various methods used for food grain management practices in study area.
VI. **Experimental trials at laboratory level** – Selected plant resources used by local people for food grain management against pest control were collected. They were dried in shade, powdered and tested in the laboratory on insect *Callosobruchus maculatus* life cycle and results are reported in this chapter.

VII. **Results and Discussion** – The findings of various traditional agricultural practices, food grain preservation at local level and laboratory testing of selected plant resources used for stored grain pest control are discussed with early studies carried out elsewhere in this chapter.

VIII. **Summary and conclusion** – The salient findings of the work are reported in this chapter.