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BG Shambulingappa

Assistant Professor (c.),
Animal Husbandry Polytechnic,
Shiggaon, Karnataka, India

CP Mansur

Dean (Agri.), College of
Agriculture, Hanumanamatti,
U.A.S. Dharwad, Karnataka,
India

Traditional practices to overcome weeds, pests and diseases in agricultural crops: A study among farmers in Haveri district, Karnataka state, India

BG Shambulingappa and CP Mansur

Abstract

Indigenous traditional knowledge has the advantage of being cost effective, readily available and help in solving problems of local nature. In spite of these advantages, very few attempts have been made to collect record and analyze them. In this study, we have recorded and documented the important traditional practices associated with pest and disease management among farmers in Haveri district, Karnataka state. Several farmers were found to be adopting practices like biocontrol, using plant derived extracts, multi-cropping etc. Festivals like Shige-Hunnime also were found to be relevant to pest management. Application of pesticides with vegetable gum on a bright coloured board and placing it in the field also helped in overcoming the pests. Awareness about traditional practices among the younger generation of farmers should be increased and such study involving documentation of these practices help in this process.

Keywords: Traditional knowledge, pest management, weed control, disease management, biocontrol, agriculture

Introduction

Cultural heritage forms one of the most important treasures of any civilized nation. India, with its diversity is one of the most culturally rich nations of the world. The Indian society is indebted to the life in Indian villages including their art, crafts, religious beliefs, scientific ideas, agricultural technologies, and medical practices.

Indigenous traditional knowledge (ITK) can be considered as a collection of knowledge unique to a particular culture, society or geographical region. These treasure troves of wisdom have been preserved by generation after generation and have been efficiently utilized for the betterment and conservation of natural resources [1]. Moreover, this knowledge system has successfully spread its wings to boundaries beyond their origin through travelers and traders.

The indigenous communities generated a knowledge base capitalizing on their understanding of the environment. Community based organizations were established which served as a platform to identify and overcome problems through experimentation, innovation and exchange of information within societies [2]. The ITK thus developed plays a huge role in overall life of rural areas including different aspects of scientific knowledge like veterinary science, medical science and agriculture. The partial and technological characteristics of modern biology makes it highly dependent on laboratory based experiments and innovations, as a result of which the essence of nature gets diluted. In indigenous people have developed knowledge over a period of several centuries based on their interaction with the surrounding, thus propelling this into a primary source of knowledge [3].

Agriculture, which forms the backbone of Indian economy, depended heavily on the traditional knowledge, until recent discoveries of advanced agricultural sciences. The farmers were able to arrive at new ideas and concepts based on their experience, thus enriching the ITK system [4]. ITK among farmers has evolved through experimentation, though unintended, as a result of adaptations based on pragmatic approach to survive in a fragile soil system [5-7].

With the prominence that the western knowledge commands over the ITK, a situation prevailed where in the ITK was grossly ignored or neglected [1]. In many cases the indigenous communities themselves are not aware of the value of the knowledge that they possess [8]. Though ITK was marginalized till recently, it started gaining prominence as researchers started realizing the detrimental effects of modern science.

Correspondence

BG Shambulingappa

Assistant Professor (c.),
Animal Husbandry Polytechnic,
Shiggaon, Karnataka, India

Thus this branch of knowledge became an alternate to modern approach. In the modern approach, the concept of folklore has advanced its perspective. From a study that covered the local significance of ballads, arts and social psychology, folklore has now expanded to achieve sustainable development and progress^[3].

Traditional knowledge has been passed on to subsequent generation through oral means. There are no/limited accounted versions of this knowledge, which can be preserved for future reference and dissemination^[9]. The source of this knowledge base is the older generation and there is an imminent requirement to document this before they fade away^[3]. Traditional information on health, animal health, livestock management, food, agriculture, timber, dye, religious ceremonies etc. can be put into the best use for future generations through documenting. Projects associated with conservation of biological diversity, sustainable uses of natural resources, indigenous health practices etc. will be benefitted as important aspects of the ITK can be used for their proper implementation. It also increases the awareness of the younger generations towards the traditional knowledge^[9].

The ITK pertaining to agriculture remains a fairly unexplored field, with many information being undocumented. By identifying, documenting and incorporating some of these practices, the information that is available in this field can be put into best use. Most of these practices involve lower cost and hence may benefit the national economy too. Through the current study, an attempt has been made to document some of these practices related to agriculture for the future benefit of the mankind.

A plant which is undesired in a particular context is called a weed. Weed control is a process in which growth of such plants are checked or controlled to reduce its competition with the desired flora of a place. Several methods including chemical methods are used by farmers to get rid of the weeds. But, chemical methods of weed control have their baggage of issues like affecting the growth of desirable plants and accumulation of the chemical residues, causing harm to the consumers. Hence traditional methods of weed control are increasingly becoming important. In this study, we have documented the prevalence of traditional weed control measures taken by farmers in the study locale.

A large chunk of agricultural crops succumb annually to attacks by different insects, pests and diseases during cultivation, harvesting and storage. In order to minimize these losses, several pest and disease management techniques involving various biological and chemical agents are being adopted by different farmers. Through the usage of pesticides, the farmers have been able to increase their agricultural productivity to a large extent. However, as with chemical methods described in earlier sections, excessive usage of chemical pesticides have led to serious hazards like environmental pollution, adversely affecting the health of consumers and causing death of non-target organisms. To overcome these adverse effects, the farmers are now going back to practicing traditional knowledge to manage pests and diseases. Some of these practices adopted by farmers in Haveri district have been documented in this study.

Methodology

Locale of the study

The study was conducted to analyze the folk practices followed in agriculture at Haveri district of Karnataka State, India.

Geography of the place

Haveri district is located at the center of the state of Karnataka. It has Bidar in the far north to Kollegal in the far south. The district consists of seven taluks, namely Hanagal, Shiggaon, Savanur, Haveri, Byadagi, Hirekerur, and Ranebennur. It was part of Dharwad District before being assigned the status of a district.

Rainfall

The minimum average rainfall recorded over a decade spanning from 2005-2015 was 621.2 mm in the year 2012, while the maximum average rainfall was recorded at 1097 mm in the year 2014.

Agriculture crops

The district is well known for agriculture. The major crops of the region include rice, pulses, cereals and vegetables. The district produced 57599 tonnes of rice, 26027 tonnes of jowar, 59 tonnes of bajra, 265188 tonnes of maize, 100 tonnes of ragi, and 617 tonnes of wheat in the year 2012-2013.

Research design

“Ex-post facto design” was employed in the present study as the event have already occurred and design was considered appropriate. Discussions were initiated with the farmers regarding several agricultural practices. In this study, we focussed on the information regarding the traditional practices involved in pest and disease management. In all, 122 farmers were involved in this study. All the information that was collected from the farmers during the course of discussion was noted down immediately. This information were later grouped and analyzed.

Sampling technique

The sampling technique of the farmers chosen to participate in this study was mainly based on random selection. Through this technique, every participant of the study was chosen randomly and the choice was based entirely on chance. The participants of this study were recruited through snowball sampling because the potential participants were few. This technique is a non-probability sampling technique, where the future participants are recruited by the existing participants among their acquaintances.

Result and Discussion

Weed Management

Weeds are unwanted plants which have no or little benefits. They germinate and grow rapidly. They compete with the crops for space, light, water and nutrients, thus affecting the growth of the crops. Weed control is one of the major aspects of agriculture.

Some of the common weed control practices adopted by farmers in Haveri district include intercultivation, manual removal of weeds and usage of chemicals. The extent of prevalence of these practices has been represented in table 1.

Table 1: Represents the weed control practices followed by the farmers in Haveri district.

Sl. No.	Weed control measures	No. of farmers	% of respondents
1	Intercultivation	96	78.68
2	Manual removal	20	16.40
3	Chemical use	30	24.60

Of the farmers who participated in the study, 96 farmers resorted to intercultivation (Figure 1) as a method of weed control. Intercultivation or intercropping involves a process wherein two or more crops are cultivated simultaneously in the same space. This is a traditional process and common practice used to control the growth of yield. Vennilla *et al.*, in 2008 reported that cultivation of rice in combination with green manures was found to suppress the weeds effectively and increase rice yield while increasing the fertility status of the soil due to legume.



Fig 1: Inter cultivation for weed control

Manual removal of weeds (Figure 2) is traditionally practiced by farmers with smaller land holdings. These farmers may not find inter cultivation to be a viable option since in a small land area available for cultivation, intercultivation may reduce the yield of the major crop, thus affecting the profits of the farmer. In Haveri district, this method was practiced by 20 farmers who participated in the study.



Fig 2: Manual weed removal

A significant number of farmers who participated in the study also made use of chemicals to control the weeds (Figure 3). Several aspects like the effect of mechanical methods of weed removal on soil, adverse weather, morphological similarity of weeds with the crops, parasitic weeds that live on the crop plant and extract nutrients from them, perennial weeds that remain alive for more than two seasons of cropping and the exorbitant labour charges involved in manual deweeding process have forced the farmers to resort to chemical processes.



Fig 3: Chemical use for weed control

The process of weed control is considered to be as old as the agriculture practice itself. Hence over a period of time several traditional practices have been developed in controlling the growth of weeds. Weed control benefits agriculture by improving the soil conditions by reducing evaporation from the soil surface, improving the percolation of rain or surface water, reducing runoff to maintain ridges or beds on which the crop is grown and by reducing competition of weeds for light, nutrients and water.

Pest and Disease Management

Pests and disease causing microbes are a major menace to the crops in agriculture. Over a period of time many traditional practices have been evolved to overcome these menace, although some farmers use chemical methods also to get rid of these. In this study we came across farmers who were using chemical methods and traditional practices to overcome the diseases and pests. Around 80 farmers interviewed in this study were using chemical methods of pest and disease control. Plant derived extracts or traditional practices were followed by 30 farmers while 10 farmers resorted to some bio-control agent. About 20 farmers followed the method of multicropping to overcome the diseases and pests. Table 2 represents the prevalence of different practices among the farmers in Haveri district.

Table 2: Represents the pest and disease control practices followed by the farmers in Haveri district.

Sl. No.	Practices	No of farmers	% of respondents
1	Chemicals use	80	65.57
2	Plant derived extracts (traditional practices)	30	24.60
3	Bio-control	10	8.20
4	Multicropping	20	16.40

Pesticides refer to the kind of chemical reagents used in agriculture for protection crops from disease, insects, rodents and regulating plant growth. In some cases the seeds may be treated with pesticides to reduce their susceptibility to pests. Spraying of pesticides is also a common way of applying. But all these cause immense side effects. The side effects of increased use of pesticides include health effects, ranging from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, mimicking hormones causing reproductive problems, and also causing cancer. In this study, we came across a strategy where in the farmer had mixed the pesticides with vegetable gum and had

applied it onto a board. The board was kept in the field, fastened to a tree (Figure 4). The bright color of the board and the pesticide attracted the pests towards it, which gets glued to the board and are killed by the effects of pesticides. This way, one could avoid the gross side effects of pesticide. This way indiscriminate use of the pesticides on the agricultural area could be avoided. This was a case where we saw a combined use of the traditional and modern practices.



Fig 4: Bio control measures to control insects and pests in the fields

The ill effects of chemical pesticides have forced many people to resort to alternative means of pest control. One of the most commonly used methods to control pests is using plant extracts. Some plants are reported to have insecticidal activity against pests. Some of these include *A. indica* for Stem borer (*Scirpophagea incertulus*) Rice weevil (*Sitophilus oryza*), rice moth (*Sitotroga cerealella*) and Gandhi bug (*Leptocorsia oratoris*); *Pongamia pinnata* for Yellow stem borer (*Scirpophagea incertulus*); *Polygonum hydropiper* L. for *Sogatella furcifera* and *Nilaparvata lugens*; *Shorea robusta* for Rice hispa (*Di cladispa armigera*); *N. tabacum* for Stem borer (*Scirpophagea incertulus*) and leaf folder (*Cnaphalocrocis medinalis guenee*) etc. [Rehman S *et al.*, 2016] The different types of plant extract used as biocides such as neem, garlic, tobacco, kappettiya, syringe, ginger and many others are being utilized to control and manage the pest or disease of different plants [10].

The plant extracts also called as biocides or green pesticides are definitely a good alternative to chemical pesticides. They are safe, more eco friendly and more compatible to use. In this study we across different strategies for using plant extracts to control the spread of pests and diseases. One such method is represented in figure 5.



Fig 5: Plant derived extracts to control pests/insects in agriculture field

Multi cropping or mixed species cropping (Figure 6) is the growing of two or more plant species in the same field in the same year simultaneously. They are often grown intermingled, without specific rows. Several reports show that multi cropping helps in integrated management of pests, often resulting in minimizing or even helping in eliminating the

usage of chemical pesticides. Many a times, the sub crops in this agricultural practice act as trap crops, attracting the insects towards them. Thus through this process the main crops are left unharmed or are minimally harmed. If farmers continue to grow a single crop, the pest menace may increase. To overcome this menace they may have to use chemical pesticides, which may cause unwanted side effects. Hence, multi cropping is a better strategy to control the pests in a natural way and can be used in region where the area under cultivation is large.

The strategy of multi cropping to control pests was found to be prevalent among farmers in Haveri district. Here, more than one species were cultivated simultaneously in the same area to ward off the pests.



Fig 6: Multi cropping to control pests

The festival of Shige-Hunnime which falls in the month of August has significances which are associated with pest management in agricultural fields. One of the practices associated with Shige-Hunnime is spreading of charaga or puffed rice around the crops to attract birds to feed on insects in the field.

ITKs originated in the ancient period and have been practiced by people from time immemorial. These practices have been in vogue and were used from generation to generation in an unaccounted manner. No written documents are available for recording and disseminating this knowledge. The awareness among the researchers about the importance of these practices is on the rise and the practices have to be documented for every community [11]. The ITKs that have been collected should be disseminated and exchanged with interested people through media like newsletter, journals and others [12]. The appropriate usage of traditional practices in combination with modern practices should be encouraged for deriving the best benefit out of both the systems.

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