Abstract

Studies on traditional agricultural practices and food grain management from Bhor (Pune District) and Mahad (Raigad District) Maharashtra State

submitted to

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by

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INTRODUCTION

Traditional agriculture was initiated since 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 crop on land, which gave them high crop yield for their sustenance and also useful for improving their living standards (Lohi, 1993). The stage of cultivation came very late when a high level of social and cultural evolution took place. In Ancient India man believed on many superstitions, myths, cultural, rituals, taboos, etc. associated with agriculture. The primitive society always laid stress on traditional knowledge which they passed from generation to generation. Jain (2001) classified branches of ethno-botanical studies for modern India, it also includes ethno-agriculture. This traditional knowledge will be useful to find out suitable agricultural implements in modern agriculture, bio-pesticides and bio-fertilizers, for selecting genotype for resistance or tolerance to a wide range of biotic and abiotic stresses.

Traditional agriculture has its roots in ancient literature like *Atharvaveda* and *Rigveda* and had mentioned how to protect the crops from locusts, mice, borer, mildews, blight, birds, etc. by using plant resources or by performing ceremonies, by making noise or din, by setting traps, etc. (Raychaudhuri, 1964).

Kautilya (400 BC) and Brihat Samhita of Varahamihra (600BC) treat topics of agriculture related. Panini (600-500 BC) and Patanjali (200BC) illustrate several rules which are directly bearing on farming procedures and the living of farmers. Sadhale (1999) reported and enlisted traditional agriculture practices in *Krishi-Parashara*. The book gave detail information of different agricultural practices related to soils, agricultural implements, weather forecasting, sowing, weeding, plant protection, storage of grains, harvesting practices, etc. Such type of traditions are still practiced in rural areas of Maharashtra state.

Traditional agriculture inventorization on Bhor and Mahad regions of Pune and Raigad districts has been carried out on aspects like prediction of rainfall, farming systems, agricultural tools, wood resources utilized for different types of implements, their wood quality, manuring, harvesting methods, cutting tools, threshing operations, land races suitable for climatic
conditions, offering given to god during harvesting, after threshing practice, etc. It is observed that Bhor and Mahad regions are adjacent to each other and their agricultural practices are similar but use of wood resources are different depend on availability of plant resources. Store grain pest management and control of pest by using 10 plants leaf resources by laboratory testing on pulse beetle has major work. Both the regions are hilly and traditional agricultural practices are still exists. Present work is documented on specially prepared format. The informants/farmers has appropriate traditional knowledge pertaining to agriculture practices. Following objectives are considered during the field work:

**Objectives:**

1) Documentation of traditional agricultural practices from Bhor and Mahad regions.

2) Collection of baseline data on following points.
   a. Agricultural implements used for different operations.
   b. Fertilizer application.
   c. Seed treatment.
   d. Methods of weed control and pest control.
   e. Harvesting methods.
   f. Threshing operation.
   g. Storage methods of food grains.

3) Laboratory evaluation of plant resources to control store grain pests by using traditional way.

**Materials and Methods:**

Bhor and Mahad regions cover an area of 892.0 sq km and 810 sq.km, respectively. They are situated 54 km south of Pune and between 18°.45’ N latitude and 73° -15’ E. longitude. Mahad region is situated between 18°.5’ N latitude and 73°.25’ E. longitude. Bhor and Mahad are divided by crest line of hilly part, the Eastern side of Ghat is marked as boundary of Bhor and western part is Mahad region. Average rainfall in the Bhor region is 1235 mm and 3836 mm in Mahad from June to November. The climate of the area is humid during rainy season and moderate in winter and summer season. The soils of the area are alluvial along the banks of river and black cotton soil in eastern part while red and brown soils on western part. Local people from both areas are perform two methods of traditional farming systems:
1. Flat land agriculture
2. Shifting or ‘malkush sheti’ agriculture.

These systems includes flat land agriculture, mixed cropping, terrace farming, intercropping system, rabi season cropping system and shifting cultivation system.

The major two cropping seasons are, *kharif* (rainy season) and *rabi* (Winter season). In plain land paddy is major crop in kharif season.

Local strains of jowar like *Dukari* and *Kawali* are cultivated in *Kharif* season of Bhor region. In case of *Dukari*, grain colour is yellow. maturity is in September and cultivated in light soils. White grain is a special characteristics of *Kawali*, cultivated in mixed cropping pattern.

In the inter cropping pattern, main crops like jowar, ground nut, bajara, seeds of pulses or even some medicinal plants like Owa, Shepu, and Til, are cultivated. Pulses are playing major role in the diet of local communities. Cultivating pulses as intercrop on flat land agriculture, are like *Phaseolus vulgaris* L. (Rajma) green pods are boiled and consumed during food shortage, *Castanospermum australe* A.Cumn. (Black gram), *Vigna unguiculata* (L.) Walp, subsp. *unguiculata* (Hulga, Kulith), sub sp. *cylindrica* (L.) Van. (Cow pea) in *Kharif* season.

Shifting cultivation follows crops like Nagli or Ragi (*Eleusine coracana* L.), Vari (*Panicum miliaceum* L.), Sawa (*Panicum sumatrense* Roth ex Roem. & Shult.), Niger (*Guzotia abyssinica* Cass.), Til (*Sesamum orientale* L.), Kathal (*Setaria italic* (L.) Beauv.)

In *Rabi* season, some crops like *Sorghum vulgare* Pers (Jowar), *Triticum vulgare* Vill (Wheat), *Cicer arietinum* L. (Gram) and *Dolichos lablab* L. (Wal or Pavata) are taken after harvesting kharif crop.

Till today local inhabitants from both the regions practice traditional farming. In this modern era, they are still using local resources based on their traditional wisdom for performing various agricultural operations, utilization of locally available time tested wood resources for making agricultural implements, also observing different types of social rituals during agricultural operations.

Systematic use of locally available plant resources for preservation of food grains for longer shelf life is an interesting aspect of study and document their traditional wisdom.
Complete systematic data has been documented using specially prepared format and through personal visits (one to one interviews). The data has been cross checked using standard ethno-botanical practice and then analysed for drawing conclusions.

Laboratory experiments were carried out using powder of plants on insect (pulse beetle) *Callosobruchus maculatus*.

Thesis is formulated in following chapters:

**FORMAT OF THE THESIS**

I. **Introduction** – This chapter gives historical background of traditional agriculture and its relation 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 agriculture data collected from local informants. Herbarium is prepared as per standard method and deposited in AHMA at Agharkar Research Institute, Pune-411 004. Various data collected on wood parameters are mentioned, 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, farm yard 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 against food grain management aspects were collected. They were shade dried, powdered and checked in the laboratory against insect *Callosobruchus maculatus* life cycle and growth 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 management 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.

**DISCUSSION AND CONCLUSION**

During traditional agricultural survey 109 people from Bhor and 74 people from Mahad regions were interviewed and information was documented. Total 41 and 35 villages from Bhor and Mahad region covered. Average population in villages surveyed are 95.9 and 94.4 percent respectively. *Maratha* informant 45% (82) and *Baudah* 28% (52), and *Mahadeokoli* 10% (19) are playing major role in agriculture practices. Social community structure in Bhor and Mahad is presented. It shows that *Maratha, Kunbi* and *Mahadeokoli* in Bhor and *Katkar, Harijan, Dhangar, Bhandari* and *Nahvi* (Barber) are major community in Mahad region. Farming operations are initiated on particular month or particular days. Most of the farmers select April or May months for tillage practices, *Akashay Tritiya* is one of the auspicious day for initiation of agriculture and only 4 informants from Mahad follow this tradition. 12 informants from Bhor region sowing rice seeds in *Rohini Nakshatra* and only 4 informants depend on this *Nakshatra*. Majority of farmers from Bhor(46) and Mahad (13) are not linked to any *titthi* or month or particular day.

In present year old peoples in this region have very scanty information regarding prediction of rainfall. Few people depend on *Panchag* and flowering of *Cassia fistula*, birds noise during April and May for prediction of rainfall.

The main crop paddy is cultivated in Kharif season and it is prepare on the land by using *Rab* method. *Rab* is traditional ‘slash and burn’ agricultural practice. Twenty farmers were interviewed for data collection on *Rab*. The various layers composed of twigs, leaves, grasses and soil. Twigs of *Terminalia alata* Heyne ex Roth, *Bridelia squamosa* (Lam.) Gehrm., *Terminilia paniculata* Roth, *Syzygium cumini* (L.) Skeels., *Casearia graveolens* Dalz and *Anogeissus latifolia* (Roxb. ex DC.)Wall.ex Guill&Perrare used for *Rab* preparation. Grasses like *Themeda triandra* Forssk., *Arthraxon lancifolius*(Trin) Hochst, *Dichanthium annulatum* (Forsk) Stapf., *Heteropogon contortus* L are also used for *Rab* purpose. Some farmer prefers farm yard manure too. *Pateri* means all type of leaves are used during burning of soil. For
intense burning of soil it is necessary to spray soil on layers in Mahad region. This data is useful to know which plant species are preferred to perform traditional slash and burn operation.

The operation of Rab is made for burning of soil to eradicate insect eggs and disease spores. They use chemical fertilizer like Urea or DAP at the time of transplanting of paddy seedlings in the field.

Agricultural implements plays major role in the traditional practices. Each implement functions differently and its capacity of wood strength is consider while preparing implements. The selection of wood for implements in traditional practices is science oriented. In recent years availability of wood is difficult and it replaced with exotic species. *Terminalia alata* wood is preferred by 40 and 30 informants from Bhor and Mahad region. Plant species of *Canthimum diccomum* -24, *Terminalia chebula* -22 and *Terminalia bellerica* -14 are used by Bhor farmers. Farmers from Mahad region uses 20 *Tectona grandis* and 13 *Lagestromia microcarpa* plant species. It shows that in hilly regions of Bhor and Mahad different types of wood resources are preferred for making of plough. Plough beam is a part attached to main part or Dind of plough. *Tectona grandis* used by 41 and 18 farmers in both regions. *Canthium diccomum*, *Bridelia squamosa*, *Actinodaphne angustifolia*, *Memecylon talbotianum*, *Madhuca longifolia* and *Eucalyptus globulus* are used by 36, 8, 2, 3, 2, 2 farmers respectively from Bhor region. *Grewia tiliifolia*, *Bambusa arundinaceae* and *Butea monosperma* are used by 5, 3 and 2 farmers respectively from Mahad region. The rope required for tying purpose made up of *Agave angustifolia* and Nylon for all types of agricultural operations.

In Bhor region 35 and 6 farmers uses *Terminalia alata, and Tectona grandis* while from Mahad 14 and 8 farmers uses same plant species for making harrow bar. Plant species of *Terminalia chebula and Cassia fistula* are preferred by 26 and 6 farmers only from Bhor region while in Mahad region only 6 and 3 farmers uses *Emblica officinalis* and *Catunaregam spinosa* plants for making harrow bar. From Bhor region 16 farmers uses *Memecylon umbellatum* Burm.f. plant species for making harrow prong. In Mahad region 6 and 7 farmers uses *Tectona grandis* and

*Mangifera indica* for making prong of harrow. Plant species of *Canthium diccomum*, *Terminalia alata, Terminalia chebula and Tectona grandis* are used by 38, 14, 12 and 9 farmers
for making harrow beam from Bhor region whereas 9, 6, 5 and 4 farmers from Mahad region uses *Emblica officinalis*, *Bambusa arundinacea*, *Tectona grandis* and *Memecylon umbellatum* respectively for making harrow beam.

Maind is prepared from *Terminalia alata* 25 and 24 Mahad and Bhor farmers respectively. *Mangifera indica* - 24 and 3 prefer Mahad and Bhor regions respectively. Bhor farmers 17 and 8 Mahad prefer *Terminalia chebula* wood. Mahad farmers used *Artocarpus heterophylla* 16 while 3 from Bhor, *Tectona grandis* 10 and 2 from Mahad and Bhor respectively. Both Acacia catechu and *Bridelia squamosa* are used by 6 farmers from Bhor region only.

In Bhor and Mahad region sowing, puddling and broadcasting methods are followed by 13, 24, 81 farmers and 62, 8, 5 farmers respectively. Forty five farmers from Mahad and 40 farmers from Bhor uses organic pesticides while 17 and 7 farmers does not use organic pesticides. From Bhor, 40 farmers use inorganic pesticides while 17 and 5 farmers from Bhor and Mahad does not use inorganic pesticides.

Weed control is done by using hoe and *Halka* (Tooth cultivator). Hand weeding is preferred by the local people. Seeds are kept in the ash after harvesting. Corriander seeds rubbed to separate cotyledons for easy seed germination. Some farmers use ash of *Mangifera indica* L. and *Azadirachta indica* A. Juss leaves to control aphids and pumpkin beetles.

Harvesting of crop is done with the maturity of crop. Maturity indices like yellowing of leaves and drying of whole plant helps to detect the maturity of crop. 62 and 39 farmers from Mahad and Bhor understand yellowing of crop for proper harvesting time. Very few farmers consider as red colour of crop for harvesting. At the time of harvesting offering is given to god, 61 and 62 giving offering to god and 15 farmers not believe on god and not giving offering to god. Cutting of crop is made through sickle 95 farmers and scythe (Vila) 4 farmers.

Sickle or Axe handles are prepared from specific wood like *Acacia catechu* (L.f.) Willd. *Acacia nilotica* (L.) Willd ex Del., *Babunia racemosa* Lam., *Carallia brachiata* (Lour.) Merr., *Cordia dichotoma* Forst., *Garuga pinnata* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Maytenus rothiana* (Walp.) Lobreau–Collen, *Pongamia pinnata* (L.) Pierre., *Syzygium cumini* (L.) Skeels., *Wrightia tinctoria* R.br., *Ziziphus mauritiana* Lam. All the wood resources are useful for smooth handling of implements.
Threshing of crop is an important operation in agriculture for collection of grain. Threshing floor is prepared in different months or specific festival. In this connection farmers from Bhor and Mahad region performed this operation in January, May or festival like Akashaya tritiya, Dasara, Devali, even some auspicious days like Sunday and Wednesday, some thithis like Panchami and Saptmi etc.

This has relevance to crop harvesting and threshing on a particular month or day. On this event specific wood is brought from forest and inserted in centre of threshing yard. *Terminalia alata*, *Bombax ceiba* and *Tectona grandis* are preferred by Bhor and Mahad farmers. *Erythrina stricta*, *Euphorbia legularia* and *Azadirachta indica* and *Syzygium cuminii* are selected by Bhor farmers while *Gnedia glauca* and *Sesbania sesben* from Mahad region.

Rope use for tying bullock or circumference around threshing pole is prepared from leaves/barks of *Agave angustifolia*, *Carypea arborea*, *Bambusa arundinaceae*, *Dendrocalamus strictus*, *Flacourtia latifolia*, *Coccus nucifera*, *Vitex negundo*, *Oryza sativa* and *Setaria italic*. 4 farmers from Mahad region are not use rope or threshing may be done in small area.

During the threshing bullock do not feed on threshing material muzzle is prepared from Agave, Bamboo, Nylon and other plant material bark or sticks in Bhor and Mahad region. During the threshing operation brooms are required to separate waste and grain in bulk threshing material. *Agave angustifolia* Haw. *Artemisia japonica* Thunb *Cajanus cajan* (L.) Mill. *Cajanus lineatus* (Wt. & Arn.)Van *Cocos nucifera* L. *Emblica officinalis* Gaertn *Eucalyptus globulus* Labillus. *Gnidia glauca* (Fresen.)Gilg. *Lawsonia inermis* L.


Wood quality is important for selection of carpentry work.

*Terminalia chebula*- very hard wood character. Such type of wood is suitable for making plough.

*Tectona grandis*- A strong wood of average hardness and of outstanding merit in retention of shape and durability. *Mangifera indica*- Fairly strong, not very durable in exposed positions. *Syzygium cumini*- Moderately hard, rough, strong, durable; lasts well under water. *Artocarpus*
**heterophyllus**- Moderately hard, strong; seasons easily without trouble or degrade; fairly durable.

**Terminalia paniculata**- Very hard, strong, fairly heavy, kiln seasoning produces good result.

**Anogeissus latifolia** - Hard, smooth, strong tough; not much durable, apt to split in seasoning.

The wood is hard, strong, and can be used for making agricultural implements.

All these wood resources are used by farmers due to hardness, durable quality, seasoning, etc., for different types of agricultural implements. This tradition of preparing instruments by carpenters and farmers are making threat to plant diversity.

Farmers are using methods for grain storage, 72 farmers dry grain properly, some farmers kept under soil layer or some grains are salted or keeping in wood ash. After drying food grain store in the *Hatari, Kanagi* prepared from *Dendrocalamus strictus, Melia dubia, Pongamia glabra* and *Vitex negundo* sticks or pilling.

Leaves of plant species are mixed in seeds to control food grain pests. Agave, Melia, Embelica, Tectona, Tridex and Vitex are used by Bhor and Mahad farmers. 27 farmers do not use any material for control of food grain pest. Efficacy of different plant leaf powders are tested on the basis of their toxicity to adult beetles and effects on egg laying, hatching of eggs, percentage of loss in grain weight and progeny adult emergence.

The average percentage of mortality recorded 72 hrs after release of adults indicate 33.33 per cent adult mortality in *Gnidia glauca* powder at 5% level, followed by *Eucalyptus globules* and *Catunaregam spinosa* leaf powder at 3% and 5% levels. *Vitex nigundo* powder at 3% level did not show any toxicity against bruchids. *Madhuca longfoliat* 3% and 5% and *Pogostemon bengalensis* at 3% showed minimum adult mortality of 3.33 %. *Azadirachta india* at all three levels shows remarkable adult mortality.

In Mahad region, some farmers can cultivate second crop of paddy known as Vaigan method in rabi season where water facility is available.

Special land races were selected like *Kolamba* (early maturity and less water requirement), *Patani* (drought resistant and suitable in coarse sand or murmad soils where water holding capacity of soil is very low). *Kalbhat* is a scented type of rice and generally grown in the middle of the field due to destruction of crop before maturity by wild animal. The yield of these varieties is very low but is high economic value.
Scientific evaluation of traditional agriculture practices and food grain management has importance in conservation of traditional knowledge pertaining to agriculture, wood resources, food grain pest management, etc.

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