Introducing Scientific Techniques For Efficient Home Storage Practices

BY

R. Geetha

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY) COIMBATORE - 641 043

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

MAY 1995

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Certified as bonafide research work

Signature of the Head of the Department

Signature of the Dean of the Faculty

Signature of the Guide

Acknowledgement

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Contents

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF APPENDICES

Introduction

I INTRODUCTION

"Our salvation can only come through the farmers. Neither the lawyers, nor the doctors, nor the rich landlords are going to secure it".

- Mahatma Gandhi

Agriculture occupies the key position in Indian economy and about 90 per cent of the people are dependent on agriculture and allied activities for their living, which account for about 44 per cent of the national income. Development in the field of agriculture is one of the sure step to alleviate hunger. Farming is a family occupation in India. Both men and women participate in all the agricultural activities, namely, food production, processing and storage (Kalidurai, 1995)

Since Independence, India has made tremendous progress in food grain production for attaining self-sufficiency in order to alleviate hunger. Our domestic production is now more than sufficient to meet the current requirements. The World Scenario in food production shows that the production has risen by 4 per cent in 1990 by 2,160 food grains which was 132 millions tonnes in 1978-79, rose to 176.23 million tonnes in 90-91 and the forecast is that the country would achieve a target of 210 million tonnes of food grains production by 1994-95(Subrahmanya, 1990 and

Girish, 1992). According to Singh (1991) the per capita availability of food grains has improved from 310.4 gms per day in 1951 to 472.6 gms per day in 1989. By the year 2000 A.D. the total food production should be 235 - 240 million tonnes. (Mehta, 1995).

With the enormous amount of production, there is still shortage of food for consumption. Panday (1990) quotes that India has been losing food during the entire post harvest system Food worth Rs.350 crores is lost every year due to absence of adequate storage facilities and transport bottlenecks. The post harvest losses vary from 10 to 25 per cent in India (Sharma and Jain, 1989 and Giraddi, 1990). Devadas (1992) and Janaiah et al., (1993) estimated that the food grain loss as 25 per cent field loss, 10-25 per cent storage loss, seven per cent during handling and processing and three per cent of other losses.

Nearly two third of the total food grains produced for food, feed and seed purposed, where considerable losses take place both in quality and quantity at various stages due to moisture insects, rodents and storage conditions etc. The World Health Organisation (WHO), 1988. and Girish,(1992). Devadas (1992) revealed that quantitative and qualitative reduction of food produce results from pest infestation and inefficient handling. The increased food production should go hand in hand with better post harvest processing, trans-

port and storage to ensure adequate food and nutrition. Hence combined efforts of farmers, government and voluntary agencies to promote agricultural production and prevent the colossol waste of food at various stages are also recommended. While each country is taking the required measures in its own way to minimise the post harvest losses based on their agricultural pattern, local conditions and the infrastructure available, the integrated approach by developing Asian countries for developing the arrangement of inter country co-operation would go long way in multigating the problems. (Gogoi, 1992 and Rai , 1994).

Girish et al., (1992) study revealed that nearly 70 per cent of the food grains produced in the country are Birwar (1980) and Parry (1994) pointed out that nearly 80 per cent of the harvested grain is stored in traditional storage structures constructed from locally available materials such as straw, split bamboo, mud, brickwork, wood and jute bags etc. Food grains stored in such receptacles do not remain in a sound conditions for longer periods. Hence modern technology needs to be applied on scientific basis in constructing food grain storage.

In recent years, considerable attention has been given to the post harvest sector to ensure conservation of food grains through safe harvesting, processing, preservation and distribution(Krishnamoorthy et al., 1992).

Institution under the Indian Council of Agricultural Research (ICAR) such as Agricultural Universities all over the country and the Central Food Technological Research Institute, Mysore are engaged in research on minimising post harvest losses with a view to modernise grain storage practices especially at the level of farmers, traders and co-operatives in the country(Upadhyah and Singh, 1988 and Mahalingam, 1994). Research findings being desseminated by the Save Grain Campaign under the ministry of food,

According to Gogoi (1992) "A grain saved is a grain produced". Prasad (1990), Bunyan (1988) and Kumar (1993) view that saving of atleast three per cent could be made with post harvest improvements. This accounts for 12 million tonnes of additional grains which is a significant contribution to the over all food security.

Exploring alternative approaches in promoting reduction of food losses and there by contributing to an increased availability of food should be desseminated to farmer through long term and short term training courses giving stipends and other facilitating incentives. Training programme for Government functionaries, mass education and postal and personal dessemination of information such as application of modern and improved techniques of insect and rodent control, introduction and construction of modern and

scientific storage structure to minimise moisture, rodent and insect loss and maximise benefits must be imparted to the farmers.

Realising the importance of minimising the food grain loss during storage the study was undertaken with following objectives to

1) collect the information on the cultivation of various food crops from three selected villages - Kaliannanputhur, Vandikkaranur and Valayapalayam of Thondamuthur Block in Coimbatore District.

2) Study the existing storage practices, problems faced in using them.

3) Determine the factors leading to storage losses in food grains and assess the extent of losses.

4) Evolve a training curriculum to impart education regarding better storage practices.

5) Impart skill oriented training to the selected 72 households and

6) To evaluate the impact of training implemented in terms of

a. Knowledge gained on scientific storage practices

b. Adoption of scientific storage practices and

c. Conservation of food grains.

It is hoped that this study would help farmers to improve their storage practices which would result in saving every grain produced.

Review of Literature

II. REVIEW OF LITERATURE

The literature pertaining to the study on "Introducting Scientific Technique for Efficient Home Storage practices" are reviewed under the following headings:

A. Role of Agriculture in Indian Economy.

B. Importance of Post Harvest Technology.

C. Post Harvest Losses of Food Grains.

D. Steps to Counteract the Post Harvest Losses.

E. Existing storage practices and

F. Modern Storage Structure.

A. Role of Agriculture in Indian Economy.

Agriculture forms the backbone of the Indian Economy and occupies a place of pride despite concerted industrialization in the last two decades. As India is predominantly an agricultural country where more than 70 per cent of the population live by practising agriculture, there is a heavy responsibility on the agriclure sector to produce food to meet the needs of the population both in terms of quantity and quanlity and also provide employment to a large section of the population (Tewari, 1990 and Sharma, 1991).

Janaiah (1993) remarks that agriculture has played and shall continue to play in the coming decades, a crucial role in

the process of development of the country. During the last 46 years of independence, India has achieved near self-sufficiency in food grain production which reflects the enormous promise and potential of Indian Agricultural.

The green revoluation and the impetus given by the Central and State Government, Agricultural Universities and other organisation through the evolution and introduction of numerous hybrid varities of grains, legumes and vegetable and agricultural practices have stepped up food production in the country. The estimates for 1990-91 have put the total production of between 176.5 and 177.5 million tonnes. Experts see this positive trend arising from sustained efforts, to consolidate the technological and other inputs to further agricultural output (Economic and Commercial News, 1991). Since food has come to be used as a political weapon in international relations, it is all the more desirable that India achieves a certain level of Food Security (Swaminathan, 1991 and Kumar, 1993).

In the words of Gandhi (1990) and Kalidurai (1995), the role of agriculture in India towards economic development continues to be important as a producer of food, as an employer of about two - thirds of the labour force and as a source of purchasing power for much of the non agricultural consumer goods and services in the economy. Thus rapid increase in agriculture

is essential for sustainable growth and development of the economy.

B. IMPORTANCE OF POST HARVEST TECHNOLOGY

Post harvest technology is the transformation of the raw grain yield to a marketable commodity Sharma (1986) destines that post harvest starts after completion of the process of collecting or separating of food or edible quantity from the site of immediate production. The major operations in the post harvest sector are harvesting, threhing, drying, grading, processing, storage and distribution. Thetzin (1986) recommended that the technology involved in these activities be appropriately called harvesting technology.

Post harvest technology can play a major role in the establishment of agro - industries by producing value added products, assuring greater financial returns and generating employment oppurtunities for the farmers. Such establishment of agro-industries will help in alleviating the sufferings of poor rural people. These technologies not only help the country to be self sufficient in food grains but also save foreign exchange (FAO, 1992, Shukla, 1993 and Mahadevappa, 1995).

C. Post harvest losses of food grains

'Loss' is defined as reduction in food supply brought out by either reduction in weight or deterioration between two handlings and on the whole between production and consumption.

The quantitative and qualitative losses occur due to physical (Temperature and moisture) biological (Micro-organisms, insects, rodents, birds, mites and properties of produce), chemical (break-down of produce and pesticides) and engineering (structural and mechanical aspects) factors Central Food Technological Research Institute (C F T R I) 1992.

The Directorate of Economics and Statistics, Government of India (1984), Renganathan (1988) and Viswanathan (1992) state that ten per cent of the total food grains produced worth about Rs.2000 crores are being wasted in various ways in the country. Although losses through insects and rodents are as high as 25 per cent of the annual losses of food grains stored in godowns in India, loss due to insect infestation accounts for five million tonnes (Krishnamurthy and Girish 1992 and Viswanathan 1992). The Food and Agricultural Organisation (FAO) (1994) confers that the average loss of five per cent of the world production of harvested food stuffs was a conservative figure.

Sharma and Jain (1983), Ahamed (1990) Gupta (1990) and Kumar (1993) present the break-up of loss of 9.33 per cent during the post harvest stages as threshing 1.68 per cent, processing 0.92 per cent, transport 0.15 per cent, rodents 2.50 per cent, insects 2.55 per cent, birds 0.85 per cent and moisture 0.68 per cent.

Storage losses:

Agents namely insects, rats, birds,moisture, temperature and enzymatic reactions invade the stored food grains. Though the food grains cannot be completely saved from these foreign bodies, the losses can be minimized to a certain extent. (Kumar, 1993).

The factors responsible for th losses during storage may be grouped into biological and non-biological. The biological factors comprise of insects, rodents, birds and micro-organisms and mites. The non-biological factors are temperature, moisture and humidity. (Pandey, 1990 and Raj, 992).

1. Biological Factors:

A. Insects:

The principal causes of loss in quality and quantity of stored grains are varied, the most important among them being insects of which damage is about 2% (Mohan and Babu,1992).

Insects, during storage, mainly cause quantitative weight losses by directly feeding on the kernels of grains. Ac cording to Singh (1992) the major pests in storage - insects, mites and micro-organisms grow only in a favourable environment - temperature, humidity and atmospheric oxygen.

The losses due to insect infestation vary between 10 to 40 per cent depending upon the type of food grains and condition and period of storage (Balwani et al 1992). Sathyanarayana (1984) is of the opinion that there are about 50 kinds of insect

damage in stored food grains.

b) Rodents:

Rats create problems in the fields by destroying the seed sown in the soil, cutting the standing crops and the stored grains in the stores and godowns (Devadas, 1992). It has been estimated that rats damage ten times the quantity of food grains than what they actually consume. In India 15 per cent of all the edibles lost by rats amount to five million tonnes (Pandey et al.,1983). Shrestha (1992) report that about 2.5 per cent losses are caused due to rodents in storage annually. The annual estimated loss of rice throught the world during storage due to damage by rodents is 12 million tonnes approximately, and around one crore tonne in India itself (Sambasivam, 1990).

c) Micro-organisms:

Shankar (1992) indicate the primary factors influencing the micro-flora of stored food grains as moisture and relative humidity, temperature, oxygen, types and period of storage and foreign matters.

According to Kalia(1992) the total loss of food commodities accounts for 15 to 20 per cent of food produced and more than 50 per cent of this is due to the activities of moulds. Fungi play an important role in deterioration of stored food grains in tropical and subtropical areas of the world and this loss is accounted for 2-10 per cent (Tyagi et al., 1986). The best way to avoid damage from micro-organisms during storage is

to clean and dry the food grains and to cool the grain structure before storage .

2. Non-biological Agents:

a) Moisture:

Moisture plays an important role in storage of food grains. High moisture content increases storage hazards. Insect infestation tends to increase with increase in moisture content above 10 per cent. Humidity influences the survival of insects mainly through the effect of their water content. Dry conditions appear to be generally unfavourable for the reproduction of most insects (Chung, 1991).

b) Tempertaure:

The initial high temperature of freshly harvested grains in storage, encourages rapid deterioration of the stored grains. The optimum temperature for most important granarivorous insects is between 82 F - 100 F (Bidan, 1992).

D. Steps to Counteract the Post Harvest Losses:

Pest control measures include natural and applied including mechanical and physical; chemical; biological and legal methods (Narasimhan, 1992).

Natural control measure are those which do not depend upon man for the application or success. The climatic factors such as rainfall, cold, heat and wind play important roles in life cycles of insects and other pests. Each species of animal

and plant also has a restricted range of conditions under which it can survive or compete effectively against other species.

Applied control measures are those which are dependent upon man for their application or success.

Mechanical and Physical Control:

Trapping is a cheap method which comes under mechanical methods to control rats. The traps should be so set that the tradle is on the rat run and is close to the well and some attractive food placed inside. Rodent-proofing is an important step for elimination of rodent trouble. This comes under physical method. Eventhough it may be difficult to eliminate all the rodent entry points, atleast to a large extent the entry of rodent can be controlled in the dwellings in rural areas by use of window screens, traps, drainage of swamps, flooding and syringing, burning, gassing, heating or freezing, electrical shock and the use of sound waves and other waves (Narasimhan, 1992).

Chemical control under the modern conditions and the safeguarding of the farmers' crops at their present level of production depend on the use of chemicals (Narasimhan, 1992).

Roban:

Pest Control (India) limited (PCi) suggests that Roban in a new single dose anticoagulant rodenticide. It controls field and commensal rats when consumed by causing haemorrage in the blood system. It included delayed action ensuring kill in 4-5 days period. One application provides good control. Pre-

baiting is not necessary.

Of all the poins, zinc phosphide is a quick acting, convenient,efective and ecnomical rodenticide (Kumar, 1992). The components of bait according to Sharma (1987) are, 2.5 parts (by weight) zinc phosphide, 95 parts (by weight)cracked grains or any food suff released by rats, and 2.5 parts (by weight) vegetable oil. Vegetable oil canot be replaced by water.

Fumigation:

Save Grain Campaign (1994) suggets that the practical method of prevention and control of infestation is fumigation. It is the process of prevention and control of infestation is fumigation. It is the process of controlling pests by exposing them to poisonous fumes of a fumigant at a lethal dose under air-tight conditions, and it is the best measure for a complete pest control in a commodity, empty storage space, flour mills and shifts Pradhan and Mookherjee (1994) and Parry (1994).

Aluminium posphide (with trade name celphos) had now emerged as the most important fumigant in the world replacing other fumigants by its efficacy,ease in handling,ecnomy in use, high toxicity to all stages of insects and having remarkable penetration power for uniform and satisfactory results (Agarwal, 1988). Aluminum phosphide is a volatile toxicant producing phosphine gas, which is a good insecticide and rodenticide.

Aluminium phoshide is available in two forms-pellets and table-thaving the same chemical composition. Each pellet weighs 0.6 gm and tablet 0.3 (Thakre, 1988). Alluminium phosphide when used in recommended dosages leaves a residue less than 0.5 ppm and has no adverse effect on germination of seeds. Hence it could be concluded that under normal recommended dosages, the use of aluminium phosphide is safe (Agarwal, 1988).

Biological control requires that man must encourage, introduce or artificaially increase the parasite, predators, diseases of other agents that destory the pest species.

Legal control involves the control of insects and other pests by regulating the activities of men.

The reduction of post harvest grain losses especially those caused by insetcs, micro-organisms, rodents, and birds can increase available food supplies, particularly in less developed countries, where the losses may be largest and the needs greatest Kumar, 1993).

No sigle control component could solve the complex pest problems. The answer lies with the development of an integrated pest managment system. Maximum emphasis has to be laid on developing of cheaper and safer insecticides, economization of

insecticide dosage, simplification of mode of pesticide application techniques and economic injury.

The storage stuctures for use at present do not satisfy many conditions described and considerable loss occurs in storage, both in quantity and quality because the farmers use cheap and locally made storage stu tures for storing their grains. The storage structures in the rural areas need to be modified and improved so that the grains could be stored for a longer period without any damage (Herald, 1993).

Consequent to the realisation of the important of storage in rural areas, work on the development of new desings and improvement of existing storage stuctures are being carried out at many places. The Indian Grain Storage Institutite, Hapur (U>P), several agencies suggested certain imoprovements in the existing storage structures using different locally available raw materials and engineering techniques (Birwar, 1987).

E. Existing Storage Practices:

The most prevelant traditional storage structures in Tamil Nadu are locally known as 'Seru', 'Kalangiam', 'Thombi', 'Pathayam', 'Kudir' and 'Koni' (Gunny bags). The method of construction differs from place to place. These structures are

made up of eiher straw, bamboo, reeds or masonry.

1. Seru:

It is constructed with paddy straw wound in the form of ropes of diameter varying from 50-100 mm. The structure is a tapered one having lesser diameter at the bottom and higher diameter at the top. Usually dry threshed straw is used for making the ropes and freshly harvested or partly threshed straw is used for inside lining. The cost of construction is low and the materials used are abundantly available with the farmers. The storage structure provides good thermal insulation.

With all these good points, these structures have certain drawbacks and limitations. The structures are not insect proof and are not gas tight to carry out disinfestation measures. They are susceptible to rodent attack resulting in heavy losses. They are not free from fire hazards and are protected poorly against theft and damage by animals. Considerable amount of loss is experienced by the farmers as a result of insects, rodents and moisture damage (Om Prakash, 1992 and Masthan Roa, 1992).

The improvement has been made in the local structure by introducing water and rodent proof base constructed of brick masonry or RCC ring or Cement concrete or metal sheet underneath the structure (Ananatha Krishnan, 1992).

2. Kalangiam - 'Pucca Kothi':

It is a masonary structure for bulk storage for storing

paddy. It is similar to that of 'Kotlu' of Andhra Pradesh and 'Kothi' of northern states of the country. It is usually rectangular or square in shape. This rook-like structure is constructed as a part of the house or separately in the middle of one of the rooms of the house. This structure does not give adequate proctection against rats and moisture (Raj, 1992).

The improvement made in this structure in this structure is an indoor design constructed of burnt bricks in two compartments of 1 Metric tonne capacity each with reinforced brick floor at the bottom and roof at the top. The inlet opening is provided in the roof at the top and the outlets are provided at the bottom. It has adequate facility for locking. The moisture barrier is provided in the construction to make it damp proof. As such these improved structures can be used to their full capacity and found to be sufficiently moisture proof and air tight. Depending upon the space available, the structure can be extended further to have more compartments. Such structure with compartments facilitates for the storage of different varieties of food grains (Bidan, 1992).

3. Pathayam:

This is an indoor wooden storage structure usually of retangular type. Mango wood is commonly used. Use of jackwood and banian wood is also common. The construction of 'pathayam' is in the form of tray.

The structure is not insect or rodent proof. It is not gas-tight in view of the cracks and crevices. The improvement suggeted is that the cracks or gaps between joints are to be filled with wood filling materials which are extensively used by carpenters and any suitable wooden paint can be applied to close the pores. A thin galvanised sheet of 30 g. thickness is to be nailed to the bottom of the structure to prevent rats from nibbling the bottom (Kumar, 1993).

4. 'Kudir':

a) "Kudir' is an extensively used bamboo reed storage structure in Tamil Nadu. It is usually circular in shape. The walls are made of dried red gram stalks interwoven to get circular shape. They are plastered with mud and cowdung. This structure is not rat proof, water proof and not air-tight to carryout disinfestation measure. The improvement suggested is that 'Kudir' can be kept on wooden benches and metal cones can be fixed to the legs of the wooden benches, so that the rats cannot climb (Kalia, 1992).

b) 'Kudir' is also made out of burnt clay. Grain meant for seed purposes can be stored in these structures for over a season without any reduction in viability. Being a mud structure and fabricated by the local potter, they are more economical. But the demerits of the structure are that they are breakable and not rat proof and gas tight. 3

Improvements suggested in such structures are brick (Masonry) base of sufficient height, fixing suitable outlet to the structure for easy discharge and applying externally two coats of bitumen paint. Application of paint is effective in preventing the entry of moisture in the structure (Kalia, 1992).

5. Thombe:

This local indoor storage structure made up of split bamboo is usually supported on a low raised platform. Such a structure is easily attacked by rats. The improvement has been made by introducing raised extended platform with metal cones fixed on the legs to eliminate climbing of rats on the platform.

6. Koni:

The most commonly used storage structure in Tamil Nadu is 'Koni" which is made out of hessian/jute fabrics. The gunny bags have low tear weight ratio and are easy to handle. It is also easy to measure the quantity of the grain. When empty, they can be rolled and kept in convenient places without copying much space. Grain kept in bags are well aerated and these are preferred to store seed paddy.

But 'Konis' do not give adequate protection against rats, insects and moisture. Since they are liable to damage by rats or by mechanical means, they need frequent replacement which means extra expenditure to the farmer.

The improvement suggested are:

a) Keeping bags ona wooden 'dunnage' or on a bench. By this grains will be protected from the ground water/splash water damage.

b) Providing a raised platform and fitted metal ones to the legs. This will prevent the ràts from getting inside the bags.

c) Spraying the external surface of the gunny bags wiith a suitable residual insectcidal formulation. This will prevent cross infestation and

d) Providing a gas proof sheet to disinfest the grains (Balwani et al 1992).

F. Modern Storage Structures :

Storage systems have direct relationship with the economy of the nation and therefore, there is always a need for an appropriate and efficient storage system. Safe storage structure is of paramount importance.

(i) Plastic Silo:

This is cylindrical in shape and is fabricated with 3000 gauge thick special, flexible plastic material having the dimensions of 84 cm diameter and 147 cm height. After the silo is filled, a flat trapped cap is inserted over the silo. On the free end of the cap, there is a tape belt by means of which the plastic bin can be hermetically sealed. It is air tight and

moisture proof. It can be folded and preserved conveniently when empty and transported easily. It can hold 500 kg. of cereals, (Industrial Products Finder, 1992)

(ii) Polythene Lined Double Walled Bamboo Bin:

As the name indicates, the structure has two layers of bamboo strip mats into a cylindrical shape and sandwitched with 700 guage thick polythene sheet. The diameter and the height of the bin are 100 cm and 158 cm respectively. Upto a height of 90 cm from the bottom, it is cylindrical and the remaining top portion is in the sample of a frustrum of a cone. It is an air tight bin with a low weight of 12.5 kg when empty (The Hindu, 1989)

(iii) Hapur Bin:

The bin is made up of 24 gauge galvanised plain sheet. It is cylindrical in shape and is 96 cm in diameter and 98 cm in height. An inlet of 8 cm diameter is fitted at the top of the bin and an outlet of 14 cm diameter is fitted at the bottom, horizontally. The bin is strong and it facilitates easy loading and unloading and transport (Documentation Bulletin, 1991)

(IV) Plywood Bin:

This bin is designed and developed by Indian Plywood Industries, Bangalore. It is made up of exterior grade Plywood made of selected quality veneer using thermo setting synthetic

resin. It is cylindrical in shape with 82 cm diameter and 122 cm height. An aggregate such as sand glued on the exterior surface of the bin with synthetic resin prevents gnawing by rodents.The loading hatch at the top measures 45 x 45 cm and an unloading chute at the bottom is of size 16 x 12 cm. It is water proof and resistant to decay (Asaf Ali and Mohan, 1990).

(v) Coal-Tar Drum Bin:

The used coal-tar drum is hammered to remove the dents and brought to a cylindrical shape. It is cleaned of tar by heating and by using acetone. It is provided with a cover at the top with M.S.Sheet 20 gauge and soldered. The diameter of the bin 50 cm and height 90 cm. In the top cover, porovision is made fill the grain by placing a spout of 20 cm diameter. This spout is provided with a rubber band gasket to make it air tight (Asaf Ali and Mohan, 1990).

Design of the Study

III DESIGN OF THE STUDY

The study on "Introducing Scientific Techniques for Efficient Home Storage Practices" was designed to assess and scientifically modernise the household storage practices for improving the quality of food, food security and economy. The procedure adopted for the study is presented under the following headings

A. Household Survey

B. Conduct of Training Programme and

C. Evaluation of the Impact of Training Programme Conducted.

A. Household survey:

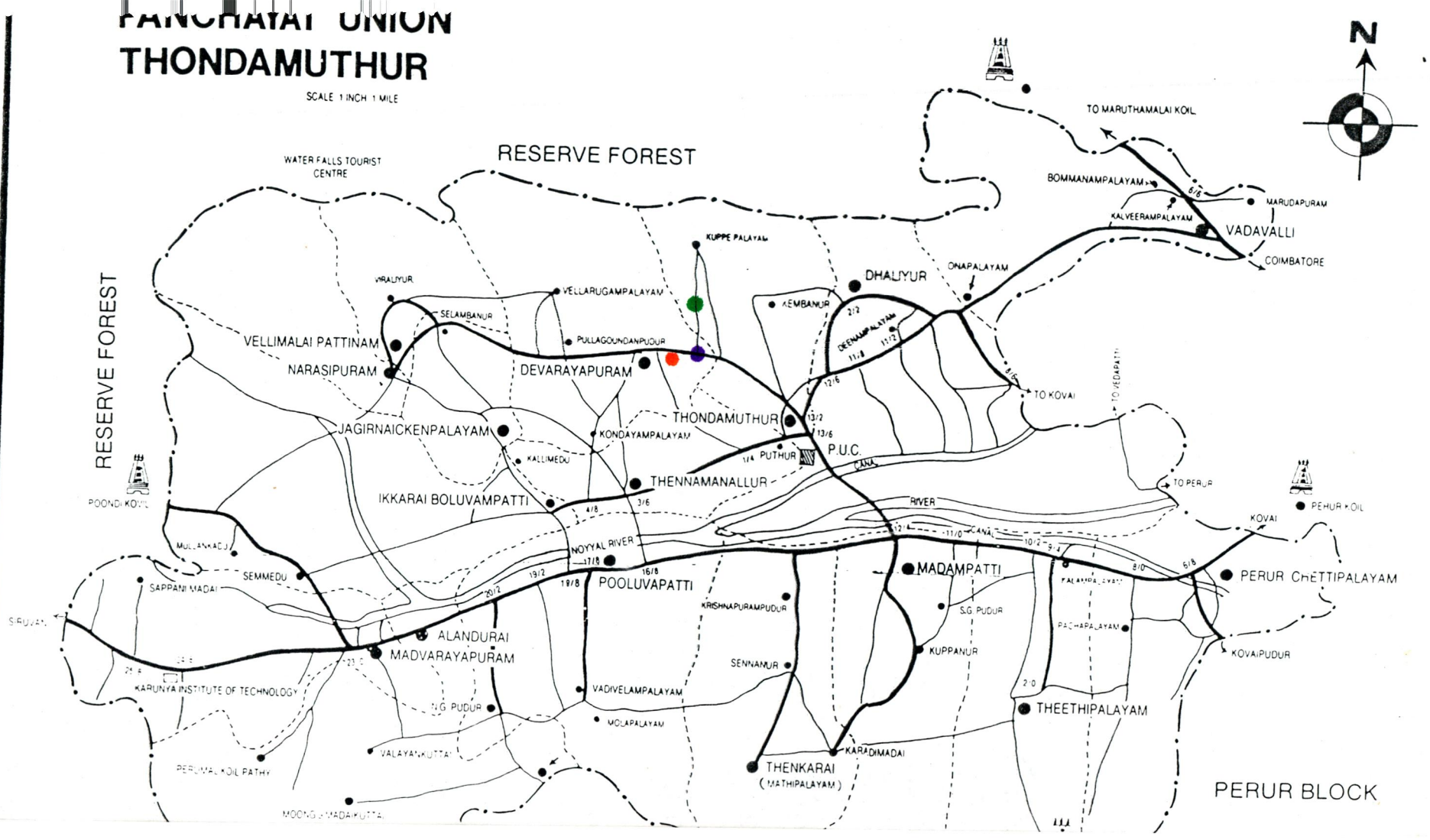
To understand the storage practices followed and the problems faced by the rural households, a household survey was found necessary.

The aspects included under this were ;

1. Selection of target area
2. Selection of sample and
3. Conduct of survey

PANCHAYAT UNION
THONDAMUTHUR

SCALE 1 INCH 1 MILE



1. Selection of target area :

The target area included three villages of Thondamuthur Block in Coimbatore District namely Kaliannanputhur, Vandikkaranur and Valayapalayam. The selection of villages was mainly based on the avialability of surplus cereals for storage. The information on food grain production was sought from the Panchyat Union Agricultural Office. Figure I illustrates the areas identified for the conduct of household survey.

2. Selection of sample:

The success of any study depends on the careful selection of the sample. The choice of the sample must be decided based on factors, such as nature of the study, size of the universe, size of the sample, degree of precision desired and avilability of resources (Elhance, 1984).

In this study purposive sampling procedure was followed, According to Gupta (1992) purposive sampling is a technique in which a desired number of sample units in selected deliberately or purposely depending upon the object of enquiry. Eight farm households from each level of land holding - marginal (below 1 hectare) small (1-2 hectares) and large (above 2 hectares) (India year book, 1994) were selected which constituted of a total of 72 households from all the three villages.3.

Conduct of Survey :

The steps involved were:

a. Selection of tool

b. Preparation of interview schedule

c. Collection of data and

d. Analysis and presentation of data

a. Selection of tool:

To collect first hand information related to socioeconomic profile, crops cultivated and information related to storage practises, a direct personal contact with the respondents was required.

Interview is a two-way method which permits exchange of ideas and information. It is a unique method in that it involves the collection of data thourgh direct verbal interaction between the interview and interviewer(Gupta, 1993). Therefore the tool selected for this study was interview method.

b. Preparation of interview schdule:

To collect details related to this study, it was necessary to include in the schedule questions which would help to elicit information on socio-economic profile of the sample, types

of crops cultivated storage practices adopted, problems encountered in storage of food grains, measures undertaken to solve the storage problems. A schedule was carefully drawn up to elicit the required information.

To check the validity and reliability of the schedule, pretesting was done through a pilot study in ten households. Based on the experieince in pretesting, the schedule was modified to ambiguity and complexity. The schedule thus finalised is presented in Appendix - I.

c. Collection of data:

With the help of the finalised schedule, the survey was carried out in 72 selected households. Rapport was developed by explaining the purpose of the study and about the organisataion backing the study. The required information was then elicited following the schedule and recorded side by side.

d. Analysis and presentation of data:

The data thus obtained was tabulated and presented in Chapter IV.

B. Conduct of training programme:

The steps included:

1. Selection of sample.
2. Formulation of training curriculum and
3. Organisation of training programme.

1. Selection of sample:

All the 72 households were considered for training.

2. Formulation of training curriculum:

Based on the data collected the training curriculum was formulated, The course content of the 'three days' training programme is given in Appendix II. The major thrust areas dealt in the training programme were;

a. Importance of storage
b. Problems in storage
c. Losses of food grains
d. Measures to minimise post harvest losses and
e. Scientific storage practices

3. Organisation of the Training Programme :

A three day training at the village level was organized and conducted in three villages. The purpose of the study and

the training programme was explained to them and their co-operation was sought for the success of the programme. The training was conducted in the local school in the following order Vandikkaranur, Valayapalayam and Kaliannaputhur. The tools used for the training programme were special lectures, participatory discussion and demonstration. The content of the message conveyed through the above tools are detailed below:

a. Special lectures:

Lectures were designed to make the trainees aware of the importance of agriculture, need for storage of food grains, problems of storage of food grains, food grains losses due to moisture, temperature, insects, mites and rodents and nature of damage and control measures.

b. Participatory discussions:

Discussion with the target group on all topics mentioned in the training schedule was held, viable extension teaching methods and audio-visual aids were used (plate 1). In this discussion, the infested and sound grains brought by the trainees from their households were displayed discussion were concerned around causes for infestation, preventive measures, scientific storage practices such as fumigation and household rat control methods such as use of Robon and aluminium phosphide. Specially prepared booklet was also distributed during discussion. A model

Plate - 1 Audio Visual Aids Used in Training Programme

of booklet distributed is given in Appendix - III.

c. Demonstration:

Lecture cum demonstration was used to show the preparation of bait with Zinc phosphide, use of rat trap, application of 'Roban' and Aluminium phosphide to control household rats was carried out.

Fumigation of stored grains in gunny bags, metal bins, polythene bags and mud kudir using celphos (Aluminium phosphide) and Ethylene di bromide (EDB) was demonstrated in the adopted villages, as shown in plates 2 and 3. Posters and charts were used as visual aids for better interaction among the participants on minimizing storage losses.

d. Meeting:

Meetings were conducted on various aspects like food production, need for grain storage prevention of food grain losses, insect and rodent control measures, scientific and modern storage structure in selected villages. Plates 4 indicates the meeting conducted during the training.

e. Exhibition:

Exhibitions were organized in the selected villages. Charts, posters and also objects were generously used in the exhibition. Display included chemicals to be used for insect and

Plate 2 - Fumigation of Stored Grains in Gunny Bags Using Aluminium Phosphide

Plate 3 - Fumigation of Stored Grains in Gunny Bags using Ethylene di Bromide

rodent control, sound and infested food grain, 'dunnage' to control the grain loss due to moisture, 'Mohan Trap' to control insects in stored grains. The training was mainly organized to help in the understanding of scientific devices to be adopted at the village level. These devices are described underneath.

Intact bag:

Gunny bags to be used for grain should either be new or should be insect free spraying the external surface of the gunny bags with a suitable residual insecticidal formulation (Malathion 50% E.C. with dilution of 1:100) will prevent cross infestation.

Polythene Sheets:

Sheets made of polythene or polyvinyl chloride film are suitable for use on the ground to over stacks in protected situations. Fumigation of stored products under gas proof sheets is a convenient way of disinfestation of commodities without moving them from their place of storage or diverting them from their usual trade channels and forms as essential operation in food technology and public health.

Dunnage:

The 'dunnage' (arranging wooden planks on the floor to stack grain sacks) can be of wooden crates, or polythene sheets. The thickness of the sheets should have 300 gauge on two layers

of mats in case of conventional bag storage. If wooden crates or polythene sheets are not available, bamboo or patera mats in two layers can be used. It helps to reduce insect infestation and moisture content from walls and floors.

Mohan trap:

Simple and low cost insect trap or pests of stored grains have been developed by entomologists at the Agricultural college and Research Institute of the Tamil Nadu Agricultural University, Killikulum. One of them is a candle-like device to trap stored grain insects, and it is popularly referred as "Mohan Trap". The plastic grain trap, resembling a candle, consists of three important parts - a main tube of 18cm length and two cm diameter, an insect trapping tube of six cm length and a detachable cone at the bottom of the main tube. This simple trap can be inserted into the stored grains, and left for two weeks for best results. Due to their natural instinct to enter bore holes the wandering insects get into the perforations in the gadget and get caught in the trapping tube. Once a fortnight, the trap can be pulled out, and the collected insects are destroyed. Plate 5 indicate the application of Mohan trap during the training.

Treatment of walls of storage structures:

White washing or application of dark paint on the wall helps to control insect infestation. When storage godowns containers are emptied, cleaning is not thoroughly done-some grains

Plate 4 - Participation of Homemakers in the Meeting.

Plate 5 - Application of Mohan Trap During Training.

continue to lie in cracks and crevices. Insect present in the stores keep on feeding and multiplying during this period also. If fresh stocks are kept in such stores, the same get infested. To control this infestation, the storage unit should be white washed or painted before storage.

Rat Proofing:

Construction of rat proof ware houses and buildings is inexpensive. Rats and mice enter the buildings through drains, ventilators, vertical pipes close to wall, by scaling rough walls, defective doors, windows, by tunelling walls and through foundations and by walking along branches of trees, telephone and other cables, through transport vehicles.

Rat profing includes water seals, fixing the vertical and horizontal pipes and cables with metal guards protecting about 23 cubic metre closing and projecting all points of entry below one metre from the ground, constructing high plinth above ground level without steps and providing a projecting colar all around the plinth for warehouses and seed storage.

Fumigation:

Fumigants occupy an important place in the field of pest control because of their great adaptability and effectiveness in controlling or eradicating pest organization or organisms.

Fumigant is a chemical which at required temperature and pressure exists in a gaseous state in sufficient concentration to be lethal to a given pest organisms in all enclosed space. There is no continuing effect from fumigation once the toxic gas is dissipated.

c. Evaluation of the Impact of Training Programme Conducted:

The impact of the training programme conducted was evaluated based on the initial knowledge of the participants of facts associated with grains storage. The steps involved were

1. Formulation of evaluation schedule
2. Conduct of evaluation and
3. Analysis and presentation of data

Formulation of evaluation schedule:

The knowledge gained by the selected households from the training given had to be elicited from them. As prasad (1989) had pointed out interview method is best method to collet such information side by side observation also helps to substantiate the details. Hence interview schedule was prepared to assess the trainees knowledge on various storage aspects. The aspects highlighted in the schedule were main causes of grain spoilage, precautions to be undertaken before, during and after storage, advantages of safe grain storage effect of insects and mites,

invasion of grains, methods to control their invasion, name of the fumigant for controlling insects, rodents and poison used to control rodents. Appendix-IV presents the schedule used to find out the knowledge gained through the training programme on various storage practices.

2. Conduct of evaluation:

The trainee's knowledge on storage practices was tested both before and after the training programme with the schedule prepared. The impact of the training programme on the trainees was assessed after a period of six months, i.e., the period necessary for one cropping. In addition, evaluation was also done through direct observation of the knowledge put into practice by the trainees. A six months period was allowed to ensure the application of knowledge to the fullest level in the household storage of grains.

3. Analysis and presentation of data:

The data collected through interview and observation were analyzed, tabulated presented and discussed under chapter IV.

Results and Discussion

IV RESULTS AND DISCUSSION

The findings of the study on `Introducing Scientific Techniques for Efficient Home Storage Practices' are analysed and presented under the following headings:

A. Household Survey and

B. Conduct and Evaluation of Training Programme

A. Household Survey:-

The findings of the Household Survey are discussed under

1. Socio-economic profile of the selected households.
2. Pattern of crop cultivation and storage
3. Storage practices adopted and problems faced by the seleected household.

1. Socio-economic profile of the selected households :

Under this headings, the educational and occupational status, type of land holding and income of the households are discussed.

a. Educational status of the households:

Table I depicts the educational status of the selected heads of the families and homemakers.

TABLE I
EDUCATIONAL STATUS OF THE SELECTED HEADS OF THE FAMILIES AND HOMEMAKERS

S. No.	Educational Status	Percentage											
		Family heads						Home makers					
		Marginal (N=24)		Small (N=24)		Large (N=24)		Marginal (N=24)		Small (N=24)		Large (N=24)	
1.	Illiterate	–	–	2	8	–	–	2	8	6	25	–	–
2.	Primary	4	16	5	21	2	8	9	38	11	46	6	25
3.	Secondary	10	42	13	54	4	17	10	42	5	21	10	42
4.	Graduate	7	29	3	13	12	50	2	8	2	8	6	25
5.	Post-Graduate	3	13	1	4	6	25	1	4	–	–	2	8

The educational status of the selected heads of the families revealed that among the small and marginal farmers in all three villages, 54 per cent and 42 per cent were educated upto secondary level while four per cent and 13 per cent upto post graduate levels respectively.

In the case of homemakers primary school level of education was high among the small farmers where as in case of marginal farmers 42 per cent were educated upto secondary level. Among the large and small farmers eight per cent and four per cent were educated upto post - graduate level.

b. Occupational status of the households :

Agriculture was the main occupation among 100 per cent of the large farmers, 89 per cent of small farmers and 77 per cent of marginal farmers.

In addition to agriculture, business was the subsidiary occupation among 79 per cent of large farmers as against 45 and 18 per cent of marginal and small farmers respectively.

C. Type of land holding of the households :

Table II gives the types of land holding of the selected households.

TABLE - II

TYPE OF LAND HOLDING OF SELECTED HOUSEHOLDS

S.No.	Types of Land	Number of households with land holding					
		Marginal		Small		Large	
		Number	%	Number	%	Number	%
1.	Dry lands	20	83	21	88	23	96
2.	Wet lands	11	46	10	42	13	54
3.	Garden	8	33	14	58	15	63

Large farmers had more dry land and garden land while the marginal and small farmers had more of dry land. The small farmers were better off when compared to the marginal farmers with regard to possession of garden land.

d. Income group:

Fifty seven per cent of the marginal and small farmers had an annual income between Rs. 3,000/- and 4,000/- and Rs. 6,000/- and Rs. 7,000/- respectively and 87 per cent of the large farmers had an annual income of above Rs. 10,000/-

Forty three per cent of marginal and small farmers had an annual income of below Rs. 3,000/-. Thirteen per cent of the large farmers had an annual income of below Rs. 8,000/-.

2. Pattern of crops cultivation and Storage:

The aspects discussed under this heading are types of crops cultivated, frequency of cultivation and quantity of food grains produced per cropping.

a. Types of crops cultivated by selected households:

Table - III depicts the types of crops cultivated in the selected households.

TABLE - III

TYPES OF CROPS CULTIVATED BY SELECTED HOUSEHOLDS

S.No	Name of the food crops cultivated	Types of crops cultivated					
		Marginal		Small		Large	
		Number	%	Number	%	Number	%
1.	Cereals						
	Paddy	14	58	17	71	24	100
	Ragi	16	67	10	42	19	79
	Maize	6	25	13	54	8	33
	Jowar	18	75	16	67	20	83
	Bajra	17	71	16	67	15	63
2.	Pulses						
	Greengram	10	42	20	83	22	92
	Redgram	2	8	4	17	6	25
	Blackgram	9	38	19	79	21	88
	Bengalgram	4	17	8	33	14	58
	Cow pea	12	50	17	71	20	83
3.	Nut						
	Groundnut	18	75	16	67	20	83
4.	Turmeric	2	8	4	17	11	46

Cent per cent of the large farmers cultivated paddy having better irrigation as against only 58 per cent of marginal farmers. The pattern of cultivation of other millets like ragi, maize, jowar and bajra did not show much difference among small and large farmers. Groundnut cultivation again showed the same trend among the three groups. But the pattern of cultivation showed only minimum difference among the farmers.

Among the pulse varieties, cowpea and greengram were the major crops cultivated by the marginal farmers, greengram and blackgram by the small and large farmers.

Turmeric a cash crop, was also cultivated by 46 per cent, 17 per cent and eight per cent of large, small and marginal farmers respectively.

b. **Frequency of cultivation:**

Paddy was cultivated yearly twice by 72 per cent of the large, 39 per cent of the small and 21 per cent of the marginal farmers.

Ragi, jowar, bajra and maize were cultivated yearly twice only by large farmers (25 per cent). All the marginal and small farmers cultivated ragi, jowar and bajra only once annually.

Pulse varieties, nuts and tubers were cultivated only once a year by all the marginal, small and large farmers due to poor water facilities.

C. **Quantity of food grains produced per cropping:**

Table IV depicts the details of quantity of different crop such as cereals, pulses, nuts and tubers produced per cropping in selected households.

TABLE IV

QUANTITY OF FOOD GRAINS PRODUCED PER CROPPING IN SELECTED HOUSEHOLDS

Sl. No.	Name of food grains	Quantity food grains produced in bags by selected households														
		Marginal = 24					Small = 24					Large = 24				
		1-10	10-20	20-30	30-40	above 40	1-10	10-20	20-30	30-40	above 40	1-10	10-20	20-30	30-40	above 40
1.	Cereals:															
	Paddy	87	28	18	5	-	52	37	25	32	4	-	8	38	87	11
	Ragi	49	9	--	-	-	21	12	2	--	-	2	15	4	--	--
	Maize	27	11	--	-	-	26	11	-	--	-	4	18	8	--	--
	JOwar	24	8	--	-	-	18	17	-	--	-	8	22	15	--	--
	Bajra	28	12	--	-	-	13	18	-	--	-	4	11	40	--	--
2.	Pulses															
	Green gram	18	3	--	-	-	23	4	-	--	-	48	2	--	--	--
	Redgram	22	5	--	-	-	23	4	-	--	-	42	2	--	--	--
	Blackgram	42	3	--	-	-	23	7	-	-	-	58	7	--	--	--
	Cowpea	23	6	--	-	-	19	8	-	--	-	12	11	--	--	--
3.	Nut															
	Groundnut	57	19	--	52	-	27	17	-	--	-	33	9	48	--	--
4.	Turmeric	57	11	--	-	-	48	20	-	--	-	--	38	18	9	11

* The capacity of each bag is : Paddy: 100 Kg
Jowar: 100 Kg
Ragi : 20 Kg
Pulse :100 Kg
Groundnut:60 Kg
Turmeric :80Kg

The cultivation of paddy, turmeric groundnut went upto 40 bags for the large farmers while it was between 10 - 20 bags for the marginal and small farmers. Regarding the cultivation of pulses it was similar for the three types of farmers (i.e., 20 bags)

3. Storage practices adopted and problems faced by the selected households.

Under this, aspects such as types of crops stored, quantity of food grains stored, duration of storage, grain storage structure in use, indigenous methods adopted to control infestation during storage and problems during storage are covered.

a. Types of crops stored by selected households:

Table V depicts the types of crops stored by selected house holds.

TABLE V
TYPES OF CROPS STORED BY SELECTED HOUSEHOLDS

S. No.	Type of farmers	Percentage of crops stored											
		Cereals					Pulses					Nut	
		Paddy	Ragi	Maize	Jowar	Bajra	Green gram	Red gram	Black gram	Bengal gram	Cow pea	Ground nut	Turmeric
1.	Marginal (N=24)	91	78	15	89	67	67	43	43	100	28	78	11
2.	Small (N=24)	100	79	23	100	78	79	100	100	100	88	15	
3.	Large (N=24)	100	88	20	100	100	100	100	100	100	87	48	

The table depicts that all the small farmers stored the crops like paddy, ragi, jowar, bajra, pulses and nuts mainly for the purpose of food and seed.

In the case of large farmers except ragi, maize, groundnut and turmeric all the other types of crops were stored by 100 per cent of them, mainly for marketing purpose whereas the marginal farmers stored the food grains solely for consumption.

b. Quantity of food grains stored by selected households

Table VI explains the quantity of food grains stored.

TABLE VI
QUANTITY OF FOOD GRAINS STORED BY SELECTED HOUSEHOLDS

Type of farmers	Percentage of household storing											
	Cereals					Pulses					Nut	
	Paddy	Ragi	Jowar	Bajra	Maize	Green gram	Red gram	Black gram	Bengal gram	Cow pea	Ground nut	Turmeric
Marginal (N=24)												
0-3 bags	-	79	83	63	13	75	50	100	63	100	75	-
4-6 bags	9	-	-	--	--	--	-	-	-	-	-	-
7-9 bags	91	-	-	--	--	--	-	-	-	-	-	-
10+above	-	-	-	--	--	--	-	-	-	-	-	-
Small (N=24)												
0-3 bags	-	79	100	83	25	79	53	100	83	89	80	-
4-6 bags	-	12	-	17	10	-	-	-	-	-	--	-
7-9 bags	-	-	-	-	--	-	-	-	-	-	--	-
10+above	100	-	-	-	--	-	-	-	-	-	--	-
Large(N=24)												
0-3 bags	21	22	10	69	100	59	100	65	68	-	--	-
4-6 bags	-	62	78	88	18	-	-	-	-	-	--	8
7-9 bags	-	17	-	2	13	-	-	-	-	-	--	-
10+above	100	-	-	-	--	-	-	-	-	-	79	15

Among the cereals, paddy was the major food grain stored by farmers irrespective of their group. Ninety one per cent of the marginal farmers stored seven to nine bags of paddy, whereas cent per cent of small and large farmers stored more than 10 bags of paddy per cropping.

In the case of pulse, all the groups of farmers stored upto three bags. Seventy nine and 15 per cent of large farmers stored groundnut and Turmeric upto 10 bags. The reason may be attributed to the fact that these pulses and nuts are easily invaded by insects and needs fumigation. As it difficult for the farmers to fumigate them, they did not take any risk to store large quantity of pulses and nuts.

C. Duration of Storage :

Table VII illustrates the duration of storage.

TABLE VII
DURATION OF STORAGE

S.No.	Food grains	Percentage of households storing								
		Marginal (N=24)			Small (N=24)			Large (N=24)		
		3-6	6-9	9-12	3-6	6-9	9-12	3-6	6-9	9-12
1.	Cereals									
	Paddy	-	-	100	-	-	100	-	-	100
	Ragi	-	80	-	-	70	-	-	80	-
	Maize	20	-	-	-	20	-	-	20	-
	Jowar	-	90	-	-	-	-	100	-	-
	Bajra	-	70	-	-	80	-	-	-	100
2.	Pulses									
	Green gram	-	60	-	70	-	-	-	100	-
	Red gram	40	-	-	-	100	-	-	100	-
	Black gram	-	100	-	-	-	100	-	-	100
	Bengal gram	20	-	-	-	-	-	-	-	100
	Cow pea	-	70		-	80		-	100	-
3.	Nut									
	Ground nut	50	-	-	60	-	-	80	-	-

Paddy is stored by all the groups of farmers for about a period of 9-12 months. Cent per cent and 80 per cent of small farmers stored jowar and bajra for a period of 9-12 months and 6-9 months respectively.

As pulse were readily susceptible to infestation the duration of storage was for a period of 6-9 months. Only Black-gram was stored for 9-12 months.

d. Grain storage structures in use by selected households.

Table VIII shows the types of storage structure used by the selected households.

TABLE VIII
GRAIN STORAGE STRUCTURES IN USE BY SELECTED HOUSEHOLDS

S.No	Type of Storage Structures	Number of Percentage of Households using					
		Marginal (N-24)		Small (N-24)		Large (N-24)	
		Number	%	Number	%	Number	%
1.	Use of Gunny bag	20	83	21	86	24	100
2.	Use of white polythene bag	12	50	18	75	20	83
3.	Mud kudir	2	8	3	13	5	21
4.	Separate room	- -	-	-	-	10	42
5.	Wooden box or pathayam	- -	-	-	-	4	17
6.	Metal box	- -	-	-	-	5	21

Use of gunny bags for storage was found to be popular among the three groups of farmers, followed by polythene bags and mud kudir methods of storage were rarely used. Separate room, pathyam metal bin were used for storing only by large farmers.

E. Indigenous methods adopted to control infestation during storage by selected housholds

Table IX illustrates the indigenous methods adopted to control infestation during storage.

TABLE IX

INDIGENOUS METHODS ADOPTED TO CONTROL INFESTATION DURING STORAGE BY SELECTED HOUSEHOLDS

S. No.	Indigenous Methods	Percentage of households using indigenous method		
		Marginal (24)	Small (24)	Large (24)
1.	Sundrying	100	100	100
2.	Use of neem leaves	78	53	48
3.	Use of 810 powder	21	36	42
4.	Red soil coating	5	11	19

Irrespective of the crops, the common methods used for controlling infestation was sundring in all the households. In addition, among cereals, paddy was treated with neem leaves by a a majority of marginal farmers. Pulses were coated with moist red soil and sundried by meagre per cent of farmers. In this

method the pluses are mixed with red soil and water, allowed to dry overnight, spread apart and sundried and stored for all purposes, Eight - Ten powder was also used by the farmers by spreading it around the bags in which the grains are stored, to protect the grains from infestation.

F. Problem during Storage:

Ninety two per cent of marginal, 78 per cent small and 42 per cent of large families had problems due to rodent. Seventy eight per cen to Marginal, 54 per cent of small and 30 per cent of large farmers had problems due to moisture and insects.

B. Conduct and Evaluation of Training programme:-

The impact of training in storage practices was assessed in terms of

1. Knowledge gained by the selected trainees on scientific storage practices.

2. Adoption of scientific storage practices by selected households and

3. Conservation of food grains.

1. Knowledge gained by the selectod trainees on scientific storage practices:

Table X presents the knowledge gained by the selected trainees on scientific storage practices.

TABLE X

SCIENTIFIC KNOWLEDGE GAINED BY SELECTED TRAINEES

S. No.	Aspects of knowledge gained	Percent of Trainees knowing (N =72)	
		Before Training	After Training
1.	Looses of Food grains during various stages of post harvest operation	73	100
2.	Using dunnage to reduce moisture attack through surface	69	100
3.	Agents attacking stored food grains	40	100
4.	Chemicals used for control of rodents in field and households	42	100
5.	Role of moisture in stored food grains	13	100
6.	Chemicals used for control of insects infestation	38	89
7.	Improvements in traditional storage structures	16	86
8.	Modern Storage structures	5	100

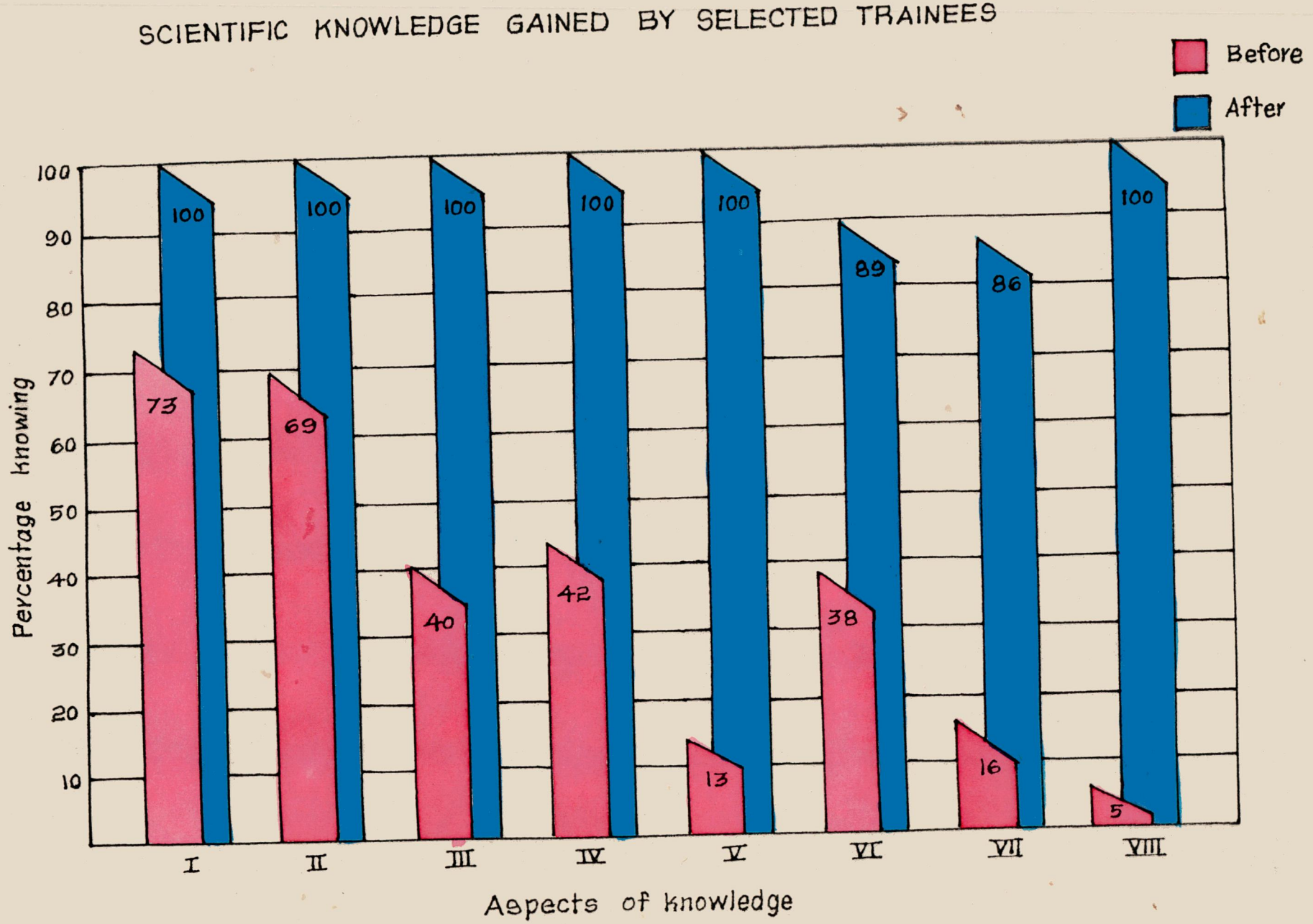

SCIENTIFIC KNOWLEDGE GAINED BY SELECTED TRAINEES
Before
After
Percentage knowing
100
90
80
70
60
50
40
30
20
10
100
100
100
100
100
89
86
100
73
69
40
42
13
38
16
5
I
II
III
IV
V
VI
VII
VIII
Aspects of knowledge

Figure - 2

The evaluation showed that the training programme improved their perception in various aspects of scientific storage practices.

Before participation, a little more than 70 per cent of the participants were aware of the food grain losses during various stages of post harvest operation. Similarly 69 per cent had knowledge on how to prevent moisture and pests while using 'dunnage'.

The participants had meagre knowledge on the modern storage structures, role of moisture in food grains and improvements in traditional storage structures. Eventually their participation in the training programme improved their knowledge substantially.

Education on these aspects helped the trainees to become aware of the various factors such as food grain losses, their causes and appropriate measures to over come these problems. The training resulted in a positive impact on the farmers and they in turn were prepared to disseminate whatever information they obtained to other farmers. After training, the knowledge on storage practices was improved as shown in figure II.

2. Adoption of scientific storage practices by selected households.

Impact of the training programme on the farmers with regard to adoption of various scientific storage techniques before and after training are analyzed and interpreted in Table XI.

TABLE XI
ADOPTION OF SCIENTIFIC STORAGE PRACTICES BY SELECTED HOUSEHOLDS

S.No.	Scientific storage practices	Percentage of household adopting scientific storage practices								
		Marginal (N=24)			Small (N=24)			Large(N=24)		
		AA*	AT	AF	AA	AT	AF	AA	AT	AF
1.	Polythene sheet	-	4	10	--	10	15	5	32	17
2.	White wash	2	82	10	15	90	9	30	99	--
3.	Dunnage	17	78	15	29	100	--	62	100	--
4.	Rat proofing	8	69	20	17	72	11	32	100	--
5.	Chemical control of rats	11	65	13	13	86	4	42	57	16
6.	Fumigation	-	18	13	--	35	42	12	52	17
7.	Metal bin	-	22	27	--	18	28	21	37	22
8.	Pucca kothi	-	-	-	--	--	--	--	--	4

AA* - Already adopted.
AT - Adopted after training.
AF - Will adopt in future

Use of the polythene sheet fumigation metal bins and pucca kothi, was not seen in practice by the marginal and small farmers whereas few large farmers used these methods before participation in the training. After participation, all the groups accepted the adoption of these methods, other methods such as polythene sheet with bamboo mats (plate 6), polythene sheet with wooden crates(plate 7), use of Dunnage (plate 8) and rat proofing (plate 9 and 10) and fumigation of stored gains (plate 11) were adopted extensively after participation, by all groups of farmers. It is encouraging to note that after training 22 per cent of marginal, 18 per cent of small and 37 per cent of large families were using metal bins. Four per cent of large families will accept to construct pucca kothi, the improved storage structures for storing the food grains. Even after participating in the training programme the marginal and small farmers were not willing to use pucca kothi due to high cost., which is around Rs. 8000/- for 75 bags. They remarked that the yield was not adequate to be stored in pucca kothi.

3. Conservation of food grains:-

Under this heading grain losses during storage, assessment of sound grain in paddy, maize and ragi stored in different storage structure over a period of six months and the amount of food grains saved per cropping are discussed.

a. Grain losses during storage:-

The losses of grain during storage before and after the training programme were noted and presented in Table XII.

Plate 6 - Polythene Sheet with Bamboo Mats.

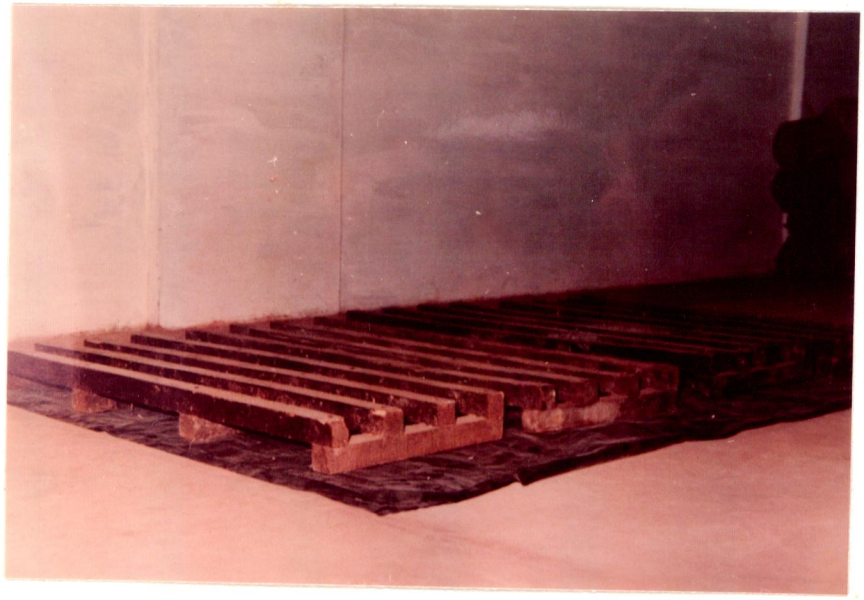


Plate 7 - Polythene Sheet with Wooden Crates

Plate 8 - Gunny Bags with 'Dunnage'

Plate - 9 Wire Mesh Fitted Window

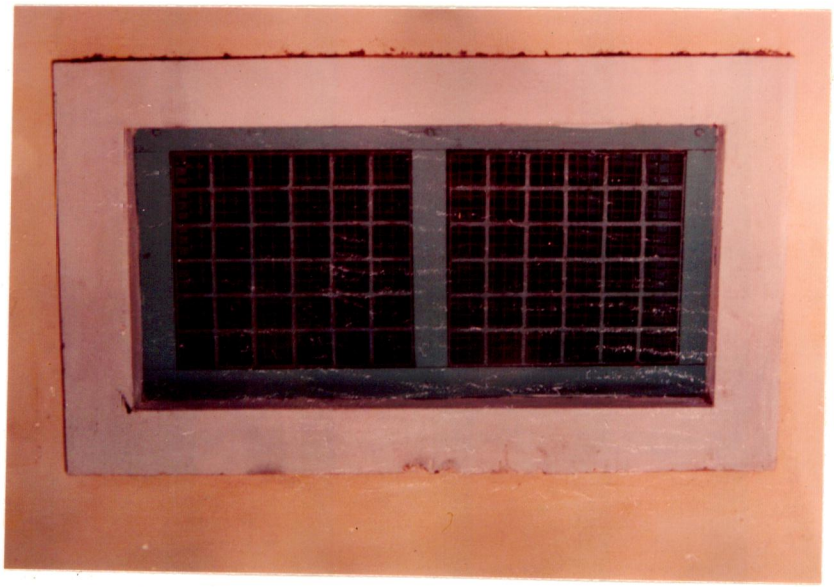


Plate - 10 Wire Mesh Fitted Window

Plate - 11 Fumigated Stock of Food Grains

TABLE XII

GRAIN LOSSES DURING STORAGE

S. No.	Type of farmers	Percentage of Losses					
		Insects		Rodent		Moisture	
		Before Training	After Training	Before Training	After Training	Before Training	After Training
1.	Marginal	5-10	3-5	5-15	3-8	5-8	1-3
2.	Small	4- 6	1-3	5-13	2-6	4-5	1-2
3.	Large	5-10	3-5	3-4	1-5	4-5	1-2

Marginal farmers considered the training programme helpful in that reduced the food grain losses through invasion of insects, rodents and moisture. Two to five per cent food grains was saved from insects, two to seven per cent from rodents and four to five per cent from moisture through application of various scientific storages methods. Similar effect was felt by small and large farmers also. Hence it can be confirmed from this Table that the training programme was useful for the farmers in saving food grains.

b. Assessment to sound grains in paddy, jowar and Ragi stored in different storage structure over a period of six months.

In order to assess the per centage of weevilization in paddy, jowar, and ragi, the farmer's storage practice were observed over a period of six months. For effective comparison the practices of farmers who underwent the training and those who did not undergo the training were taken into consideration and the observation made is given in Table XIII and figure III, IV and V.

TABLE XIII

ASSESSMENT OF SOUND GRAINS IN PADDY, JOWAR AND RAGI STORED IN DIFFERENT STORAGE STRUCTURES OVER A PERIOD OF SIX MONTHS

S.No.	Storage Structure Used	Percentage of Storage of Sound Grains											
		Before Training						After Training					
		I	II	III	IV	V	VI	I	II	III	IV	V	VI
		MONTH						MONTH					
1.	**Paddy** (N=5)												
	1) Gunny bag	100	98	94.00	93.00	91.00	88.00	100	100	99.50	98.00	97.50	97.50
	2) Mud Kudir	98	92	90.00	88.50	87.30	85.00	100	100	97.00	96.00	94.20	93.00
	3) Polythene bag	100	97	93.80	92.00	90.00	87.00	100	100	99.00	98.00	97.00	96.00
	4) Metal Bin	100	100	98.00	97.00	95.00	94.20	100	100	100.00	99.50	99.00	98.80
2.	**Jowar** (N=5)												
	1) Gunny bag	100	97	96.50	96.00	95.50	95.00	100	100	99.50	98.80	98.50	98.50
	2) Mud Kudir	--	--	--	--	--	--	--	--	--	--	--	--
	3) Polythene bag	98	94	94.00	93.80	93.50	93.00	100	100	99.00	98.00	97.00	96.00
3.	**Ragi** (N=5)												
	1) Gunny bag	100	98	97.00	96.50	95.00	99.00	100	100	99.00	99.50	98.00	97.00
	2) Mud Kudir	--	--	--	--	--	--	--	--	--	--	--	--
	3) Polythene bag	99	97	96.50	95.00	94.00	93.00	100	100	100.00	97.50	97.00	96.00

PERCENTAGE OF INFESTATIONS IN PADDY STORED IN DIFFERENT STORAGE STRUCTURES OVER A PERIOD OF SIX MONTHS

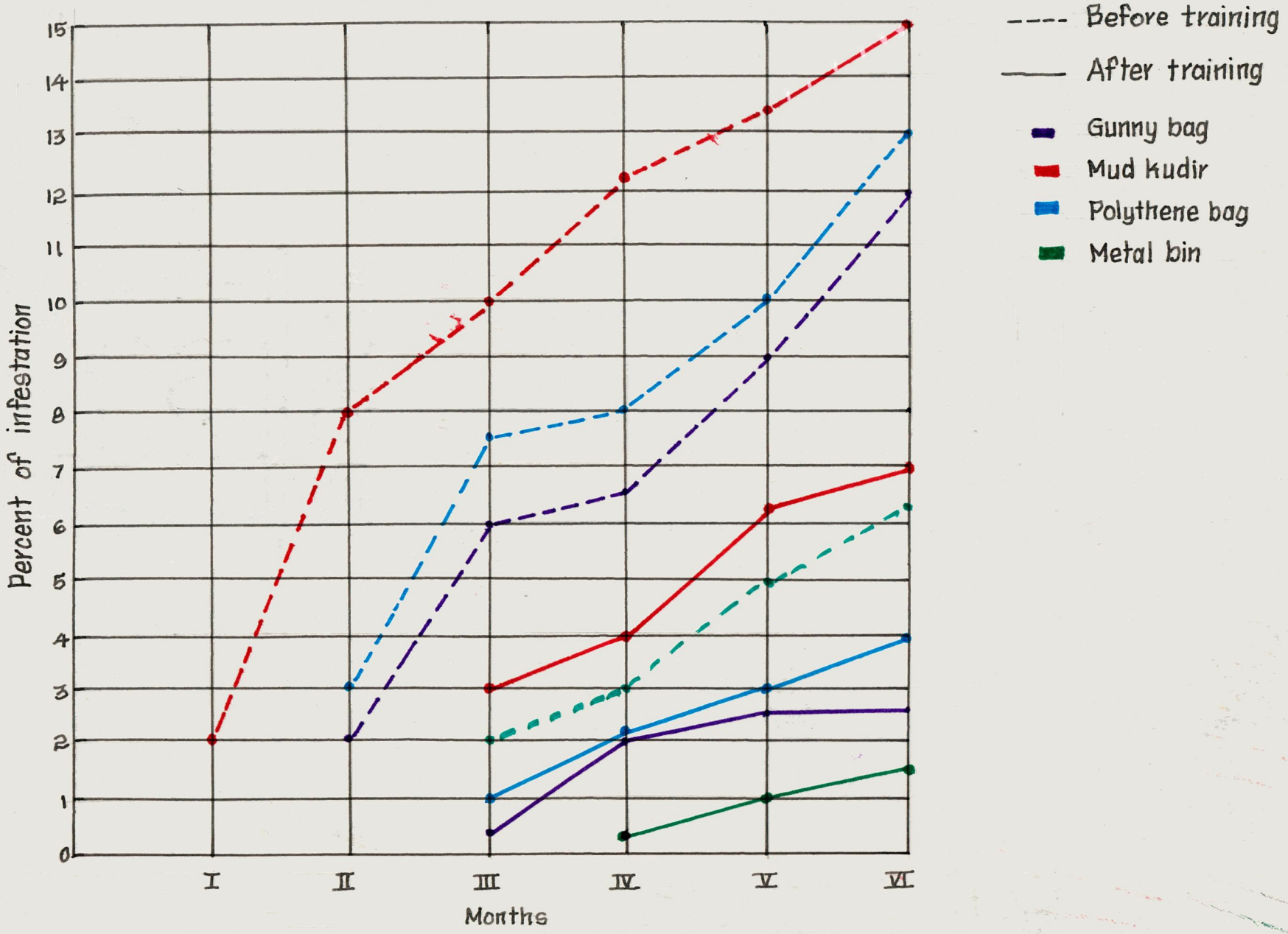


Figure -3

PERCENTAGE OF INFESTATIONS IN JOWAR STORED IN DIFFERENT STORAGE STRUCTURES OVER A PERIOD OF SIX MONTHS

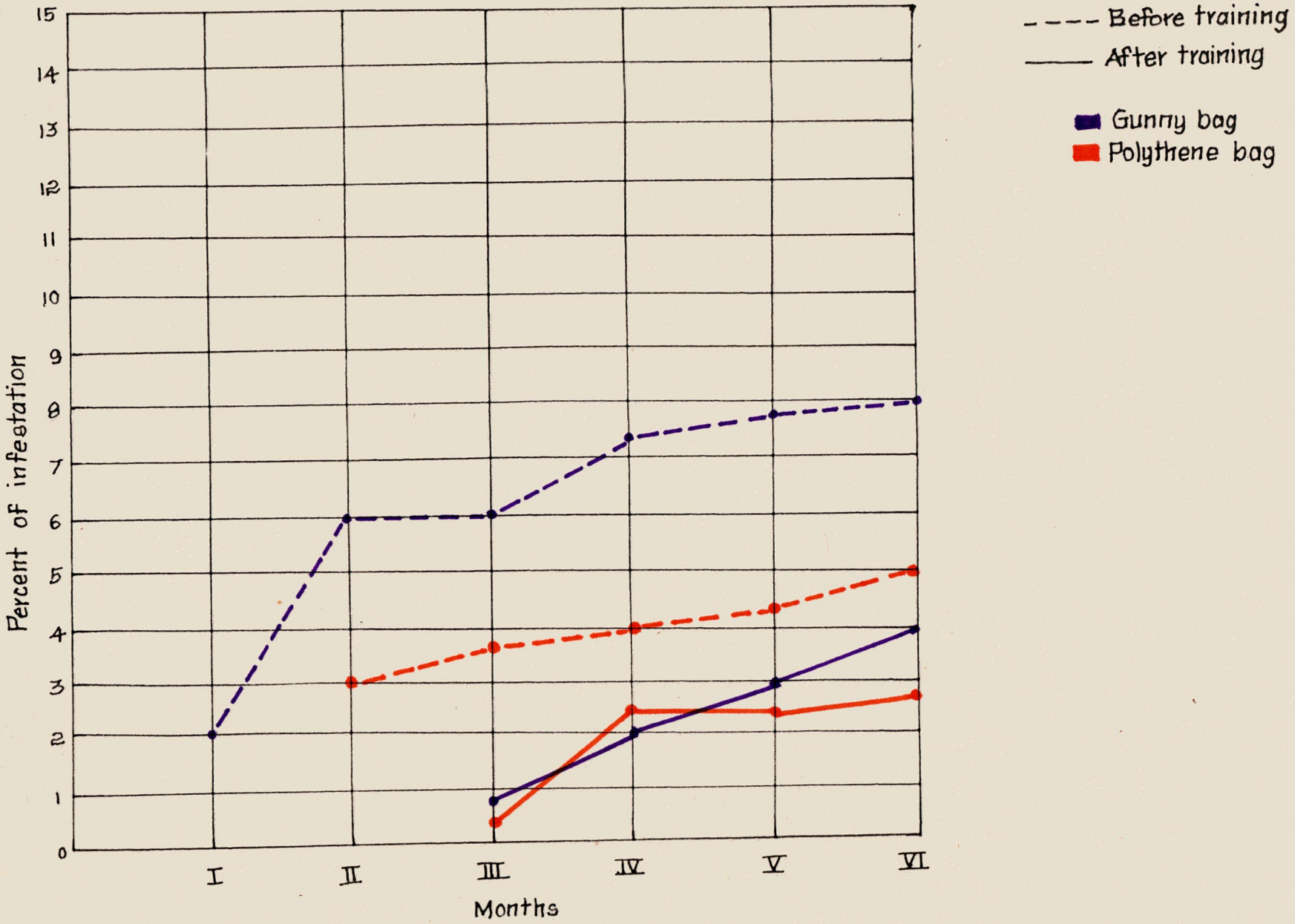


Figure - 4

PERCENTAGE OF INFESTATIONS IN RAGI STORED IN DIFFERENT STORAGE STRUCTURES OVER A PERIOD OF SIX MONTHS

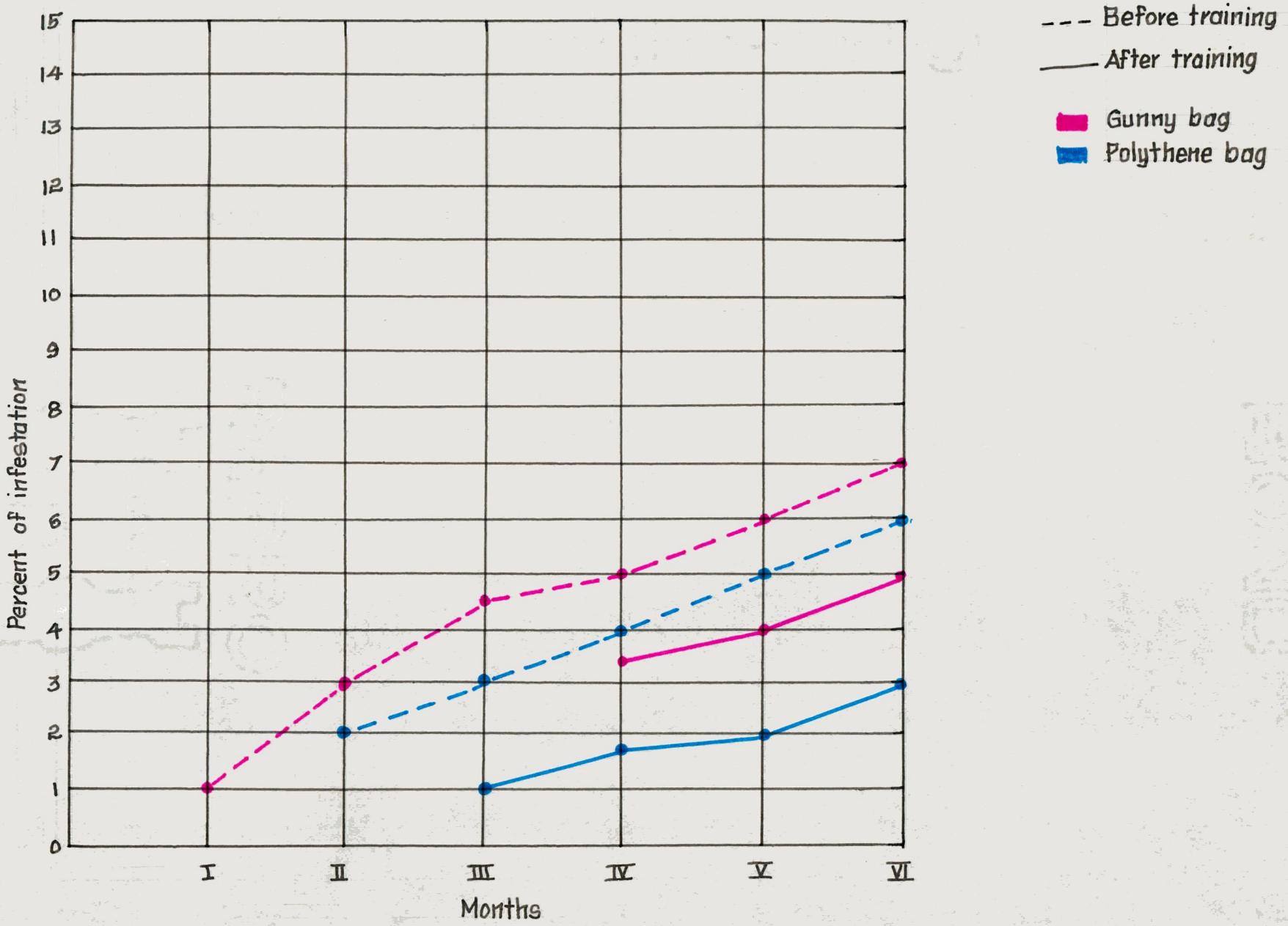


Figure – 5

and V.

Participation in the training programme had favourable effects on the soundness of paddy, jowar and ragi stored. All these grains stored by the non-participants of the training programme was infested more when compared with the paddy stored by the participants of the training programme. The participants were able to decrease of weevilization through scientific storage method such as dunnage white washing and fumigation. Compared to other structures metal bin for paddy and gunny bags for ragi and Jowar was found to be the best storage structures. The weevilization was observed in this structure after six months the infestation was 1.5 per cent in paddy, 1.5 per cent jowar and 3 per cent in ragi.

C. Amount of foodgrains saved per cropping.

The money conserved through the adoption of scientific storage practices among the selected households per cropping was calculated using the quantification formula.

Quantification formula was arrived, after ascertaining from the farmers the amount of grain eaten by rats and the amount of grain saved by fumigation.

Quantification formula for calculating the among of grain saved and the money equivalent to the total amount saved are give below.

1. Household rat control : Total number of dead rats X 4 kg (per dead rat)

2. Fumigation = Quantity saved = 10 per cent of the total quantity fumigated

Value : Rs. 500/- Quintal (Existing cost of paddy per quintal)

Value : Rs. 400/- Quintal (Existing cost of jowar per quintal)

Value : Rs. 350/- Quintal (Existing cost of Ragi per quintal)

1. Details of home level rodent control in selected households:

In the selected households the common practice of grain storage at home level was found to be in gunny bags and polythene bags. The gunny bags are usually more prone to damages due to rats bitting while making an attempt to enter the bags. The rats damage the grains by passing urine, shedding hairs thereby making the food grains unfit and unpalatable for human consumption.

Details of home level rodent control in selected households.

Table XIV depicts the details of home level rodent control in selected households.

TABLE XIV

DETAILS OF HOME LEVEL RODENT CONTROL IN SELECTED HOUSEHOLDS

Type of farmers	Number of dead rats noticed	Quality of Grain saved (quintal)			Money value of the grain saved (Rupees)		
		Paddy	Jowar	Ragi	Paddy	Jowar	Ragi
Marginal (N=24)	15	0.6	0.6	0.6	300	240	42
Small (N=24)	24	0.96	0.96	0.96	480	384	67
Large (N=24)	32	1.28	1.28	1.28	640	512	90
			Total		**1420**	**1136**	**199**

Rodent control through the adoption of scientific storage. Practices was found to be effective which in turn raised the qunitals of grains and money among, large farmers followed by small and marginal farmers.

ii. Fumigation of food grains in selected households:

Fumigation is one device which is used for pest control during storage of grains. By using this device many qunitals of grains are saved, and the saving effected by this method is shown in Table XV

This special method of fumigation was demonstrated by the investigator. First the chemical was obtained with special permission and assistance from the Joint Director of Agriculture and given to the farmers. The chemical celphos (1 tablet : 3 gms) was kept on bags by the investigator herself.

TABLE XV

FUMIGATION OF FOOD GRAIN IN SELECTED HOUSEHOLDS

Type of Farmers	Quantity of grain fumigated (Quintal)	Quantity of Chemicals used(celphose) in gms.	Quantity of grain saved (Quintal)	Money value for the grain saved (Rupees)
PADDY :				
Marginal N = 24	15	45	0.15	75
Small N = 24	90	90	0.30	150
Large N=24	50	50	0.50	250
Total			0.95	475
JOWAR:				
Marginal	2	6	0.02	8
Small	5	15	0.05	20
Large	7	21	0.07	28
Total			0.14	56
RAGI				
Marginal	5	15	0.05	3.5
Small	10	30	0.10	7.0
Large	12	36	0.12	8.4
Total			0.27	18.9
Grand Total			1.36	550.0

From Table XV it is inferred that fumigation method is one of the effective method of protecting and saving the food

grains. The table values also imply that 1.36 quintal of grains was saved per cropping. Money value for the saved grain was Rs. 550.

iii. Amount of food grains saved and the money value per cropping.

The money saved through the adoption of scientific storage practices among the selected households was calculated and presented in Table XVI and figure VI.

TABLE XVI

AMOUNT OF FOOD GRAINS SAVED AND THE MONEY VALUE PER CROPPING

S.No.	Type of farmer	Methods adopted			
		Rodent control home level (Quintal)	Fumigation of food grain (Quintal)	Total amount of food grains saved (Quintal)	Money value for the saved grain (Rupees)
1.	Marginal	15	22	2.02	669
2.	Small	24	45	3.33	1108
3.	Large	32	69	4.53	1528

AMOUNT OF FOOD GRAINS SAVED AND THE MONEY VALUE PER CROPPING

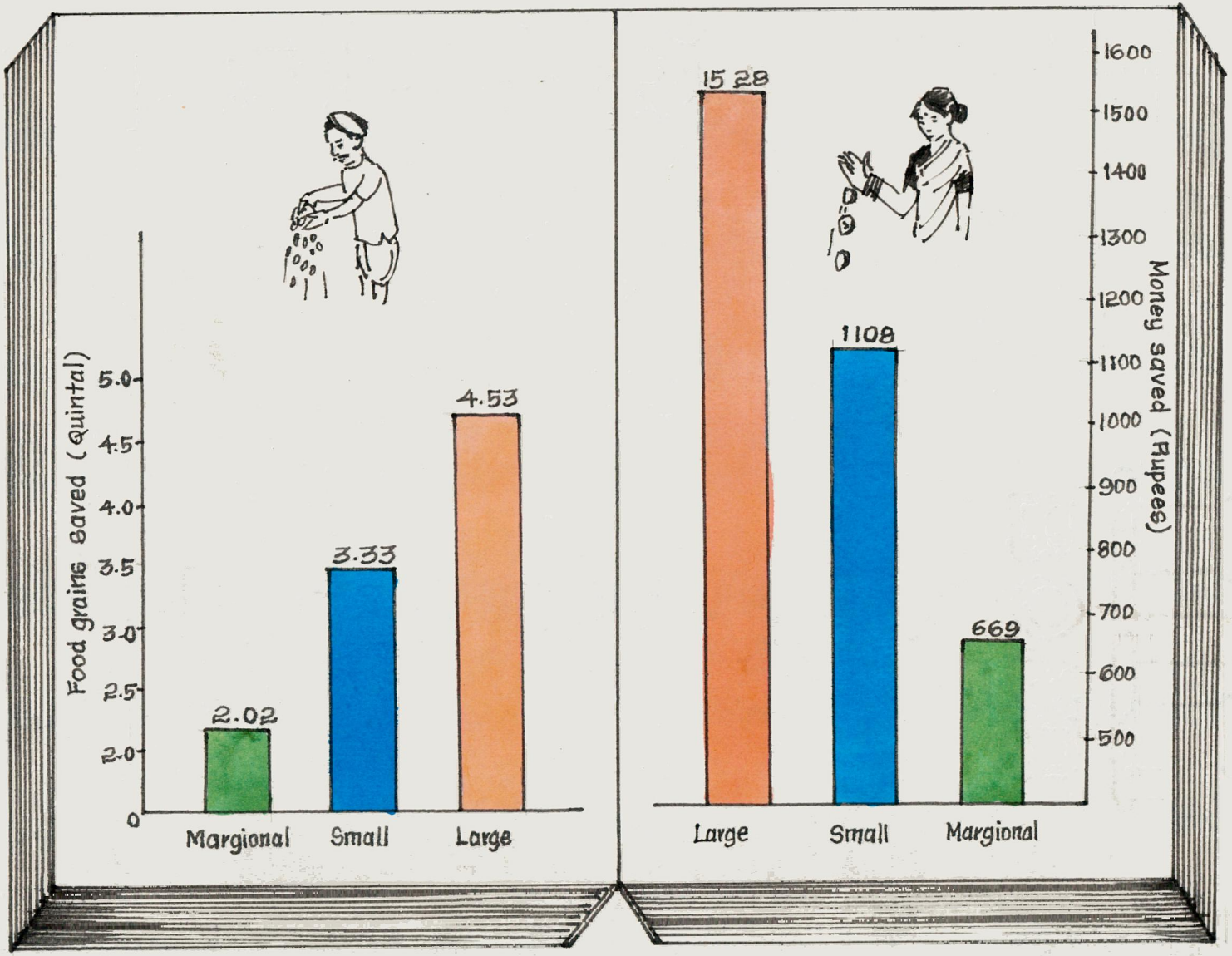


Figure - 6

After the training, the farmers were given Roban Aluminium phospide and zinc phosphide to control rat and fumigation to control insects in stored food grains. The other farm families also were motivated to use rat control and fumigants.

As a result of the selected farm households a marginal farmer saved on an average Rs. 669/- as against Rs. 1,528/- saved by large farmers whereas the small farmers, saved upto Rs. 1108/- per cropping. If farmers continue to adopt such practices, large amounts of grains produced could be saved.

Summary and Conclusion

V. SUMMARY AND CONCLUSION

The study on "Introducing Scientific Techniques for Efficient Storage Practices" was undertaken withthemain objective of minimizing food grain losses during storage for improving the quality of food, food security and economy through imparting training to the farmers. To conduct the study three villages in Thondamuthur Block were selected, viz Kaliannanputhur, Vandikkaranur, Valayapalayam of Coimbatore District. Using purposive sampling technique, the samples for the study were selected. Eight farm households from each level of land holding - marginal, small and large - were selected which Constituted a total of 72 households from all the 3 villages taken together.

A household survey was conducted through inteerview method using a pre-structured schedule to identify the different kinds of storage practices followed and the problems encountered during storage. Based on the data collected, the trainig curriculum was formulated to impart knowledge on scientific storage practices. Training was given to 72 farmers from 3 villages.

Training was given for a period of three days, at the local school in Vandikkaranur. Training programme included lectures, participatory discussions, demonstrations,meetings and exhibitions. The visual aids used were charts, posters and Booklets.

The impact of the training progoramme was evaluated with the help of an evaluation schedule which was administered before and after the training programme. Salient features of the evaluation are presented below:

1. Fifty four per cent and forty two per cent of the small and marginal farmers were educated upto secodary level while four per cent and 13 per cent were educated upto Post Graduate level.

2. Agriculture was the main occupation among cent per cent of the large famrers, 89 per cent of small farmers and 77 per cent of marginal farmers.

3. Ninety-six per cent and sixty- three per cent of the dry land and garden land respectively were owned by large farmers while marginal and small farmers respectively had eighty-three per cent and eighty-eight per cent of dry land.

4. The annual income was above Rs. 10,000/- for 87 per cent of large farmers, while fifty-seven per cent of marginal and small farmers had an annual income of Rs.3,000/- - 4,000/- and Rs.6,000/- - 7,000/- respectively.

5. Cent per cent of the large farmers cultivated paddy among cereals as against 58 per cent of the marginal farmers. Among pulse varieties, cow Pea (50 per cent) and greeengram (42 per cent) were the major crops cultivated by the marginal farmers. Greengram and blackgram by the small and large farmers.

6. Paddy was cultivated yearly twice by 72 per cent of the large, 39 per cent of the small and 21 per cent of the marginal farmers. Pulse varieties, nuts and tubers were cultivated only once a year by all the marginal, small, large farmers to poor water facilities.

7. The large farmers cultivated mere than 40 bages of paddy, turmeric and groundnut while the marginal and small farmers cultivated from 10-20 bags.

8. All the small farmers stored the crops like paddy, ragi, Jower, bajra, pulses and nuts mainly for the purpose of food and seed. Large farmers stored all types of crops except ragi, maize and turmeric mainly for marketing purposes, whereas marginal farmers stored the food grains for consumption only.

9. Ninety one per cent of the marginal farmers stored seven to nine bags of paddy, whereas cent per cent of small and large farmers stored more than 10 bags. The amount of pulses and nuts stored is not noticeable when compared to cereals among all groups of farmers. The reason may be attributed to the fact that these pulses are easily invaded by insects and therefore need fumigation. As it is difficult for the farmers to fumigate them, they did not want to take any risk to store large quantity of pulses and nuts.

10. All types of farmers stored their food grains up to 9 - 12 months. More than 65 per cent of the farm families stored their food grains in gunny bags followed by polythene

bags.

11. Sun drying was the Popular method used by all types of farmers irrespective of the crops. Among the cereals, paddy was treated with neem leaves by majority of marginal farmers, (78 per cent). Moist red soil was coated over pulses, by 19 per cent of large farmers and 11 per cent of the small farmers for protection.

12. Ninety - two per cent, 78 per cent and 42 per cent of large, small and marginal farmers respectively had problems due to rodents. Seventy-eight of marginal, 54 per cent of small and 30 per cent of large families had prblems due to moisture and insects.

13. Participation in the training programme helped the homemakers to gain knowledge on scientific storage practices such as using polythene sheet, 'dunnage', rat proofing, chemical control of rats, fumigation and the use of metal bins and 'Puccakothi'. 27 per cent of marginal, 28 per cent of small and 37 per cent of large farmers started using metal bins after the traing programme. The improved scientific storge structure for storing the food grains. As a result, the losses of food grains were minimized by all types of farmers. 5-10 per cent of foodo grains was saved from insects, 3-4 per cent from rodents and 1-2 per cent from moisture.

14. Percentage of sound foodgrains was found to be less

among the non-participants of the training programme. They used gunny bags and 'mud kudir' to store grains which always caused more weevilization in paddy, while the participants were able to decrease the amount of Weevilization through the practice of scientific storage methods such as 'dunnage' and fumigation. Of all structures, metal bin was found to be the best storage structure. The weevilization observed in this structure after six months was 1-5 per cent.

15. Through adoption of scientific storage practices a marginal farmer was able to save per cropping an avderage of Rs.669/- as against Rs.1528/- by large farmers and Rs.1108/- by small farmers.

This study reveals the fact that the training had a dramatic and favourable effect on the farmers who in turn will educate the community on scientific storage practices.

Recommendations emerging out of this study are the following:

1. Atleast one 'storage centre' for each village or Panchayat union could be developed where all the storage operations can be done. All essential requirements like small size dryers, cleaning machine, weighing scale, 'dunnage', Polythene covers, insecticides (chemicals) and temporary storage can be provided to this 'storage centre' which could be of great help the marginal and small farmers.

2. Short term training courses on 'Scientific storage Practices" could be organised for the benefit of the local farmers, in the Panchayat Union by trained agriculturists.

3. Improved storage structures such as metal bins and 'Pucca Kothi' need to be popularised through wider publicity by the concerned extension agencies.

4. The Government can help the marginal farmers by providing 50 per cent subsidy for buying metal bin and constructing 'Pucca Kothi'.

5. Research on improved scientific storage practices so as to minimise the food grain losses could be encouraged. Studies should be implemented in all agricultural productive areas to improve the awareness and importance of scientific storage practices.

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Appendices

APPENDIX I

AVINASHILINGAM INSTITUTE FOR
HOMESCIENCE AND HIGHER EDUCATION
FOR WOMEN (DEEMED UNIVERSITY)
COIMBATORE - 641 043.

INTRODUCING SCIENTIFIC TECHNIQUES FOR EFFICIENT
HOME STORAGE PRACTICES

1. Name of the Interviewee :

2. Name of the Interviewer :

3. Name of the head of the family :
Education :
Occupation :
Annual income from farming :
Address :

ii) Size of land holding :

S.No.	Type of Land	Size in Hectares	Total
1.	Dry Land		
2.	Wet Land		
3.	Garden Land		

iii) Types of crops cultivated:

	(FREQUENCY OF CULTIVATION)
a) **CEREALS**	
Paddy	( )
Ragi	( )
Jowar	( )
Bajra	( )
Maize	( )
Others	( )
b) **PULSES**	
Green gram	( )
Red gram	( )
Black gram	( )
Bengal gram	( )
Cowpea	( )
Others	( )
c) **NUTS AND OIL SEEDS**	
Groundnut	( )
Gingelly seeds	( )
Coconut	( )
Others	( )

d) **TUBERS**

Turmeric	( )
Tobacco	( )
Others	( )

IV. **QUANTITY OF FOODGRAINS PRODUCED PER CROPPING**

S.No.	NAME OF CROPS	QUANTITY PRODUCED PER ACRE	QUANTITY STORED (IN BAGS)	QUANTITY SOLD (IN BAGS)

V. **STORAGE PRACTICES**

S.No.	NAME OF THE GRAIN STORED	DURATION	STORAGE STRUCTURE USED	PROBLEM DURING STORAGE	METHODS OF TREAT-MENT	EFFEC-TIVE-NESS

Are you aware of improved grain storage practices?

Yes No

If yes what are they?

a) Dunnage

b) White washing the walls

c) Applying dark paint on the walls

d) Metal Bins

e) Pucca Kothi

f) Chemical Treatment

B. Sources of information gained

a) Training

b) Demonstration by experts

c) Radio

d) Television

e) News Paper

f) Others

C. Do you put them in practice?

Yes No

If yes, in what way have you been practicing?

S.No	Aspects	Yes	No
1.	Scientific storage practices		
	a) Dunnage		
	b) White Washing		
	c) Dark Paint		
	d) Metal Bin		
	e) Pucca Kothi		
2.	Chemical Treatment		
	a) Pesticides		
	b) Insecticides		
	c) Fumigants		

VI. Have you undergone any training programme in storage practices?

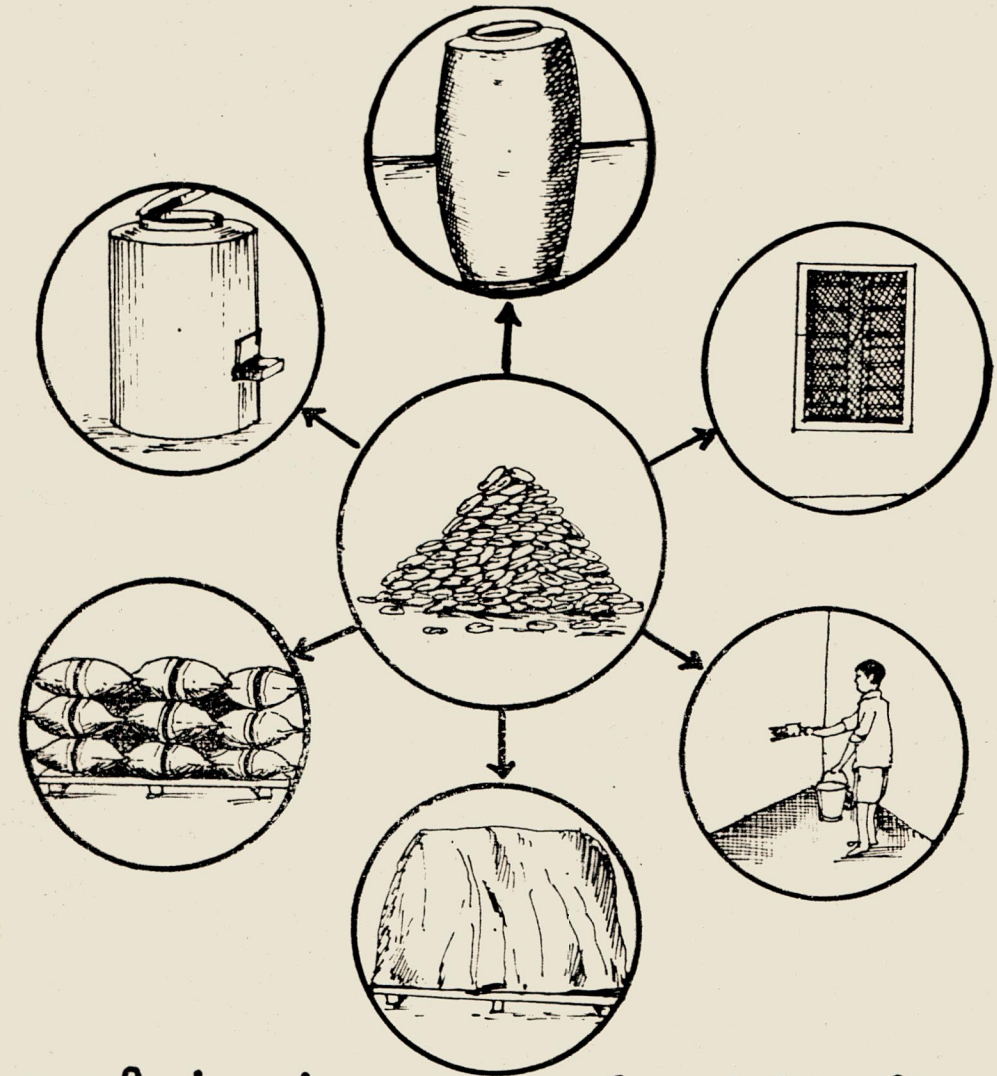
Yes No

VII. If training is conducted, would you like to participate and benefit from it?

Yes No

VIII. Are you aware of improved preservation practices?

Yes No



கானியத்தைப் பாதுகாக்க சில முக்கிய குறிப்புகள்

இரா. கீதா

அவினாசிலிங்கம் மனையியல் பல்கலைக்கழகம்

தானியத்தைப் பாதுகாத்த சில முக்கிய குறிப்புகள்

நெல் நமது நாட்டின் முக்கிய பயிராகும். நம் நாட்டிலுள்ள கோடிக்கணக்கான மக்களுக்கு அரிசி தான் முதன்மையான உணவாகப் பயன்படுகின்றது. மற்றும் பல்லாயிரக்கணக்கான விவசாயிகளுக்கும் அவர் தன் வாழ்வின் உயிர்நாடியின் உறைவிடமாய்த் திகழ்வதும் அரிசிதான்.

1. உலகத்திலுள்ள மக்கள் தொகையில் 50% சதவீதம் பேருக்கு அரிசிதான் முக்கிய உணவு.

2. உலகத்தில் மொத்தம் உற்பத்தியாகும் நெல்லில் 5-ல் 1 பங்கு நமது நாட்டில் விளைகிறது.

3. உலகில் மொத்தம் 7 ஆயிரம் நெல் வகைகள் உள்ளன. அவற்றில் 4000 வகைகள் நமது நாட்டில் பயிரிடப்படுகின்றன.

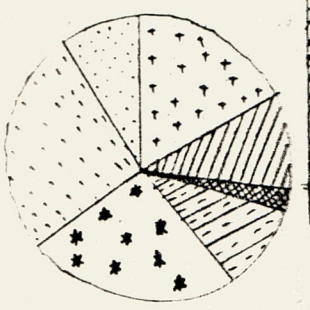
4. 40 கோடி இந்தியர்கள் அரிசி சாப்பிடுபவர்கள். இதில் புரதச்சத்து, பாஸ்பரஸ், இரும்பு மற்றும் சுண்ணாம்புச் சத்து உள்ளன. மேலும் வைட்டமின் 'B' தேவையான அளவு உள்ளது. அரிசி ஒரு சிறந்த ஊட்டச்சத்துள்ள உணவாகும்.

"உழுதுண்டு வாழ்வாரே வாழ்வார்
மற்றெல்லாம் தொழுதுண்டு பின் செல்பவர்".

என்ற வள்ளுவரின் குறளுக்கு ஏற்ப நம் நாட்டில் உழவுத் தொழில் இல்லாவிட்டால் உயிர் வாழ முடியாது. விவசாயி தன் கிறன் அனைத்தும் கொடுத்து பயிர் செய்து உற்பத்தி செய்கின்றான். ஆனால் அவனது உழைப்பின் பயனை நெல் மற்றும் தானியங்களின் கொடும் விரோதிகளான எலிகள் பெறிச்சாளி, புழு, பூச்சிகள் முதலியன நுகரவிடுவதில்லை.

விவசாயிகளின் கடும் உழைப்பால் விளைந்த தானியத்தில் 10-ல் 1 பகுதியை இந்தப் பகைவர்கள் உண்டு விடுகிறார்கள். உழுதவனுடன் பலரும் விளைந்த தானியத்தில் தங்களுக்கு தேவையான அளவைப் பெற முடிவதில்லை.

மொத்தமாக விளைந்த தானியம் பலவிதமான காரணங்களால் பத்தில் சதவீதம் சேதம் அடைகின்றது.



புழுப்பூச்சிகள்	2.55%
எலிகள்	2.50%
நெல் அடித்தல்	1.68%
சுத்தப்படுத்துதல்	0.92%
ஈரப்பதம்	0.68%
பறவைகள்	0.85%
போக்குவரத்து	0.15%
	9.33%

இந்த இழப்பு பயிர் தொழில் செய்பவனுக்கு மட்டும் மல்லாமல் இந்நாட்டிற்கே ஒரு போராட்டமாகும். நெல்லை சரியான முறையில் பாதுகாத்து காக்காததாலும் அதனைக் காக்க வேண்டிய சரியான ஏற்பாடுகள் செய்யாததாலுமே இப்படி இழப்புகள் நேருகின்றன.

நாம் உற்பத்தி செய்யும் தானியத்தில் 100 கிலோவிற்கு 5 கிலோ வீதம் நாம், சேமித்து வைக்கும் போது சேதம் அடைகின்றது. எல்லாவற்றையும் மொத்தமாகப் பார்க்கும் போது ஒவ்வொரு ஆண்டும் 3 மில்லியன் டன் தானியம் சேதம் அடைகிறது. எனவே சுமார் 13 கோடி ரூபாய் இந்த சேதத்தால் நஷ்டம் ஆகிறது.

சேர்த்து வைக்கும் போது இப்படி சேதம் அடைவதற்கு முக்கிய காரணம்.

1. சேர்த்து வைப்பதற்கு ஏற்ற சாதனம் நன்றாக இல்லாததினால்.

2. ஈரப்பதம், தட்பவெப்ப நிலை மாறி, மாறிக்கொண்டு இருப்பதால்.

3. புழு பூச்சிகளினாலும், எலிகளினாலும்.

4. போதுமான நவீனமான சேமிப்பு முறைகளைப் பற்றி தெரிந்து கொள்ளாததால்.

சேதாரம் ஏற்படக் காரணங்கள்

நாம் தானியத்தை சேமித்து வைப்பதற்கு வீட்டில் ஒரு அறையையோ அல்லது குதிர்களையோ, கோணிப்பைகளையோ பயன்படுத்துகின்றோம். அறையானது எப்பொழுது வெப்பமாகவும், குளிர்ச்சியாகவும் மாறும் தன்மையுடையது. அப்படி அடையும் போது தானியம் சேதம் அடைகின்றது. அத்துடன் தரையில் ஈரப்பதம் ஏற்படும் போது ஒன்றுடன் ஒன்று சேர்ந்து கேக்காக மாறி நாம் சாப்பிடுவதற்கு பயன் அற்றதாகி விடுகின்றது. அதோடன் அதில் அடங்கியுள்ள சத்துக்கள் அனைத்தும் சேதம் அடைந்து விடுகின்றன. இதை நாம் சாப்பிட்டால் நம் உடல் நிலையும் பாதிக்கப்பட்டு நோய்களும் ஏற்படுகின்றன.

குதிர்களில் நாம் சேமித்து வைக்கும் போது பூழுப்புச்சிகள் ஏற்படுவதற்கு அதிகமான வாய்ப்புகள் உள்ளன. கோணிப் பைகளில் சேமித்து வைக்கும் போது பூழுப்புச்சிகளினாலும், எலி-களினாலும் அதிகம் சேதம் அடைகின்றது.

ஈரப்பதம் :

நாம் சேமித்து வைக்கும் தானியம் ஈரப்பதம், வெப்பத்தின் மூலம் அதிகம் பாதிக்கப்படுகின்றது. சேமித்து வைக்கும் தானியத்தில் நெல்லிற்கு தேவையான ஈரப்பதத்தின் அளவு 13%, கோதுமைக்கு தேவையான

ஈரப்பதத்தின் அளவு 12% ஆகும்.

இவற்றைவிட அதிகம் இருந்தால் புழு பூச்சிகள் பூஞ்சைக்காளான் ஏற்படுகின்றது. இவற்றால் தானியம் பொரிதும் பாதிக்கப்படுவதோடு அவற்றை விதையாகவோ, உணவாக உண்பதற்கோ பயன்படாமல் சேதம் அடைகின்றது.

புழுபூச்சிகள் :- தானியத்தை பலவிதமான புழுபூச்சிகள் தாக்குகின்றன. குறிப்பாக

1. அரிசி வண்டு
2. துளை வண்டு,
3. பருப்பு வண்டு
4. காப்ரா வண்டு
5. ரம்பப்பல் வண்டு
6. சிவப்பு மாவு வண்டு அதிகம் காணப்படுகின்றன.

புழு பூச்சிகள் தானித்தை சாப்பிடுவதோடு மட்டுமின்றி அவற்றின் மீதியை நாம் உண்பதற்கு லாயக்கற்றதாக்கி விடுகின்றன. புழுபூச்சிகள் ஏற்படுவதற்கு காரணம் ஈரப்பதமும், வெப்பமுமே ஆகும். ஈரமும் வெப்பமும் அதிகம் ஆகும்போது புழுபூச்சிகள் அதிகம் உற்பத்தி ஆகின்றன. ஈரமான தானியம் மென்மையாக இருப்பதால் பூச்சிகள் அவற்றை எளிதில் தாக்குகின்றன. ஈரமான தானியத்தைச் சேமித்து வைப்பதால் பூஞ்சைக்காளான் வளர்வதற்கு மிகவும் ஏதுவாக இருக்கும்.

இதனால் தானியம் முழுவதும் கெட்டுவிடும் இவ்விதம் பாழான தானியம் மனிதனுக்கு மட்டுமின்றி கால் நடைகளுக்கும் பயன் அற்றதாகிவிடும். இப்படிப்பட்ட தானியத்தை நாம் விற்கவும் முடியாது.

எலி : அதிக அழிவு செய்யும் உயிரினம்

இந்தியாவில் மக்கட் தொகையை விட, 6 மடங்கு அதிகமாகப் பெருகியிருக்கும் ஒரே இனம் எலி இனம். ஒரு மனிதன் உண்ணும் உணவின் அளவை சுமாராக ஆறு எலிகள் உட்கொள்கின்றன.

எலிகளினால் தானியத்தில் ஏற்படும் சேதாரங்கள்

எலிகள் உணவு தானியத்தை உண்பதைவிட அவற்றின் கழிவுப் பொருட்களால் பல்த மடங்கு கெட்டுப் போகிறது. எலிகள் வீட்டில் உள்ள தானியங்களையும், மற்ற பொருட்களையும் விதைகளையும், நாற்றுக்களையும், புழுங்களையும், காய்களையும் அழித்த சேதம் விளைவிக்கின்றன.

இப்படிப்பட்ட தொல்லைகளில் இருந்த நாம் தானியத்தை பாதுகாப்பதற்கு சில வழிமுறைகளை கையான வேண்டும். இது ஒவ்வொரு விவசாயக் குடும்பத்தின் கடமை ஆகும். அவற்றில் மிகவும் முக்கியம் வாய்ந்த ஐந்து பொன்னான வழிமுறைகளை பார்ப்போம்.

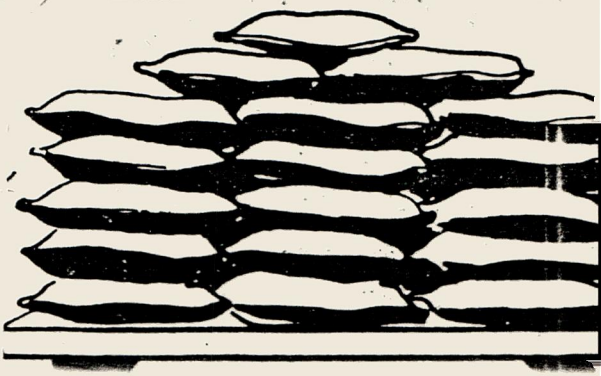
ஐந்து பொன்னான வழிகள் :

1. அறுவடைக்குப் பின் நெல்லில் ஈரம் அதிகமிருக்கும். சேமிப்பு உறையில் இடுமுன் நெல்லை மிதமான சூரிய ஒளியில் உலர்த்த வேண்டும். கடும் வெயிலில் உலர்த்தினால் அரிசியின் தன்மையை பாதிக்கும். தானியம் நொறுங்கி விடும்.

தானியம் நன்றாக இறுகும்வரை உலர விடவேண்டும். தானியங்களை உலர்த்துவதற்கு பல இயந்திரங்கள் கூட இப்போது உள்ளன. அவற்றை எல்லாம் பயன்படுத்தி தானியத்தை நன்றாக உலர வைக்க வேண்டும்.

2. தானியங்களை மூட்டைகளில் சேகரிக்கையில் தரை ஈரம் தானியத்தை பாதிக்காமல் இருக்க, மூட்டைகளின் கீழ்க் கம்புகளை, மரக்கட்டைகள் அல்லது மூங்கில் பாய்கள் அல்லது பாலித்தின் விரிப்புகளை பயன்படுத்த வேண்டும். இவற்றின் மூலம் தரையிலிருக்கும் ஈரம் தானியத்தை பாதிக்காமல் பாதுகாக்கலாம்.

3. உங்கள் தேவைக்கேற்ப தானியக் கிடங்கு கட்டுங்கள்.



வீனமான கிடங்குகளில் ஈரப்பசை பிடிக்க முடியாது. எலிகளால்
ற்படும் நாகமும் இருக்காது. தானியத்தை சேமிக்கும் முன்
கிட்டங்கியை பரிசோதிக்கவும். சுத்தப்படுத்தவும், கீரல்களை
டைத்து, வெள்ளையடிக்கவும், புழுபூச்சிகள் ஏற்படாமல் பார்த்துக்
கொள்ள வேண்டும். கிடங்குகளில் எலிகளால் ஏற்படும் தொல்லை
போக்குவதற்கு ஐன்னல்களுக்கு கம்பிவலைகளை பொருத்துங்கள்.

. சிமெண்ட் கான்கீரிட், கல்நார், அலுமினியம் அல்லது உலோகக்
தீர்களில் உலர்ந்த நெல்லை சேமித்து வைக்கலாம். இதனால்
தீர்களுள்ள நெல்லை புழுபூச்சிகள், பறவைகள், எலிகள், ஈரம்
மற்றும் பூஞ்சைக்களான் ஆகியவை தாக்கமுடியாது. உன் கொள்ளக்
டிய ஒரு உலோகக் குதிரின் விலை கிட்டதட்ட ரு.350/- ஆகும்.
க்குதிர்களில் சேமித்து வைக்கப்பட்டிருக்கும் தானியங்கள் தங்களுடைய
ட்டச்சத்தைத் திறனை இழப்பதில்லை. மற்றும் தீ விபத்துக்கான
பாயமும் இதில் குறைவு. சேமிப்பு அறையையும் உலோகக் குதிரையும் மிக
கவும் கவனமாகப் பாதுகாத்தல் அவசியம்.

. நெல்லைச் சேமிக்கும் அறையில் இடுமுன், அதை மாலதியான்
:100 என்ற விகிதத்தில் நீருடன் கலந்து அக்கலவையை 100 சதுர
ட்டருக்கு 3 லிட்டர்
தம் தெளிக்க வேண்டும்.
ாக்கு பையை உபயோகிக்-
ம் முன்பு மாலதியான்
ரவத்தில் நனைத்து பின்பு
ாய வைத்து புழுபூச்சிகள்
ராமல் தடுக்கலாம்.

உலோகக் குதிர்கள்

6. ஈடிபி மருந்தின் மூட்டத்தைக் கொண்டு, பூச்சிகள் பரவுவரை தவிருங்கள். தானியம் கிட்டங்கியில் இருக்கும்போது புகைமூட்டம் செய்ய தானியம் கிட்டங்கியில், கிட்டங்கியைக் கவனித்து வரவும். பூச்சிகளேதுமிருந்தால், மீண்டும் புகை மூட்டமிடுங்கள்.

7. எலிகளைக் கட்டுப்படுத்தும் முறைகள் :

வீடுகளிலும், கடைகளிலும், முக்கியமாக வயல்வெளிகளில் விடாப்புகை நடவடிக்கை எலிப்பொறிகளை உபயோகிக்கலாம். எலிகளை ஒழிக்கும் பணிக்கு இவற்றின் உபயோகம் துணை செய்யும், பொறியில் பிடிபடும் எலிகளை அப்படியே விட்டுவிடாமல் நீரில் அமிழ்த்திக் கொ பின்னர் புதைத்துவிட வேண்டும். எலிப்பொறிகளை மீண்டும் உபயோகிக்கும் முன் அவற்றை சோப்பும், சுடுநீரும் கொண்டு நன்றாக கழுவவும். பொறியில் நாற்றம் இருந்தால் எலிகள் அவற் அருகில் அண்டாமல் போகலாம்.

இராசயன மருந்துகளைப் பயன்படுத்தியும் நாம் எலிகளை கட்டுப்படுத்தல் அவை :

1. ரோபான் புரோமோடியலோன் 0.005% என்ற விகிதத்தில் விடாம் கலந்த மருந்தை, உடனடியாக உபயோகித்த தருந்தல. இந்த கேக்கை உண்ட பின் எலிகளை இரத்த நாளங்கள் வெடித்து மெல்ல இறந்து விடும். (எலிகளை மட்டுமே கொல்லும் வளர்ப்புப் பிராணிகளை அல்ல).

ஹண்டிகோஸ்ல்ன்ட்ஸ் - தயாரிக்கும் விதம் :

உலர்ந்த நிலையிலுள்ள 0.5% அடர்த்தியான பாஸ்தாவத்தின் ஒரு பாகத்துடன், மாவு அல்லது பொடி செய்யப்பட்ட தானியம் போன்ற உலர்ந்த உணவுப் பண்டங்கள் 19 பாகமும், சிறிதளவு சமையல் எண்ணெய்யும் சேர்த்துக் கொள்ள வேண்டும். இரை சுவையாக இருக்கும் பொருட்டு, சிறிதளவு வெல்லம் அல்லது சர்க்கரை கலந்து, கலவையை நன்றாக கலக்க வேண்டும். இந்த மருந்துக் கலவையை அப்படியே எறிகள் அதிகம் நடமாடும் இடங்களில் பயன்படுத்தலாம்.

நீரில் கரைக்கக் கூடிய கலவை :

0.5% கலவையின் ஒரு பாகத்தை 19 பாகம் தண்ணீரில் கலந்து கொள்ள வேண்டும். (ஒரு லிட்டர் தண்ணீரில் எறக்குறைய ஒரு டீஸ்பூன்) இந்த கலவையை நன்றாகக் குலுக்கவும்.

பயன்படுத்தும் விதம் :

தயாரிக்கப்பட்ட கிடை இரையையோ, அல்லது அப்படியே பயன்படுத்தக் கூடிய தயார் நிலையிலுள்ள இரையையே, குறிவான பாத்திரங்களில் எறிகள் நடமாடும் பகுதிகளில் ஆங்காங்கு வைக்கவும். ஒவ்வொரு பாத்திரத்திலும் 200 கிராம் இரை வைக்கலாம். இந்த மருந்து இடங்களுக்கும், எறித் தொல்லைகளுக்கும்

தகுந்தவாறு இரைகளைப் பல இடங்களில் வைத்தல் அவசியம்.

கிட இரையைப் போலவே, கிரவ இரையையும் குழிவான பாத்திரங்களில், ஒவ்வொரு பாத்திரத்திலும் ½ (கால்) லிட்டர் வீதம், எலி நடமாட்டமுள்ள இடங்களில் வைத்தல் வேண்டும். இரைவைத்த அளவு குறைந்திருந்தால், எலி நடமாட்டம் இருப்பதை கிட்டும். எனவே, எலி மருந்து இரையினை மீண்டும் நிரப்புதல் அவசியம்.

3. அலுமினியம் பாஸ்பைடு :

வர்த்தக பெயர்கள் :

அலுமினியம் பாஸ்பைடு மாத்திரைகள் இந்தியாவில் கற்போ செல்டாக்ஸ், பாஸ்ப்ரூம், டெக்ஹியா, க்விக்பாஸ் போன்ற வர்த்தகப் பெயர்களில் வெவ்வேறு நிறுவனங்களினால் தயாரிக்கப்பட்(கிடைக்கின்றன.

உபயோகிக்கும் முறை :

வயல்களில் அலுமினியம் பாஸ்பைடு மாத்திரைகளை உபயோ -கும் முதல் நாள் மாலை ஒரு குறிப்பிட்ட பரப்பளவு உள்ள வயலில் எல்லா எலி வளைகளையும் மண்கொண்டு மூடிவிடவேண்டும். மறுநாள் காலை இவ்வளைகளைப் பார்வையிடும் போது, கிறந்த

காணப்படுபவை எலிகள் வசிக்கின்றன.என்பதை உறுதிப்படுத்தும். இந்த கிறந்த வளைகளில், ஒரு வளைக்கு இரண்டு மாத்திரைகள் (0.6 கிராம்) வீதம் அடிவரைப் போட்டு ஈரகளின் மண் கொண்டு வளைகளை அடைக்கவேண்டும். மறுதினம் மாத்திரை-யிடப்பட்ட எலி வளைகளைப் பரிசீலித்தல் வேண்டும். இவ்வளைகள் மறுபடியும் கிறந்த காணப்பட்டால், அவற்றில் மேற்கூறிய வண்ணம் மாத்திரைகளை மறுபடியும் போட்டு ஈரகளிமண் கொண்டு அடைக்க வேண்டும்.

வயல்களில் உள்ள வரப்புகளில் காணப்படும் வளைகளையும் மேற்கூறியபடியே மாத்திரையிடும் குழல் சாதனம் கொண்டு உபயோகித்த எலிகளை கட்டுப்படுத்தலாம்.

அலுமினியம் பாஸ்பைடு (3 கிராம்) மருந்த தானியக் கிடங்குகளில் புழுபூச்சிகளைக் கட்டுப்படுத்தவும் பயன்படுத்தப்-படுகின்றன. 1 டன் எடையுள்ள தானியத்திற்கு மருந்துப் புகையிட 2 முதல் 4 மாத்திரைகள் போதும். இம்மாத்திரைகளை தானிய மூட்டைகளின் இடுக்குகளில் வைத்த அவற்றைக் காற்றுப்புகா வண்ணம் பாலிதீன் தாள் கொண்டு மூடி, அதன் விளிம்புகளில் மண் சாற்றைக் கொண்டு பூசிவிட வேண்டும். இம்மாத்திரைகளிலிருந்த வெளிவரும் ∴பாஸ்பின் என்ற விஷ வாயு புழுப் பூச்சிகளைக் கொன்று விடுகின்றன.

நாம் மேற்கூறிய வழிமுறைகளை கையாண்டால் தானியம் வீணாகாமல் தடுக்க முடியும்.

APPENDIX - II

APPENIX III

COURSE CONTENT OF THE THREE DAYS TRAINING PROGRAMME

S.No	DAY	CONTENT	METHODS AIDS USED	VENUE
1.	1	Background on production of Letures using Foodgrains, particularly in Tamil Nadu, need for storage of Foodgrains problems of storage of Foodgrains in Rural Families, loss of Foodgrains due to Physical, Chemical, Biological and Mechanical factors.	lectures using Charts	Vandik-kara Local School
2.	2	Foodgrain losses due to moisture temperature, insects, rodents and the nature of damage and its control measures.	Lectures using Charts,Pamphlets demonstration on control of house hold rats using Chemicals.	Respon-dents houses
3.	3	Methods to prevent control insects of mites, Synthetic insecticides, malathion and fumigants.	Lectures with Pamphlets, demon-stration on fumigation of Foodgrains.	Respon-dents Houses.

APPENDIX IV

SCHEDULE TO TEST THE KNOWLEDGE OF TRAINEES BEFORE AND AFTER TRAINING

1. What are the main causes of grain spoilage?

   Moisture & fungus
   Insects - Pests
   Rodents

2. What are the important points which can help in safe storage of food grain?

   a. Before storage:

   - Storage structure are white washed before storage
   - Cleaning and Plastering of storage unit
   - All the cracks, crevices, holes, existing in the floors, walls, ceiling are closed with cement and levelled permanently

   b. During Storage:

   - Proper stocking of bags to protect grains
   - Stores are kept water proof and moisture proof
   - Using new bags. Disinfecting old bags or dipping in malathion emulsion for 10 minutes and sun drying
   - Do not mix the old grains with new grains
   - Mixing sand ash
   - Mixing of neem leaves
   - Using 810 Powder

   c. After Storage:

   - Doors and windows of storage rooms are kept closed during rainy season
   - Treating the grains with insecticides in case of infestation
   - Making the store air tight

3. Do you know the advantages of safe grain storage?

   - Sound grain for long period
   - No loss in quantity
   - No change in taste and flavour
   - Nutritive value is not degraded
   - Better seed for next sowing
   - Time, energy and money saved

4. What is the effect of insects and mites on grains?

- Quality is changed
- Reduce the quantity
- Makes the grains unhygenic and unpalatable
- Reduce the marketability of grains

5. What are the methods to be followed to save grain from insects and mites?

- Dry the grains properly before storing
- Floor of the store house should be pucca and there should be no leakage during rainy season
- Spread the polythene sheets & dunnage on the floor, while spilling the grains into the gunny bags
- Doors and windows of the store house should be closed during the rainy season

a. List the fumigant for controlling insects:

- Emulsion malathion
- Celphos tablet
- Ethylene dibromide ampules

6. Types of damages to grains caused by rodents:

- Making the grain unhygenic
- Change the quality
- Reduce the quantity
- Reduce the marketability

a. Method of controlling rodents:

- Rat proofing
- Trapping
- Poison

b. Mention the name of poison used for rodent control:

- Aluminium Phosphide
- Roban
- Zinc Phosphide