DEVELOPMENT OF INSTRUCTIONAL PACKAGE IN BIOLOGY FOR PROMOTING VOCATIONAL INTERESTS IN SECONDARY SCHOOL STUDENTS

(An Individual Research Project of SCERT)

Submitted by

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DECLARATION

I, Dr. Bindu S., do here by declare that the project entitled 'DEVELOPMENT OF INSTRUCTIONAL PACKAGE IN BIOLOGY FOR PROMOTING VOCATIONAL INTERESTS IN SECONDARY SCHOOL STUDENTS' is an independent work carried out me under the academic and financial support of SCERT, Kerala. The project report and data will not be published without the permission of SCERT

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Dr. Bindu S

CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

BACKGROUND AND CONTEXT

Education is needed for every human being not only to become literate and a scholar, but also to lead a better and happier way of life. UNESCO (2005) envisages that education should provide the skills for learning to know, learning to live together and learning to be. Education is the primary agent of the transformation towards sustainable development and increasing the people's capacities to transform their vision for society into reality. As a child enters the adolescent stage, he has the desire to achieve self-sufficiency and to be independent like the adults. The objective of complete education for an individual must aim at 'making a living' and also for 'making a life'. Thus viewed, the complete education of an individual involves both vocational and cultural education. The individual must be able to earn a living for leading a civilized life. In Spencer's (1875) view, knowledge is most worthwhile which helps the individual in the process of 'earning a living'. In this sense, 'earning while learning' is a very significant factor of the education system in a country, as it satisfies an important criterion of proper education, viz., development of the individual, which takes place essentially with his own effort and is directed towards the needs of the society.

In the words of Mahatma Gandhi, "True education ought to be for boys and girls a kind of insurance against unemployment." Unfortunately, our school education is still quite bookish and impractical, . with the result that those who graduate are unfit for many jobs - clerical, technical, computer - based, or agricultural. And no subject is studied or taught with enthusiasm or goal-orientation. In most advanced countries in the world, much money is spent on school education. From very early levels, children are given orientation to the practical aspects of life. They learn by doing. This approach to school education equips every student to face life with confidence. Much earlier, Dewey (1916) argued for an 'education through occupations', rather than an 'education for occupations'. Education through occupations would be used as an organising principle through which many subjects could be taught. The 9th Five Year Plan (1997-2002) proposed to establish a closer

link between education and employment. Curricular–reorientation has been recommended to maximise returns through effective linkage with development and employment, by inculcating qualities of self-employment and by introduction of improved practices in agriculture and other rural occupations. The curriculum content or subject matter to be studied should be useful and interesting to the learner and be relevant to the nation's economy. The learning activities accorded by the curriculum should be such that it enables the learner not only to gain mastery of the content, but also develop the skills for facing and tackling the problems in life.

The development of an individual and the progress of a nation depend upon the educational system of that country and the awareness of the people about the system. Many individuals get life confused about the type of job he will pursueor the type of career that suits for him. Some are more confused and wish to have a counsel on the career that is apt for them. It is important that individual realises his innate ability and the job that satisfies his interest.

Through the National Policy on Skill development 2009, India recognised the need for the development of a national qualification frame work that would transcend both general education and vocational education and training. The National Skills Qualifications Framework (NSQF) is a competency-based framework that organizes qualifications according to a series of levels of knowledge, skills and aptitude. These levels, graded from one to ten, are defined in terms of learning outcomes which the learner must possess regardless of whether they are obtained through formal, non-formal or informal learning. NSQF in India was notified on 27th December 2013. Specific outcomes expected from implementation of NSQF include mobility between vocational and general education by alignment of degrees with NSQF, standardised, consistent, nationally acceptable outcomes of training across the country through a national quality assurance framework and Recognition of Prior Learning (RPL), allowing transition from non-formal to organised job market.

VOCATIONAL INTEREST

According to Bingham (1937), *interest* is a tendency to give sustained attention to an activity, be absorbed by it and persist in it because of the satisfaction it yields. Dewey (1937) attributes three meanings to the word 'interest'. The first is the whole

state of active development (one's interest in an occupation, employment, pursuit, business etc.); the second-the objective results that are foreseen and wanted; and third-the personal emotional inclination. In non-technical usage, the terms 'interests' and 'attitudes' refer to rather similar concepts. Interests are attitudes held with respect to objects or classes of objects towards which there is some attraction. Lack of interest is an indication of a negative or unfavourable attitude.

Strong (1943) considers that both attitudes and interests involve acceptance-rejection of stimuli, but along different dimensions; agreement-disagreement for attitudes and liking - disliking for interests. Strong (1949) had been working in the vocational interest area for several decades, had expressed that "*interest* is concerned with activities in which the activity is evaluated in terms of liking - disliking".

Eysenck (1953) pointed out that in contemporary psychology, *'interest'* refers almost exclusively to vocational/occupational preferences of a person. Strong (1955) differentiates between '*interest*' and '*interests*'. He attributes four criteria for 'interest', viz., persistent attention, feeling, activity and direction. In addition to these, 'interests' are also characterised by intensity and duration.

The word 'vocational' is taken to be synonymous with career development and career that simply means a person's occupational history. It denotes a series of related occupations, jobs and positions through which the plans of a person moves. "Vocational interest are one's own pattern of preferences, aptitudes, likes and dislikes, preferred in any manner, wisely or another resources for a given area or Vocation" (Kulshresta, S.P). When asked what field of work he/she prefer to enter, a young person's response incorporates not only his preferences for job activities but also his understandings or misapprehensions about the nature of the employment setting, the likely economic rewards he associates with a given occupation, and the factors relating to the social prestige of various occupations,

Academic achievement and related aspects have influence on the acquisition of interests and attitudes – all of which are beneficial to the individual in the society in which he lives. Vocational guidance is another factor which influences the vocational interests of students. Several researchers have highlighted the

importance of vocational guidance for developing vocational interests in students.

The choice of vocation depends on ability, interest and aspiration of the individuals.

In fact the individual needs to know what interest is in him and thus bring him personal satisfaction and success in life. The development of measures of vocational interest aimed at assessing the inclinations of the young person so that he may be assisted in the choice of an occupation that will sustain his interests and keep him usefully employed throughout his working life.

In developing countries, unemployment and social strife among youth and school leaver are commonly attributed to lack of linkages between formal schooling and occupation. Thus , it is believed that introducing a vocational element in school curriculum is very useful when asked abou the t field of work the child prefers to enter. A young person's response incorporates not only his preferences for job activities but also his understandings or misapprehensions about the nature of the employment setting, the likely economic rewards he associates with a given occupation, and the factors relating to the social prestige of various occupations. The development of measures of vocational interest has resulted from the need to obtain more systematic and more veridical descriptions of occupational preferences and economic development.

INTEGRATION OF ACADEMIC AND OCCUPATIONAL ASPECTS IN THE CURRICULUM

The gap between what the individual requires for his subsistence and what the school offers to the children as its daily activity are increasing day by day. This accounts for the majority of the problems that any system of education face today. Though there is no easy remedy for this, integrating the curricular activities with some life sustaining productive activity seems to be most relevant in this context which is expected to do good to the student community at large, particularly to those from the weaker sections of the society.

There is imminent need for taking speedy and effective steps for the integration of academic and occupational curricula. Dewey (1937) argued that education through occupations would be one in which, occupations would be used as an organising principle through which many subjects could be taught. It is possible to teach Biology using local occupations like Sericulture, Apiculture, Poultry Farming, Coconut cultivation, Mushroom Farming and Ornamental Fish culture respectively, but the possibilities are not being utilised to the required extent.

Role of Biology in developing vocational interest in students

The aims of teaching Biology not be very different from the aims of education itself, is to lead to the development of what is commonly termed the 'full man' or 'whole man'. Frazer (1975) stated three-fold aims for Biology course at secondary or tertiary level, which are:

(i) to prepare students for professional careers
(ii) to contribute to the general education
(iii) to inform future citizens about the nature and role of Biology in every day life.

The three-fold objectives mentioned above indicate that our *Secondary School Biology* curriculum can do a lot in the field for developing 'vocational skills' as well as '*vocational interest*' in students. But, it is generally alleged that the Secondary School Biology course of Kerala does not help much in catering to the employment needs or does not even inculcate vocational interest in students. As the objective of science education at the Secondary School stage is to lay the foundation of a good scientific career, the modern concepts of science have to be taught in some detail, so that the pupils are enabled to follow new developments in the field of their interest and other scientific achievements. In an approach paper of NCERT (1997), it has been emphatically stated that the learning experience of children should be planned in terms of activities and programmes in order to promote 'vocational interest' in students. This points to the need for developing in students adequate *vocational interest* and the appropriate skills required for earning a livelihood, along with learning the academic subjects.

ROLE OF INSTRUCTIONAL MATERIALS INTEGRATING OCCUPATIONS / VOCATIONS IN THE LEARNING OF BIOLOGY

We are living in an era where the traditional methods and processes of teaching and learning are changing rapidly. The boundaries of specific academic subjects are becoming more and more irrelevant. Kyle (1995) feels that reforms in science education and its implementation should be linked to the life of an individual. Mere textbook information, which is transformed into knowledge, is not useful. What is vital in the present Indian situation is not to provide merely general education which only produces graduates and post graduates in various disciplines, but also to provide some sort of vocational orientation along with education at all levels, so as to improve the quality in respect of producing practical persons doing their jobs systematically and scientifically.

For an effective programme in science, it is beyond doubt that adequate *instructional materials* can promote the orderly and controlled development of an individual's skills and interest in different agriculture-based vocations. The requirements relating to the learners, learning materials, instructional strategies/techniques, and all other required aspects need urgent attention, so as to keep pace with the fast growing knowledge and ways of utilising it for the welfare of humanity.

NEED AND SIGNIFICANCE

In order to lead the life of an effective citizen in the society, each individual should be able to choose the right type of vocation beneficial to him, enter into it and improve competency in it. As Strong (1934) puts it, a man will become more effective in his vocational career, if he is engaged in the work that he likes, than he dislikes. Philip (1968), Paul (1978), Mathew (1994) and Arun (1997) have conducted studies on the vocational interests of pupils at different age levels and found that making a vocational choice is of great concern to both boys and girls, particularly those in the adolescent stage. But as it is observed from the present system of education, opportunities to explore vocational choices are relatively limited. Specialisations make it difficult for the young to go from job to job in different lines of work. Hence the need of the hour is to provide some form of a

vocation-based education, so that our students will not be left groping in darkness, after they complete their studies.

The soaring problem of unemployment among the educated, casts a pall on the glory of education in the state. It is duly recognized that the secondary education is much theory-oriented and does not help much to promote vocational interest in students. For an effective programme in science, it is beyond doubt that adequate instructional package can promote the orderly and controlled development of an individual's skills and interest in different occupations or vocations. The requirements of learners, learning materials, instructional strategies and techniques and all other such aspects need urgent attention, so as to keep pace with the fast growing knowledge and ways of utilising it for the welfare of the humanity. As such it is highly imperative that measures should be taken for developing instructional materials integrating occupations / occasions with the teaching-learning of biological concepts and promotion of vocational interest in students.

The present practice of teaching biological concepts at secondary level is in no way linked to any vocations. Thousands of students leave the secondary schools every year and they start the long and arduous process of looking for higher studies, but very often, a good majority of them are unsuccessful in getting a suitable job. Can anything be done to remedy this situation and alleviate the problem of educated unemployment? Several educational thinkers, in recent times, believe that one of the major steps that can be taken in this context is the development of appropriate instructional packages for the simultaneous learning of Biology and the promotion of Vocational interest in students. It is argued that this can help them learn biology and along with that develop the interest to practice a worthwhile vocation to earn a living.

The investigator did not come across with studies which aimed to develop appropriate learning package pertaining to different vocations/occupations which can not only help in optimum transaction of the biology curriculum but also to promote vocational interest in students. It is presumed that learning will be made product oriented if occupation/vocation is integrated through regular course. It is beyond doubt that the need of the hour is to provide some form of a vocation based education so that the concept of drop out can be wiped out and this will also provide

opportunity for earning while leaning. It is in this context that, the investigator made an attempt to develop instructional package for learning Biology and promotion of vocational interest in students and hence the need and relevance of the study.

ASSUMPTIONS AND HYPOTHESIS

The investigator being a teacher in Biology and also a teacher educator got opportunity to observe many classes in Biology for several years. Also a sweeping analysis of the secondary school Biology text books and casual interaction with secondary level students and teachers has led the investigator to assume that textual information still, continues. So the mode of transaction of the curriculum at the secondary level needs drastic changes. Moreover the investigator assumes that the instruction at the secondary level have dual purpose i.e., learning the contents of the academic subjects as well as promotion of vocational interest in the students to gain knowledge which has functional utility. Even though many instructional materials and packages including ICT resources are available there is still a need for materials highlighting slots for vocational interests and hence formulated the following hypothesis:

H1. The package developed is effective for learning Biology and promoting vocational interest in students at secondary school level.

OBJECTIVES

The objectives are:

1. To collect the opinion of teachers regarding the need for developing instructional package for promoting vocational interest among students at secondary school level
2. To develop an Instructional Package for promoting vocational interest and achievement in Biology among students at secondary school level
3. To test the effectiveness of the instructional package.

SCOPE, DELIMITATIONS AND LIMITATIONS OF THE PRESENT STUDY

This study is an attempt to develop instructional package for learning Biology at Secondary School level with special emphasis on promoting vocational interest in students. Based on the views expressed by the Secondary School students,

teachers, and experts in the field, the instructional package on topics viz. 'Rabbit Farming' 'Medicinal Plants Cultivation' and Fish Preservation were developed for learning of biological concepts and promotion of vocational interest in Secondary School students. The effectiveness of the instructional package was tested using the experimental method. It is hoped that the package developed in the study would be helpful in learning Biology and in promoting vocational interest among students. The findings would be helpful to educationists and curriculum planners to prepare need-based curricular materials for other vocations too, on similar lines. It is also hoped that the results of the study would project the expected outcomes and pave way for further research in different areas, which can, perhaps, yield more fruitful outcomes.

The preparation of package (for promoting vocational interest as well as learning Biology) was delimited to one of the areas mentioned in the Secondary school Biology syllabus viz., 'economic importance of plants and animals; In economic importance of plants and animals only three areas such as Rabbit farming, Medicinal plant cultivation and fish preservation were selected. Likewise, under 'Medicinal Plants Cultivation', the choice of Medicinal Plants was delimited to four viz., *Asparagus racemosus* (Shatavari), *Indigofera tinctorea* (Nilamari), and *Ocimum sanctum* (Tulsi). However, it is presumed that the procedure adopted for the present study is sound enough to throw light on the problem under investigation.

Despite the precautions taken to arrive at valid and reliable results, certain delimitations have crept into the study, the major delimitations being the following:

(1) More topics could not be selected for the development of instructional package. Being an exploratory study, the investigator had her own limitations in selecting more than three topics for a detailed study.

(2) The tools prepared by the investigator may have their own limitations too. However, the investigator would like to state with full conviction that, within the constraints experienced, all possible efforts were taken to make the tools as objective and reliable as possible and hence the results of the study are valid and generalisable to a great extent.

CHAPTER II

METHODOLOGY OF THE STUDY

'Methodology' indicates the practical way in which the whole research project has been organised. This chapter contains the methodology of the study. The details of the methods adopted for the study, the variables under study, the samples selected for the study, the tools used for data collection, development of instructional packages for the study Rabbit Farming' 'Medicinal Plants Cultivation' and Fish Preservation'), the procedure adopted for data collection, and the statistical techniques employed for the analysis of data are presented under appropriate heads.

Survey and Experimental methods were used for the study. Normative survey was used for collecting the views of secondary school teachers regarding the need and relevance of the package for simultaneous learning and promotion of the vocational interest among students and the availability of such instructional package in their schools. Experimental method was used for determining the effectiveness of the instructional package developed for simultaneous learning and promotion of vocational interest in the secondary schools students in Kerala.

The Experimental Design

After consultation with experts in the field, it was decided that the 'Pre test - Post test single group experimental design' is the most appropriate method for testing the effectiveness of the package developed for learning of Biology and promoting vocational interest in Secondary School students. In this design, a single group of subjects is selected, usually randomly, and then measured on the dependent variables. The subjects are obviously not independent of each other, since both groups (pre-test and post-test groups) are composed of the same people. Then the independent variables are manipulated, and the same subjects are again measured on the dependent variables. According to Best and Kahn (1996), this design provides some improvement over other designs, since the effects of the treatment are judged by the difference between pre-test and post-test scores. In the present study, the 'Pre test - Post-test Single Group Experimental Design' is used to test the effectiveness of the instructional package developed on the topics 'Rabbit Farming', 'Medicinal Plants

Cultivation' and Fish Processing , which were meant for learning of Biological concepts and promotion of vocational interest in students at secondary school level.

SAMPLE FOR THE STUDY

The sample selected for survey part of the study constituted of representative groups of secondary schools teachers (N=80). The samples for the experimental study were of 40 students of class IX (N=40). A small group of subject experts (N=10) was also used for validating the package developed.

TOOLS AND MATERIALS USED FOR THE STUDY

Tools used for collecting data relevant for the study are

1. Questionnaire for teachers
2. Vocational Interest Inventory
3. **Instructional Package in Biology**: Package for learning Biology on Rabbit farming, Medicinal plant cultivation and Fish preservation and promoting vocational interest in secondary school students
4. Rating Scale for Subject Experts
5. Achievement test in Biology

The detailed description of the tools and materials were given below:

1. Questionnaire for teachers

The questionnaire for teachers was specifically meant for collecting the views of Secondary School Biology teachers regarding the extent of suitability of the Secondary School Biology curriculum for promoting vocational interest in students, advantages of learning Biology relating to different agriculture- based vocations, and the need and relevance of instructional materials for the simultaneous learning of Biology, promotion of vocational interest in students. The items in questionnaire were prepared after surveying the literature related to the area under study, and making a preliminary review of the Secondary Biology text books, followed by discussion with subject teachers. In preparing the questionnaire, all precautions suggested by Barr, Davis and Johnson (1953) were taken into consideration. The Questionnaire for Teachers used for the study is given as ***Appendix I.***

2. Vocational Interest Inventory in Biology Based Vocations

The Vocational Interest Inventory in Biology based vocations, 'was prepared as part of the present study, is an instrument intended to provide an objective measure of the interest of Secondary School students in 'Rabbit Farming, 'Medicinal Plant Cultivation and 'Food Preservation '. A careful analysis of the literature relating to Rabbit Farming, 'Medicinal Plant Cultivation and Food Preservation preceded the construction of the inventory. The well-known interest inventories by Strong (1934), Kuder (1953 Form C, 1963, Form D), Chatterji's Non-Language Preference Record (1953, Form 962) and Thurstone's Interest Schedule (1958) were consulted and these provided the basic models for constructing the inventory. Moreover, discussion with subject teachers and knowledgeable persons in the field of Rabbit Farming, 'Medicinal Plant Cultivation and Food Preservation were helpful in developing the inventory.

The draft vocational Interest inventory consisted of 55 items and after item analysis, certain items with low discriminating power were deleted and thus the number of items in the final inventory had come down to 30. The final inventory is given as ***Appendix* II.** The details regarding the development of the Vocational Interest Inventory are provided in the Manual of Instructions ***(Vide Appendix III).***

3. Instructional Package for learning Biology and promoting vocational interest in students

The Instructional Package for learning Biology and promoting vocational interest in secondary school students was developed after analysing the secondary school Biology text book. The Instructional package was developed in three vocations such as Rabbit farming, Medicinal plant cultivation and Food Preservation. The Instructional package was developed is given in Appendix **IV**:

3.A. Package developed in 'Rabbit Farming'.

The materials developed in this study on the topic 'Rabbit Farming' was meant for learning of Biology contents relating to Rabbit Farming and promotion of vocational interest in Secondary School students.

3.B. Package developed in 'Medicinal Plants Cultivation'.

The materials developed in the study on the topic 'Medicinal Plants Cultivation' was meant for the simultaneous learning of Biology content on 'Medicinal Plants Cultivation' and promotion of vocational interest in Secondary School students. The unit on 'Medicinal Plants Cultivation' contains **3 subunits,** the details of which are as shown below:

Subunit **1**: Medicinal Plants: Status and Uses

Subunit **2**: Factors Influencing the Growth of Medicinal Plants

Subunit **3**: Cultivation of Medicinal Plants

3.1 Asparagus racemosus (Satavari)

3.2 Indigofera tinctorea (Nilamari)

3.3 Ocimum sanctum (Tulsi)

3.C. Package developed in 'Food Preservation'.

The package developed in this study on the topic 'Food preservation' was meant for learning of Biology contents relating to Food preservation and promotion of vocational interest in Secondary School students.

4. Rating Scale for Subject Experts

The Rating Scale for Experts was meant for validating the package prepared on Rabbit Farming', 'Medicinal Plants Cultivation' and Food preservation. It was administered to 10 experts in the field. (List of experts is given in **Appendix VII**) The major aspects given in the Rating Scale are given below:

1. Possibility of learning the Biological concepts through the instructional materials prepared relating to the vocation identified.
2. Possibility of promoting vocational interest in Biology students at Secondary School level through the instructional materials prepared relating to the vocation identified.
3. Feasibility of equipping the students for self-employment through the instructional materials prepared relating to the vocation identified.
4. Scope of the instructional Materials for
    a. making Biology learning more interesting

b. developing scientific attitude

c. stimulating independent thinking

d. interacting with the community

5. Relevance of the instructional materials prepared in the present educational context.

6. Overall assessment of the instructional materials with respect to their suitability for learning Biological concepts and promoting vocational interest in students at Secondary School level. The details of the analysis done with respect to the validation pertaining to the three topics are presented in Table below:

Table No.1

Percentage Analysis of Responses of Experts for validation of package

Sl. No.	Aspects of Evaluation	Responses of Teachers			
		Great Extent	Some Extent	Not at all	Total
		(No. & %)	(No. & %)	(No. & %)	(No. & %)
1	Possibility of learning the Biological concepts through the package prepared relating to the vocation identified.	7 (70.00%)	3 (30.00%)	0	10 (100)
2	Possibility of promoting vocational interest in Biology students at secondary level through the package prepared relating to the vocation identified.	8 (80.00%)	2 (20.00%)	0	10 (100)
3	Feasibility of equipping the students for self-employment through the package prepared relating to the vocation identified.	7 (70.00%)	3 (30.00%)	0	10 (100)
4	Scope of the instructional package for				
	a) making Biology learning more interesting	9 (90.00%)	1 (10.00%)	0	10 (100)
	b) developing scientific attitude	6 (60.00%)	4 (40.00%)	0	10 (100)
	c) stimulating independent thinking	7 (70.00%)	3 (30.00%)	0	10 (100)
	d) interacting with the community	16 (80.00%)	4 (20.00%)	0	10 (100)
5	Relevance of the package prepared in the present educational context.	7 (70.00%)	3 (30.00%)	0	20 (100)
6	*Overall* assessment of the package with respect to their suitability for learning the Biological concepts and promotion of vocational interest in students at secondary level.	7 (70.00%)	3 (30.00%)	0	20 (100)

Table shows that majority of the subject teachers (70%) under study feels that the package is *suitable to a great extent* for learning of biological concepts related to rabbit farming, medicinal plant cultivation and food preservation and for the promotion of vocational interest in students at Secondary School level. The table further reveals that majority of the subject teachers are satisfied *'to a great extent'* about the other aspects of evaluation also viz., making Biology learning more interesting (90.00%), scope of the package for interacting with the community (80.00%), possibility of promoting vocational interest in Secondary School Biology students by learning the package (80.00%), feasibility of equipping the student for self-employment (70.00%), relevance of the package prepared in the present educational context (70.00%), scope of the package for stimulating independent thinking (70.00%), possibility of learning the content through the vocations identified (70.00%) and scope of the package for developing scientific attitude (60.00%). Rating Scale for Subject Experts is given in ***Appendix – V***

It is highly gratifying to note that none of the subject teachers has the opinion that the package is unsuitable for learning of Biology and promotion of vocational interest in students.

5. Achievement test in Biology

An achievement test in Biology based Vocations was also inevitable to determine the effectiveness of the package prepared. Since such an achievement test was not available, the investigator constructed a draft Achievement test based on three Biology based vocations such as Rabbit farming, Medicinal plant cultivation and Food preservation which carries 50 marks and the time was set for 2 hours. The achievement test was prepared, following all the steps suggested for the construction of an achievement test. Items in the draft achievement test were scrutinised by experts and a few suggestions for improvement were made by them. Based on these suggestions, modifications were made and the final test was prepared. The final achievement test consisted of 30 multiple choice questions. A copy of the Achievement test is given as ***Appendix VI***.

PROCEDURE ADOPTED FOR THE STUDY

The investigator scrutinized the contents of the Biology textbooks at secondary level and syllabi in order to assess its potentiality for developing

vocational interest in students. Using a questionnaire, the investigator collected the views of teachers regarding and the need and relevance of instructional package for learning Biology and promoting of vocational interest, the extent of availability of such materials in their schools. Based on the views expressed by teachers under study, an Instructional package was developed based on three topics viz., Rabbit Farming, Medicinal Plants Cultivation and Food Preservation. Regarding the validation of the package, majority of the teachers in Biology (70%) responded that the instructional package is suitable *to a great extent* for learning biological concepts and promoting vocational interest in select topics in Biology such as Rabbit Farming, Medicinal Plant Cultivation and Food Preservation. Teachers are satisfied '*to a great extent'* about the other aspects of evaluation of the package viz., scope of the instructional materials for interacting with the community (80.00%), feasibility of equipping the student for self-employment (70.00%), scope of the instructional package for stimulating independent thinking (70.00%), and scope of the instructional materials for developing scientific attitude (60.00%). The experimental group was taught using the instructional package developed. The Vocational Interest Inventory and Achievement Test in Biology were administered as pre-test and post-test on the experimental subjects before and after the intervention to test the effectiveness of the package.

Conduct of the Experimental Study

The investigator made necessary arrangements with the Principal of the Secondary School selected for the experimental study viz., New Higher Secondary School. Nellimoodu, Thiruvananthapuram. The pre-tests were administered on the experimental subjects-which provided valuable information about the subject's vocational interest and knowledge regarding 'Rabbit Farming', 'Medicinal Plants Cultivation' and 'Fish Preservation'. After administering the pre-tests, the experimental subjects(N = 40) were taught, using the packages developed on the topics 'Rabbit Farming', Medicinal Plants Cultivation' and 'Fish Preservation'. Regarding the date on which the post-test would be conducted was given to the experimental subjects. The same tests were administered again as post-test and the scores obtained were used for statistical treatment, to test the effectiveness of the packages prepared. Statistical techniques employed for the analysis of data were Percentage Analysis and Test of significance (t-test).

CHAPTER III

ANALYSIS OF DATA AND DISCUSSION OF RESULTS

The purpose of the present study is to develop instructional packages for learning Biology at Secondary School level with special emphasis on promoting vocational interest in students. It was hypothesised that the package developed on the topics 'Rabbit Farming,' 'Medicinal Plants Cultivation' and Food preservation would be effective for learning of Biology and promotion of vocational interest in students at secondary school level. The data relevant for the study were collected by administering a questionnaire for *teachers*(N = 80) and A Rating Scale for *subject teachers* (N = 10) was also administered for validating the instructional materials developed in the study. The data thus collected were analysed using appropriate statistical techniques, so as to verify the hypotheses of the study. The details of the analysis carried out with respect to each section are presented below, followed by discussion of the results.

Views of the secondary school teachers in Biology, regarding the need and the relevance of the package for learning of Biology and promotion of vocational interest among secondary school students

An attempt is made in this section to examine the views of the secondary school teachers in Biology, regarding the need and the relevance of the package for learning of biology and promotion of vocational interest among secondary school students. The data collected using a questionnaire for teachers was analysed and the details are presented below followed by discussion of the results.

Possibility of promoting vocational interest in students through the secondary school present Biology curriculum : Responses of teachers

In this part of the analysis, an attempt is made to study the views of the secondary school teachers under study regarding the possibility of promoting vocational interest in students through the present Secondary School Biology curriculum. The analysis done in this context is presented in Table 2.

Table 2

Possibility of promoting vocational interest in students through the present Biology curriculum at secondary school curriculum: Responses of teachers

Sl. No.	Responses	Groups		Total (No. & %)
		Male teachers (No. & %)	Female teachers (No. & %)	
1	Possible to promote vocational interest in students through the present Secondary School Biology curriculum	3 (3.75%)	4 (5.00%)	7 (8.75%)
2	Impossible to promote vocational interest in students through the present Secondary School Biology curriculum	30 (37.5%)	32 (40%)	62 (77.5%)
3	Uncertain	7 (8.75%)	4 (5.00%)	11 (13.75%)
	Total	**40**	**40**	**80**

It is seen from Table 1 that majority of the Secondary School Biology teachers under study (77.5%) feels that *'it is impossible'* to promote vocational interest in students through the present Secondary School Biology curriculum. while only 8.75% of the teachers feel that 'it is possible' to promote vocational interest in students through the Secondary School Biology curriculum, 13.75% of teachers are 'uncertain' about it. From this it can be concluded that majority of the Secondary School teachers are of the view that 'it is impossible' to promote vocational interest in students through the present Biology curriculum of Secondary Schools.

Suitability of the contents of the present Secondary School Biology curriculum for promoting vocational interest in students: Responses of teachers

The views of teachers regarding the extent of suitability of the contents of the present Secondary School Biology curriculum for promoting vocational interest in students were analysed and the details are presented in Table 3

Table 3

Extent of suitability of the contents of the present Secondary School Biology curriculum for promoting Vocational Interest in students: Responses of teachers

Sl. No.	Reponses	Groups				Total	
		Male teachers		Female teachers			
		(No. & %)		(No. & %)		(No. & %)	
1	Suitable to a great extent	5	12.5	6	15	11	13.75
2	Suitable to some extent	12	30	14	56	26	32.5
3	Not at all suitable	23	57.5	20	50	43	53.75
	Total	40	100	40	100	80	100

It is seen from Table 2 that more than fifty per cent of the teachers under study (53.75%) is of the view that *'the contents of the present Secondary School Biology curriculum is not suitable for promoting vocational interest in students'*, while 32.50% of the teachers under study feel that the present Secondary School Biology curriculum is 'suitable to some extent' for promoting vocational interest in students. Only 13.75% of the teachers state that the present Secondary School Biology curriculum is 'suitable to a great extent' for promoting vocational interest in students.

`Agreement with the idea that 'learning will become more effective, if Biology can be taught by integrating it with different agriculture-based vocations' : Responses of teachers.

The responses of the Secondary School teachers regarding the extent of agreement with the idea that 'learning will become more effective, if Biology can be taught by integrating it with different agriculture - based vocations' were collected and the details of the analysis done in this context are presented in Table 4

Table 4

Extent of agreement with the idea that 'learning will become more effective, if Biology can be taught by integrating it with different agriculture based vocations' : Responses of teachers

Sl. No.	Responses	Groups		Total (No. & %)
		Male teachers (No. & %)	Female teachers (No. & %)	
1	Agree to a great extent	26 (65%)	30 (75%)	56 (70.00%)
2	Agree to some extent	10 (25%)	8 (20%)	18 (22.50%)
3	Do not at all agree	4 (10%)	2 (5%)	6 (7.5%)
	Total	**40**	**40**	**80**

It is seen from Table 4 that majority of the teachers under study (70%) agree to a great extent, 22.50% agree to some extent and 7.50% do not agree with the idea that learning will become more effective, if Biology can be taught by integrating it with different agriculture – based vocations.

Advantages of learning Biology by integrating it with different agriculture-based vocations: Responses of teachers

The advantages of learning Biology by integrating it with different agriculture-based vocations, as responded by the Secondary School teachers were analysed and the details of the analysis are presented in Table 5

Table 5
Advantages of learning Biology by integrating it with different agriculture-based vocations : Responses of teachers

Sl. No.	Responses	Groups		Total (No. & %)
		Male teachers (No. & %)	Female teachers (No. & %)	
1	Integration is helpful for promoting vocational interest in students as well as learning of biological concepts.	30 (75%)	36 (90%)	66 (82.5%)
2	Integration is helpful for creating awareness about different agriculture-based vocations and their employment prospects.	33 (82.5%)	32 (80%)	65 (81.25%)
3	Integration is helpful for developing in students the interest to seek self-employment	36 (90%)	38 (95%)	74 (92.5%)
4	Integration makes Biology learning more interesting	37 (92.5%)	36 (90%)	73 (91.25%)

Table 5 makes it clear that a majority of the teachers under study responded favourably to all the advantages of learning Biology, integrating it with different agriculture-based vocations. The advantages prioritised by the teachers under study are, Integration is helpful for promoting vocational interest as well as learning of Biological concepts (82.5%), Integration is helpful for creating awareness about different agriculture-based vocations and their employment prospects (81.25%), Integration is helpful for developing in students the interest to seek self-employment (92.5%) and Integration makes Biology learning more interesting (92.15%).

Need for improving the present Biology curriculum of the Secondary School level for equipping the students to engage in self-employment : Response of teachers.

Table 6 gives the details of the analysis of responses of the teachers under study with respect to the 'need for improving the present Biology curriculum of the Secondary level to equip the students to engage in self-employment.

Table 6

Need for improving the present Biology curriculum of the Secondary School level for equipping the students to engage in self- employment : Responses of teachers

Sl. No.	Responses	Groups		Total (No. & %)
		Male teachers (No. & %)	Female teachers (No. & %)	
1	Needs curriculum improvement	32 (80.00%)	35 (87.5%)	67 (83.75%)
2	No need for curriculum improvement	1 (2.5%)	0 (0%)	1 (1.25%)
3	Uncertain	7 (17.5%)	5 (12.5%)	12 (15.0%)
	Total	**40**	**40**	**80**

As per Table 6, majority of the teachers under study (83.75%), states that *'the present Biology curriculum of the Secondary School level should be improved in order to enable the students to engage in self- employment'*. Only 1.25% of the teachers state that 'there is no need to improve' the curriculum, while 15% of the teachers are 'uncertain' about it.

Need for packages that can be helpful in promoting vocational interest in students, along with learning of Biology at Secondary School level : Responses of teachers .

The responses of the teachers regarding the extent of need for packages that can be helpful in promoting vocational interest in students, along with learning of Biology at Secondary School level were analysed and the details are presented in Table 7.

Table 7

Extent of need for instructional materials that can be helpful in promoting vocational interest in students, along with learning of Secondary School Biology : Responses of teachers

Sl. No.	*Responses*	Groups		Total (No. & %)
		Male teachers (No. & %)	Female teachers (No. & %)	
1	Needed to a great extent	32 (80%)	33 (82.5%)	65 (81.25%)
2	Needed to some extent	8 (20%)	7 (17.5%)	15 (18.75%)
3	Not at all needed	0	0	0
	Total	**40**	**40**	**80**

Table 7 shows that majority of the teachers under study (81.25%) feel that the packages that can be helpful in promoting vocational interest in students along with Biology learning are *'needed to a great extent'*. The remaining 18.75% of the teachers feel that the instructional materials are 'needed to some extent' in this context.

II . Effectiveness of the package developed for learning Biology and promotion of vocational interest in students at Secondary school level.

The effectiveness of the package prepared on the topics 'Rabbit Farming,' 'Medicinal Plants Cultivation' and Food preservation for learning of biological concepts and promotion of vocational interest in students at Secondary school level were tested, using 'single group experimental design'. In this design, both the pre-test and post-test groups were composed of the same students. The experimental subjects of the study were 40 Secondary school students of Class IX from New Higher secondary school, Nellimoodu in Thiruvananthpuram

district(Kerala). In this study, the package developed on the three topics ''Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food Preservation' were the independent variables, where as *'Achievement'* and *'Vocational Interest' in* 'Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food preservation' were the dependent variables. The effectiveness of the instructional package was tested one by one, as detailed below:

Determining the effectiveness of the instructional package for learning the biological concepts and promotion of vocational interest in students at secondary school level

The first step taken for assessing the effectiveness of the package for learning the biological concepts (related to 'Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food Preservation') and promotion of vocational interest among secondary school students was to administer the *Achievement Test* in *Biology* and the *Vocational Interest Inventory* as Pre-*tests* (to assess the entry behaviour). The time allotted for answering the test and the inventory was *one* hour each. Then the students were taught, using the package developed for learning 'Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food Preservation' (*three weeks* duration). When this was over, the same achievement test and the *Vocational Interest Inventory* were administered on the group as *post-test* (to assess the terminal behaviour).

The vocational interest scores obtained for the pre and post tests were compared using 't' test, in order to find out whether there is significant difference between the pre-test and post-test scores of the experimental group. The data and the result of the test of significance are presented in Table 8.

Table: 8

Effectiveness of the Package for promoting vocational interest in students: Data and Results of the test of significance

Sl. No	Variable	N	Pre-test		Post-test		t Value
			Mean	SD	Mean	SD	
1	Vocational Interest Biology based vocations	40	4.88	2.41	23.39	4.28	30.69 ($p< 0.01$)

In the case of *vocational interest,* it is seen from the same table (Table 8) that the 't' value obtained for vocational interest in 'Rabbit Farming,' 'Medicinal Plants Cultivation' and Food preservation is 30.69, which is also significant at 0.01 level. This indicates that there is significant difference between the pre and post vocational interest scores of the students in the experimental group. The comparative results of the pre and post vocational interest scores revealed that the instructional package is *effective* for promoting vocational interest in students.

The achievement scores obtained for the pre and post tests were compared using 't' test, in order to find out whether there is significant difference between the pre-test and post-test scores of the experimental group. The data and the result of the test of significance are presented in Table 9.

Table: 9

Effectiveness of the Package for learning Biological concepts: Data and Results of the test of significance

Sl. No	Variables	N	Pre-test		Post-test		t Value
			Mean	SD	Mean	SD	
1	Achievement in Biology	40	7.56	2.71	22.00	4.87	18.59 ($p < 0.01$)

Table 9 shows that the 't' value obtained for *achievement test* in Biology was 18.59, which is significant at 0.01 level. This shows that there is significant difference between the pre and post achievement test scores of the students in the experimental group.The comparative results of the pre and post achievement test scores in biology revealed that the package developed is *effective* for learning the biological concepts (theoretical and practical aspects) related to vocations ''Rabbit Farming,' 'Medicinal Plants Cultivation' and Food preservation.

From the above observation, it can be concluded that the 'Instructional Package is very *effective* for the learning of biological concepts (related to **'Rabbit Farming,' 'Medicinal Plants Cultivation' and Food Preservation**) and promotion of vocational interest in students at Secondary School level.

Verification of Hypothesis

Hypothesis states *The package developed in the select topics in Biology is effective for learning Biology and promoting vocational interest in students at secondary school level.*

. Analysis and discussion of the results pertaining to Hypothesis 1 makes it clear that 't' values obtained for *achievement test* in Biology was 18.59 and vocational interest was 30.69 , which are significant at 0.01 level. The comparative results of the pre and post achievement and vocational interest scores revealed that the instructional package is *effective* for promoting vocational interest in students. Since the results confirm the hypothesis formulated in this context, *Hypothesis I is accepted.*

FINDINGS OF THE STUDY

1. Majority of the Secondary School Biology teachers under study (77.5%) feel that *'it is difficult'* to promote vocational interest in students through the present Secondary School Biology curriculum. while only 8.75% of the teachers feel that 'it is possible' to promote vocational interest in students through the Secondary School Biology curriculum, 13.75% of teachers are 'uncertain' about it.

2. More than fifty per cent under study (53.75%) are of the view that *'the contents of the present Secondary School Biology curriculum is not suitable for promoting vocational interest in students',* while 32.50% of the teachers under study feel that the present Secondary School Biology curriculum is 'suitable to some extent' for promoting vocational interest in students. Only 13.75% of the teachers state that the present Secondary School Biology curriculum is 'suitable to a great extent' for promoting vocational interest in students.

3. Majority of the teachers under study (70%) agree to a great extent, 22.50% agree to some extent and 7.50% not at agree with the idea that learning will become more effective, if Biology can be taught by integrating it with different agriculture – based vocations.

4. Majority of the teachers under study responded favourably to all the advantages of learning Biology by integrating it with different agriculture-based vocations. The advantages prioritised by the teachers under study are, Integration is helpful for

promoting vocational interest as well as learning of Biological concepts (82.5%), Integration is helpful for creating awareness about different agriculture-based vocations and their employment prospects (81.25%), Integration is helpful for developing in students the interest to seek self-employment (92.5%) and Integration makes Biology learning more interesting (92.15%).

5. Majority of the teachers under study (83.75%), state that *'the present Biology curriculum of the Secondary School level should be improved in order to enable the students to engage in self- employment'*. Only 1.25% of the teachers state that 'there is no need to improve' the curriculum, while 15% of the teachers are 'uncertain' about it.

6. Majority of the teachers under study (81.25%) feel that the packages that can be helpful in promoting vocational interest in students along with Biology learning are *'needed to a great extent'*.

7. Majority of the subject teachers (70%) under study fee that the package is *suitable to a great extent* for the learning of biological concepts related to rabbit farming, medicinal plant cultivation and fish preservation and promotion of vocational interest in students at Secondary School level. Majority of the subject experts are satisfied *'to a great extent'* about the other aspects of evaluation also viz., making Biology learning more interesting (90.00%), scope of the package for interacting with the community (80.00%), possibility of promoting vocational interest in Secondary School Biology students by learning the package (80.00%), feasibility of equipping the student for self-employment (70.00%), relevance of the package prepared in the present educational context (70.00%), scope of the package for stimulating independent thinking (70.00%), possibility of learning the instructional materials through the vocations identified (70.00%) and scope of the package for developing scientific attitude (60.00%).

8.In the case of *vocational interest,* it is found that the 't' value obtained for vocational interest in Biology based vocations such as 'Rabbit Farming,' 'Medicinal Plants Cultivation' and Food preservation is 30.69, which is also significant at 0.01 level. This indicates that there is significant difference between the pre and post vocational interest scores of the students in the experimental group. The comparative

results of the pre and post vocational interest scores revealed that the package is *effective* for promoting vocational interest in students.

9.The 't' value obtained for *achievement* in Biology was 18.59, which is significant at 0.01 level. This shows that there is significant difference between the pre and post achievement test scores of the students in the experimental group. The comparative results of the pre and post achievement test scores revealed that the package developed on ''Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food Preservation' is *effective* for learning the biological concepts (theoretical and practical aspects) related to vocations.

CONCLUSIONS

The following conclusions are derived from the findings of the study:

1. Majority of the Secondary School teachers are of the view that 'it is not possible' to promote vocational interest in students through the present Biology curriculum of Secondary Schools and hence there arise the need for developing instructional packages that can be helpful in promoting vocational interest in students, along with learning of Biology at Secondary School level.
2. The 'Instructional Package is very *effective* for learning of biological concepts (related to 'Rabbit Farming,' 'Medicinal Plants Cultivation' and Food preservation) and promotion of vocational interest in students at Secondary School level.

OBSERVATIONS

1. The instructional package is helpful to the students to activate their senses, open up new avenues of learning, get them involved in activities that promote their curiosity and interest in engaging in worthwhile vocations for earning a living.

2. Learning will become effective if it is related to real situations of life, time and space of students.

3. This type of learning help to fulfil the needs of the nation - removal of poverty, provision of employment and healthy living conditions and a

general atmosphere, where everyone will have enough resources for his need but not for his greed.

LEANING OUTCOMES

The following are the learning outcome of the present study:

1. Process and product oriented learning outcomes are there
2. Work education and experimental leaning
3. Learners will get opportunities to understand and practice some form of occupation
4. Education will become a self supporting unit
5. Earning while learning
6. Helps to promote self employment
7. Learners will become more self sufficient and self confident
8. Develops the value of dignity of labour
9. Develops positive attitude towards work
10. Helps to reduce the problem of unemployment
11. Understand the ideas/ skills required for doing a vocation
12. Learning will become more interesting

IMPLICATIONS OF THE STUDY

The present study was basically intended to develop package in Biology at Secondary school level with special emphasis on promoting vocational interest in students. The findings and conclusions of the present study have wide implications for the improvement of the present system of Secondary education and also for promoting vocational interest in students. The findings of the study revealed that the contents of the present Secondary school Biology text books were not at all suitable for promoting vocational interest in students. Agriculture-based vocations are not adequately treated in the Secondary school Biology text books. Whatever mentioned had been done very superficially without giving any emphasis on promoting vocational interest in students. The study further revealed that package for promoting vocational interest in students are not at all available in the Secondary schools of Kerala as being an impediment to promoting vocational interest in students. The study thus, is a pointer to the imperative need for developing package

in Biology at Secondary school level, which specifically aims to promote vocational interest in students, keeping in mind its significance in job generation, especially in the rural sector.

The findings that emerged from the experimental study revealed that the package developed on the topic 'Rabbit Farming', 'Medicinal Plants Cultivation' and 'Fish Preservation' are very effective for *learning* of Biology and promotion of vocational interest in Secondary school level students. Such packages would be helpful to the students to activate their senses, open up new avenues of learning, get them involved in activities that promote their curiosity and interest in engaging in worthwhile vocations for earning a living. Moreover, those who choose to continue/discontinue their studies after the Secondary course can be equipped to engage in these agriculture-based vocations, so that they can secure some form of gainful employment, which will enable them to face life with confidence.

It is expected that the students, when they learn using such packages, will imbibe the value of dignity of labour and shed their inhibitions on the methods and processes of 'doing' things. They learn how to interact with teachers, fellow students and community members, discussing matters of common academic interest and practical applications of knowledge gained at school. It also enables the student to simultaneously learn subject matter, traits of personality, work habits, attitudes and appreciation.

One of the most significant contributions of the study is that if Biology is taught by *integrating* with different agriculture-based vocations, it will be helpful for developing in students the interest to seek self-employment, and create awareness about different agriculture-based vocations and their employment prospects. The study further entails the importance of providing adequate information regarding different vocations and provisions for practical particularly for those relating to different agriculture –based vocations in the secondary school curriculum.

One of the most important and fundamental characteristics of a well-planned education system is that it must be related to real situations of life, time and space. Gandhiji's vision of education in modern India (that education taken as a whole, can and must be socially relevant, self-supporting and related to real life situations of life, time and space) can become true only if the students are taught using such

instructional materials, which strive to promote vocational interest in students. In the process, it will help to fulfil the needs of the nation - removal of poverty, provision of employment and healthy living conditions and a general atmosphere, where everyone will have enough for his need but not for his greed.

This would also be helpful to curriculum framers to devise effective curricula for various levels of education and to prepare need-based curricular materials for other agriculture based vocations, on similar lines, keeping in mind in rural development with a view to ensure employment creation in rural India.

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Appendices

Appendix I

QUESTIONNAIRE FOR TEACHERS

SCERT, Kerala

Poojappura

Dear Teachers,

As part of my research work, I intend to develop 'instructional package' which will enable the secondary school students to gain interest, knowledge and skills/ability to engage himself/herself in an agriculture - based vocation along with the learning of Biology content in the prescribed text books. The questionnaire given herewith is meant to collect pertinent information for the above said purpose. Kindly go through the questionnaire carefully and record your 'honest' responses by putting a tick (✓) mark in the appropriate space provided.

Please remember that the success of my research is dependent on your honest responses. I assure you that your responses will be kept confidential and used only for research purpose.

Thanking you,

Your sincerely,

Trivandrum

Dr. Bindu S.

Part A: General Data

Name of the Teacher:

Gender: Male ☐ Female ☐

Name of the School:

Locale of the School: Urban ☐ Rural ☐

Type of Management: Govt. ☐ Pvt. ☐

Type of School: Girls ☐ Boys ☐ Mixed ☐

Any other relevant information:

Part B: Information Related to Vocational Aspects

Given below are some questions intended to know the vocational interest and opinion of Secondary School students. There is no right or wrong answer. Respond as honestly as you can (Put a '✓' mark in the appropriate place.)

1. Do you think that it is possible to promote vocational interest in students through the present Secondary School Biology curriculum?

   a) Possible ☐ b) Impossible ☐ c) Uncertain ☐

2. In your opinion, to what extent the contents of the present Secondary School Biology curriculum are suitable for promoting vocational interest in students?

   a) Suitable to a great extent ☐ b) Suitable to some extent ☐

   c) Not at all suitable ☐

3. How far do you agree with the idea that 'learning will become more effective, if Biology can be taught by integrating it with different agriculture – based vocations.'?

   a) Agree to a great extent ☐ b)Agree to some extent☐

   c) Do not at all agree ☐

4. What, according to you, are the advantages of teaching Biology by integrating it with agriculture-based vocations? Indicate your opinion by putting a tick (✓) mark against the advantage (s) agreeable to you.

   a) Integration is helpful for promoting vocational interest in students as well as learning of biological concepts. ☐

   b) Integration is helpful for creating awareness about different agriculture- based vocations and their employment prospects. ☐

   c) Integration is helpful for developing in students the interest to seek self- employment. ☐

   d) Integration makes Biology learning more interesting. ☐

e) Integration provides the scope for working in co-operation with the society. ☐

f) Any other… (Please specify)

5. Do you think that the present Biology curriculum of the Secondary course needs to be improved for equipping the student to engage in self-employment?

a) Needs curriculum improvement ☐

b) No need for curriculum improvement ☐

c) Uncertain ☐

6. In your opinion, to what extent is there need in your school for instructional packages that can be helpful in promoting vocational interest in students, along with learning of Secondary School Biology?

a) Needed to a great extent ☐ b) Needed to some extent ☐

c) Not at all needed ☐

Appendix II

INTEREST INVENTORY ON BIOLOGY BASED VOCATIONS

Directions:

Given below are a series of statements intended to find out the level of interest that you have regarding certain vocations. Each statement is followed by four alternatives: (a), (b), (c) and (d). Assume that you have equal opportunity and freedom to choose any of the given alternatives. Go through each statement and select the activity that you like best from the given choices. You may indicate your choice by putting a (√) mark in the appropriate alternative. Kindly complete all the statements making your choice from alternatives provided.

1. The activity that I like to engage in, during my leisure time is,

(a) Sewing (b) Rabbit farming (c) Social work (d) Cultural activities

2. I earnestly wish to know about the profit that I can get from

(a) Apiculture (b) Diary farming (c) Rabbit farming (d) Fishery

3. If I get an opportunity to get training in self employment, I would like to choose

(a) Rabbit farming (b) Pig farming (c) Apiculture (d) Sericulture

4. For visit I would prefer a....

(a) Dairy farm (b) Pig farm (c) Rabbit farm (d) Apiculture Unit

5. I am more interested to learn about

(a) Medicinal plant Cultivation (b) Vegetable farming (c) Ornamental fish culture (d) Forestry

6. I am interested to learn more about different breeds of

(a) Cattle (b) Rabbits (c) Ornamental fishes (d) Fowls

7. If I get sufficient land to engage in self employment I would like to start there .... (a) Rabbit farming (b) Pig farming (c) Apiculture (d) Sericulture

8. If I am expected to prepare an estimate about a self-employment, I would prefer to prepare an estimate on.....

(a) Prawn Culture (b) Mushroom farming (c) Poultry farming (d) Rabbit farming.

9. In the compound of my house, I prefer maintaining

(a) Medicinal Plant Cultivation (b) Rubber cultivation (c) Coconut cultivation (d) Mushroom farming

10. I wish to know the harvesting techniques of ...

(a) Tuber crops (b) Rubber products (c) Tapioca (d) Ginger

11. If I get an opportunity to make an income generating product I would prefer

(a) Fish pickling (b) Handloom products (c) Honey products(d) Squash making

12. If I get an opportunity to learn about the mode of reproduction in animals, I would try to learn more about reproduction in....

(a) Honey bees (b) Dogs (c) Rabbits (d) Cattles

13. If I am expected to take a class on a self-employment and its benefits, I would choose the topic...

(a) Rabbit farming (b) Pig farming (c) Apiculture (d) Sericulture

14. If I get an opportunity to motivate others to engage in some kind of self-employment, I would suggest...

(b) (a). Medicinal Plant Cultivation (b) Cattle rearing (c) Ornamental fish culture (d) Tissue culture

15. In exhibitions, I wish to watch with genuine interest –the exhibition of different breed of ...

(a). Cattles (b) Birds (c) Rabbits (d) Goats

16. For reading , I would prefer to read books on....

(a) Apiculture (b) Paddy cultivation (c) Medicinal plant cultivation (d) Ornamental fish culture

17. If I have to conduct an interview, I would be most interested in interviewing

(a) Experts in Medicine (b) Experts in Rabbit farming (c) Experts in Forestry (d) Experts in Dairy farming

18. The topic that I like the most to be discussed in a seminar is.....

(a). Medicinal Plant Cultivation (b) Environmental protection (c) Population Education (d) Poultry farming

19. I like most to learn about the structure and function of...

(a). Tuber crops (b) Medicinal Plants (c) Ornamental plants (d). Vegetables

20. I would like to acquire more knowledge regarding.....

(a). Cattle rearing (b) Rabbit farming (c) Apiculture (d) Mushroom farming

21. In TV programmes, I am more fond of watching programmes related to .....

(a) Poultry farming ☐ (b) Sericulture ☐ (c) Apiculture ☐ (d) Fishery☐

22. If I am expected to initiate a discussion on a self-employment and its benefits, I would choose the topic...

(a) Apiculture and its benefits☐ (b) Dairy farming and its benefits ☐

(c) Poultry farming and its benefits ☐ (d) Fish culture and its benefits ☐

23. If I get an opportunity to motivate others to engage in some kind of self-employment, I would suggest.....

(a) Bee-keeping (Apiculture) ☐ (b) Breeding of pigs ☐

(c) Cattle rearing ☐ (d) Fish Culture ☐

24. If a bank offered me an agricultural loan, then I would first apply for a loan for ....

(a) Ornamental fish culture ☐ (b) Cattle rearing ☐

(c) Poultry farming ☐ (d) Rearing honey bees ☐

25. If I take up agricultural research, I would like to work on the topic...

(a) The nutrient value of pulses.
(b) Mushrooms and their nutrient value
(c) Cereals and their nutrient value
(d) Chemical composition of medicinal plants and the respective drugs produced

26. I would like to write an article on...

(a) Corruption in society. (b) Food preservation
(c) Use of liquor and drugs (d) Need for environmental protection

27. If I get an opportunity for demonstration, I would like to demonstrate on the topic

a) Fish Pickling (b) Environmental protection (c) Population Education (d) Poultry farming

28. I would like to acquire more knowledge regarding…

(a) Apiculture (b) Diary farming (c) Sericulture (d) Food Preservation

29. I am more interested in reading…

(a) Poultry ☐ (b) Vegetable Farming ☐

(c) Health magazine ☐ (d) Food preservation ☐

30. If I need to understand the market demand for agricultural products, I would attempt to find out more about the marketing potential of …

(a) Rubber products (b) Tuber crops

(c) Fish Products (d) Vegetables.

Appendix - III

MANUAL OF INSTRUCTIONS FOR

INTEREST INVENTORY

SCERT KERALA

THIRUVANANTHAPURAM

2019

MANUAL OF INSTRUCTIONS FOR INTEREST INVENTORY

Nature and Purpose of the Interest Inventory

The Interest Inventory is an instrument intended to provide an objective measure of the interest of Secondary School students in Biology based vocation such as 'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation'. A careful analysis of the literature bearing this theme preceded the construction of the tool. The well known interest inventories by **Strong** (1934), **Kuder** (1953 Form C & 1963 , Form D) , **Thurston's** Interest Schedule (1958) , and **Chatterji's** Non - Language Schedule (1953 , Form 962) were consulted and these provided the basic models for constructing the inventory and also in forming an operational definition of the concept of interest.

The Interest Inventory ascertains the interest of an individual about 'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation'. The inventory consists of 43 forced choice items covering a good range of agriculture - based vocational aspects that a Secondary School Biology student is likely to be familiarised with. The tool has been constructed by giving appropriate weightage to the different **tasks** involved in 'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation'. The suggestions of experts in the field of Agriculture, Animal Husbandry, Fisheries as well as education were taken into consideration before deciding the format of the items.

Preparation of the Draft form of the Interest Inventory

Items that would effectively cover all the aspects of ''Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation'' were included in the draft inventory. Much effort was made to introduce a variety of activities representing ''Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation'. An informal discussion with experts in the field of agriculture preceded the selection of items for the draft inventory. The draft inventory contained 43 items and each item is followed by 4 alternatives from which one has to be chosen by the respondent. Special care was taken to see that the alternatives appeared to be of equal level of attraction to the pupils. One of the four alternatives of each item clearly indicated interest in 'Medicinal Plants Cultivation', whereas the other three indicated interest in areas clearly outside the area of 'Medicinal Plants Cultivation'.

Administration of the draft form of the Interest Inventory

The draft Interest Inventory was administered on a group of 60 Secondary School students Class VIII, IX and X. Each student was given a printed copy of the inventory. The investigator herself administered the inventory and gave necessary instructions. The respondents were encouraged to read each item carefully and mark their answers by putting a tick mark (✓) against the appropriate alternative. Of the 60 response sheets obtained, 10 were seen to be incomplete in some respect or the other and hence were excluded and the remaining 50 response sheets were selected for item analysis.

Item Analysis

The 50 response sheets of the draft inventory, complete in every respect, were utilised for item analysis, in order to select suitable items for the final Interest Inventory. Each item was scored as follows : If the respondent has chosen the alternative showing interest in ''Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation', one score was given for the item ; otherwise Zero score was given. The total score for each respondent on the draft inventory was computed by adding the scores of the individual items. The response sheets were then arranged in the descending order of the total scores, and the highest 27 percent and the lowest 27 percent response sheets alone were used as extreme groups for item analysis. Harper's Chart (**Harper et al.,** 1962) was used for obtaining the discriminating index for each item.

Preparation of the Final form of the Interest Inventory

For the preparation of the final form of the Interest inventory, the items having a discriminating power equal to or above 0.4 alone were selected. Out of the 43 items, 30 were selected for practical purposes and convenience, rejecting randomly six items. Prior to finalising the items in the inventory, suggestions regarding the order of arranging the items and their 4 alternatives were sought from teachers and experts in the field of test construction. Efforts were also made to make the language simple and activities familiar to an average student in the Secondary school classes.

Validity and Reliability of the Interest Inventory

The different procedures adopted in developing the inventory, especially the procedure of item selection, provide ample evidence for the internal validity of the tool. The external validity of the inventory was established by correlating the scores

obtained on the inventory with the responses quantified for certain agriculture related items in the **Chatterji's** Non-Language Schedule (1953, form 962). The validity coefficient of the interest inventory was found to be 0.52, showing that the inventory is reasonably valid for the purpose.

The reliability of the final Interest Inventory was determined by the *test-retest* method. The inventory was administered twice to a sample of 60 students, selected at random from the Secondary schools, with an interval of four weeks in between the two administrations. The two sets of scores (in the two tests) were used for calculating the coefficient of correlation. The reliability coefficient of the inventory was estimated as 0.80, indicating that the Interest Inventory prepared for the study is a highly reliable tool.

Administration of the Interest Inventory

The Interest Inventory consisting of 30 multiple choice items is presented as a re-usable booklet with separate response sheet and instructions for the respondent. It is essential that a person who intends to administer the Interest Inventory should study the Inventory and the Manual carefully prior to the administration. The Interest Inventory may be administered as an individual or group test. It is important that the respondent (s) should be instructed to read each item carefully and mark their response in the response sheet by writing the English letter indicating their choice in the cell below the question number. The examinee should not leave any item without marking his/her response; and should not mark more than one response to an item. There is no specific time limit for the completion of the Interest Inventory, however 30 minutes is usually found adequate for the completion of the test.

Directions for Administering the Inventory

While administering the inventory, the following points should be borne in mind :

1. The examiner should be familiar with the Inventory and Manual of Instructions. She / he should, preferably try the test herself / himself in a bonafide manner, so that she / he can anticipate the doubts that can be raised during the administration of the inventory. This may help the examiner to prepare herself / himself better.
2. At the beginning, the purpose of the test should be explained to the students. The examiner should encourage the subjects to have a congenial and co-operative attitude towards the test. She / he should stimulate the examinees to put forth genuine response and should guarantee the confidential treatment of the responses. A calm and tension-free atmosphere should be created for effective answering of the inventory.
3. As the inventory is a self- administering one, no instructions are necessary, except those given in the test. For ensuring careful reading of instructions, the examiner should read them aloud, while the individuals read them silently.
4. The examiner should not explain how he thinks a statement is to be responded as it may affect the validity of the item. Hence, it is important that the individual himself / herself should respond to the statement. However, it is permissible to

explain the meaning of words, which are not apparently understood, provided the examiner could do so, without prejudicing the answer of the respondent..

5. There is no time limit for the completion of the test. It has been noted that very few subjects take more than 30 minutes to complete the inventory. Hence the whole testing procedure should not exceed 45 minutes.

Directions for Scoring the Interest Inventory

Hand scoring can be done easily and rapidly. A filled-up response sheet should be treated invalid if (a) more than one response of any item has been marked (b) any item is left unanswered (c) the response given for the item is ambiguous. The scoring of the inventory can be done with the help of the scoring key prepared in this connection. As the inventory consists of 30 items, the total score of an individual ranges from 0 to 30. The scoring key prepared for the Interest Inventory is provided at the end of the manual.

Norms of the Inventory

Norms for the inventory was determined by following one of the conventional methods adopted by researchers in the field of Psychology and Education (**Rogers**, 1931). The norms for the present inventory are based upon a study on 60 Secondary School students. The scores obtained by an individual can be interpreted with the help of the norm provided below in Table IX - 1.

Table IX - I

Norm values for varying degrees of interest in

'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation'

Sl.No.	Groups	Norms Values
1	High Interest in 'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation' (scores above M + σ)	Scores above 20
2	Average Interest in 'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation' (scores between M+ σ and M - σ)	Scores between 12 and 20
3	Low Interest in 'Rabbit farming', 'Medicinal Plants Cultivation' and 'Food preservation' (scores below M - σ)	Scores below 12

N = 40 M =16.50 σ = 4.49

INTEREST INVENTORY

SCORING KEY

Note: Award one point for each of the following responses. No credit for wrong response. A total of all the items is taken as the measure on an individual's interest in ''Rabbit farming', 'Medicinal Plants Cultivation' and 'Food Preservation'.

Question No.	Response	Question No.	Response
1	a	16	c
2	c	17	d
3	d	18	d
4	a	19	c
5	b	20	a
6	c	21	d
7	b	22	c
8	a	23	a
9	d	24	d
10	b	25	b
11	b	26	d
12	c	27	a
13	a	28	
14		29	
15		30	

Package for developing Vocational interest

INSTRUCTIONAL PACKAGE ON RABBIT FARMING

Objectives

By learning these content areas, the student will be able to

- Understand the major concept of Rabbit Farming.
- Familiarise with different kinds of Rabbits
- Realise the benefits of Rabbit Farming.
- Acquire knowledge about different kinds of Rabbits.
- Understand the morphology and anatomy of a Rabbit
- Develop skill to identify different kinds of Rabbits
- Realise the conditions to be satisfied in maintaining a healthy Rabbit farm.
- Develop skill to select good quality young Rabbits for rearing.
- Understand the preparation of Rabbit feeds.
- Understand about various Rabbit diseases and their preventive measures.
- Develop skill to apply acquired knowledge in Rabbit Farming.
- Predict the economic profit of Rabbit Farming.

As you are aware, we are now facing the crucial problem of unemployment/under employment. This is the right time for you to think about the scope of engaging in one or two income – generating activities, so that you can have an income for yourself and you need not depend on others for everything. In this context, you should understand that being a student of Biology, you are in an advantageous position than many of the other students. Do you know that most of the biological concepts/aspects that are to be learnt by Higher Secondary students are actually inherent in certain vocations, which the students are familiar with? In your earlier classes, you have learnt about certain agriculture-based vocations like Sericulture, Apiculture, Dairy farming, Rabbit farming and Cultivation of plants. It is true that the present system of education is often criticised as unsuitable for preparing the individuals for occupational roles. But we should not forget that learning in the school offers opportunities, directly or indirectly, for developing employment potential, by which students can engage in self - employment, if they are willing to do so. If conscious effort is made to link the biological concepts you have learned with the vocations you are familiar with, you can engage in one of the agriculture – based vocations. It is in this context, an attempt is made to prepare some instructional materials on 'Rabbit Farming', 'Medicinal plants cultivation' and Food Preservation which can be helpful in the simultaneous learning of Biology and promotion of vocational interest in students.

The instructional materials are prepared in the form of activity-oriented print materials, following the different steps in the development of instructional materials, suggested by ***Robert Glaser****(1961). It is hoped that the instructional materials would help*

RABBIT FARMING

CONTENT AREAS

UNIT I

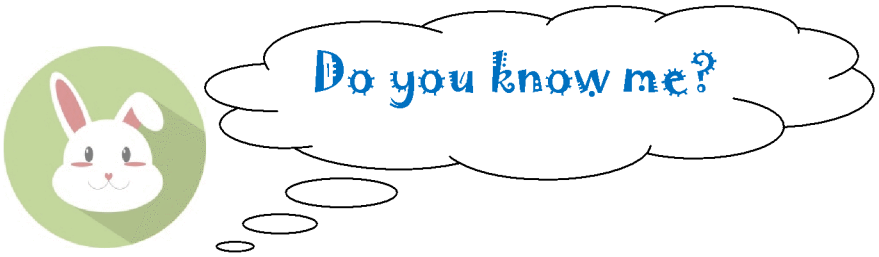
RABBIT FARMING

Have you ever thought of engaging yourself in an income-generating activity and earning your own living? It is the right time for you to think about an ideal vocation for self-employment. Rabbit Farming is a very interesting income- generating activity and an ideal agriculture-based vocation for self-employment. Now we can try to understand more about its details.

SUB UNIT – 1

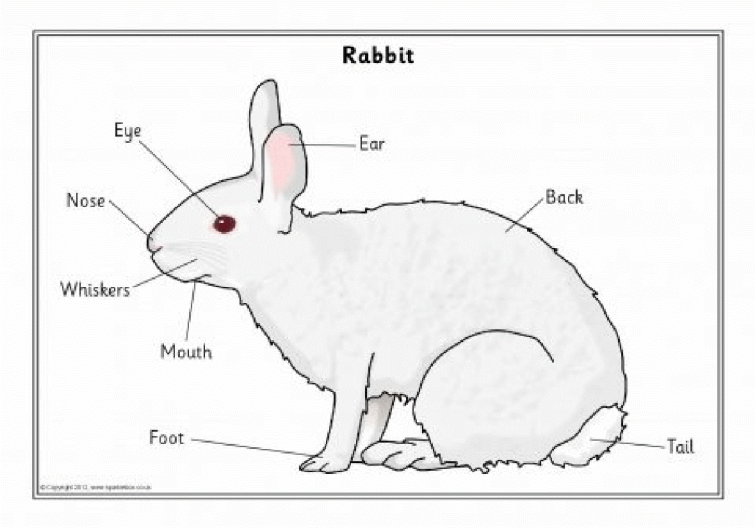
WHAT 'RABBIT FARMING' ACTUALLY MEAN

You might have seen a *Rabbit farm* and observed the different types of rabbits there. '***Rabbit'*** is a small *actually a herbivorous animal with long ears and large front teeth that moves by jumping on its long back legs it is domesticated for economic purpose.* **Cuniculture ('Rabbit Farming')** is the agricultural practice of breeding and raising domestic rabbits as livestock for their meat, fur or wool.



An adult rabbit can grow up to 40 centimetres in length and weigh between 1.2 – 2 kilograms. Both male and female rabbits are similar in size, however, young rabbits are smaller.

Rabbits vary in colour from black, grey to white. Rabbits have to groom their fur frequently otherwise it will become matted and lose its insulating properties. This means that rabbits avoid getting wet. Rabbits have very long hind feet and a distinctive fluffy tail that is usually black on top and white below.



GENERAL RABBIT STATISTICS

- Gestation (pregnancy) 30 – 33 days. Litter Size 4 – 12. Average 7.
- Weaning Age 7 – 8 weeks. From 50 days.
- Average domesticated rabbit life span 8 – 12 years.
- Heart Rate is around 220/per minute.
- Normal Temperature 37 – 39.5 degrees Celsius, 101 – 103 degrees Fahrenheit.
- Average Daily Water Intake 100 millilitres./Kg bodyweight
- Sexual Maturity of a rabbit 16 – 24 weeks
- Daily sleep: 8.4 hours (Large Adult, In captivity)

Now let us discuss about the benefits of Rabbit farming.

Students were divided into five groups and each group is instructed to discuss the topic 'Benefits of rabbit farming".

DISCUSSION PHASE

Students discuss in groups about rabbit farming

PRESENTATION PHASE

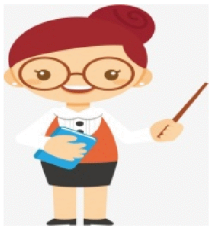
A student from each group presents their findings.

Teacher consolidates the discussion topic by highlighting major benefits of rabbit farming.

Benefits of Rabbit Farming

Rabbit farming has several benefits like the following:

- Rabbits are very fast growing animal.
- Their food converting rate is better than other animals.
- One female rabbit can give birth to about 2 to 8 kids each time.
- Rabbits can be raised within a short space.
- Production costs are less, compared to other large sized animals.
- Rabbit meat is very tasty, nutritious and easily digestible. All aged people can eat without any problem.
- There are no religious taboos consuming rabbit meat.
- In case of meat production, rabbits are placed after poultry.
- Kitchen wastes, grass, plant leaves etc. are favourite foods of rabbit. So we can raise some rabbits for our family needs, using this type of low cost and easily available commodities.
- Rabbit farming require less labour compared to another animal farming business. We can easily use were family labour for successful commercial rabbit farming business.
- Commercial rabbit farming business require relatively less capital and we will get back were investment within a very short period.
- As it is a highly profitable business, so commercial production can be a great source of earning and employment.



Evaluation

1. Name the different kinds of rabbits.
2. Define 'rabbit farming'.
3. What are the benefits of rabbit farming?
4. Why do people prefer rabbit meat to other type of meat like beef, pork and mutton?

Follow Up

- Arrange a *field trip* to a nearby rabbit farm to observe the different kinds of rabbits there and prepare a note on them.
- Collect pamphlets related to rabbit farming.
- Prepare posters related to rabbit farming reflecting its benefits.

SUB UNIT – II

BREEDS OF RABBITS IN A RABBIT FARM

There are numerous breeds of rabbit available throughout the world. Some of them are highly productive. Some breeds are very suitable for farming in India according to our weather.

ACTIVITY 1

Most productive and suitable rabbit breeds are listed below. You can choose any of those breeds.

Angora

Angora is a very ancient breed of small rabbit weighing around 3 kilograms. It is a wool type rabbit with white fur. Annual wool yield recorded is between 300-1000g in 3 to 4 clippings.

White Giant

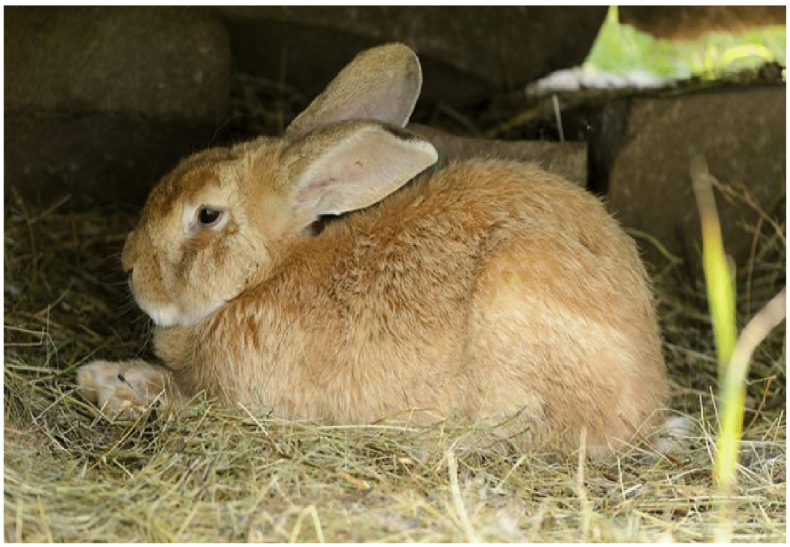
White Giant also originated in the erstwhile Soviet Union. It is almost similar in appearance to Newzealand White. Colour of the fur is white while that of the eyes and skin is red. The length of hind limbs as well as body size is larger than that of New Zealand White.

- **Grey Giant**

This breed is also a native of erstwhile USSR. Adults weigh 4.5 to 5 kg. Due to the resemblance of its fur with that of hare, it is often mistaken as hare. It is also reared for meat and fur skin.

- **Flemish Giant**

The **Flemish Giant rabbit** is a very large breed of domestic rabbit (*Oryctolagus cuniculus domesticus*), normally considered to be the largest breed of the species. Flemish Giants are a utility breed, and are most commonly bred for fur and meat. The breed is also known for its docile nature and patience in being handled, resulting in the large animals commonly being kept as pets.



- **Newzealand White**

This breed was evolved in England. Fur is white and skin is albino. The eye colour is red due to the absence of melanin pigment. Adult weight is 4.5 to 5 kg. Meat, fur and skin are the main products.

- **Newzealand Red**

The **New Zealand** is a breed of rabbit, which despite the name, is American in origin. The breed originated in California, possibly from rabbits imported from New Zealand. New Zealands are bred for meat, pelts, show, and laboratory uses, being the most commonly used breed of rabbit both for testing and meat production. They are also bred as pet rabbits.

- **Californian**

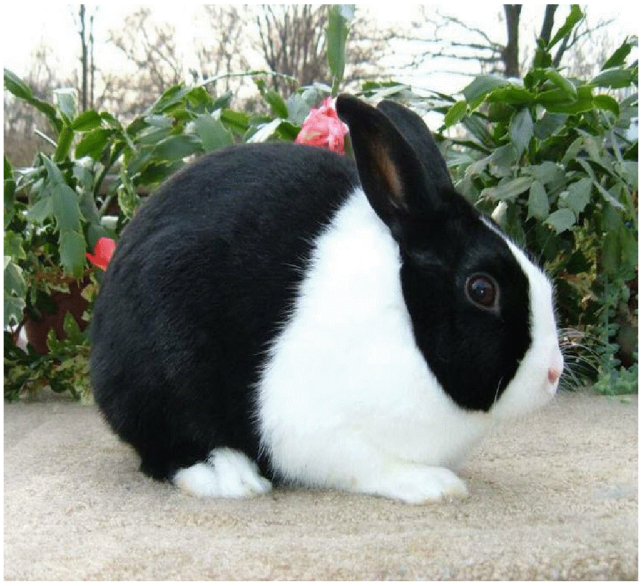
  The Californian is a fairly large rabbit, usually weighing around 3.5-4.75kg (7-10lbs).

  Californians are bulky in build with firm, plump bodies and a very short neck. The ears are fairly short and tapered and are carried erect. Californians have pink eyes.

  The Californian colouring is white with coloured ears, nose, legs and tail. The oval nose marking runs beneath the jaw and well up the profile of the nose towards the eyes. The ears are coloured from the base to tip, as is the tail. The feet, including the nails are dark and the colouring runs well up the legs.

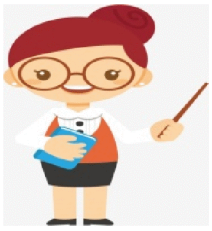
- **Duch**

The Dutch rabbit is one of the oldest rabbit breeds. It is also among the most popular rabbit breed throughout the world. The Dutch rabbit breed is easily identifiable by it's characteristic color pattern. Dutch rabbits are smaller in size, but not a dwarf breed. They have compact and well rounded body. The have rounded head, and their ears are short, stocky and well-furred that stand erect. Their back legs are longer than the front legs. And their back legs are very powerful. Their fur is soft and short.



- **Soviet Chinchilla**

  This breed was evolved in erstwhile USSR. Adults weigh 4.5 to 5 kg. Though this breed is reared for meat its fur is a fancy in fur crafts.



Evaluation

1. Name the different breeds of rabbits.
2. Name the rabbit breed exclusively reared for fur?

Follow Up

- Prepare a chart on different rabbit breeds
- Prepare an album on rabbit breeds of Indian variety
- Visit a rabbit farm nearby and observe the different types of rabbit there

SUB UNIT – III

FARMING OF RABBITS

Rabbit farming is the agricultural practice of breeding and raising domestic rabbits as livestock for their meat, fur, or wool. For farming of rabbits at first you have to choose the breeds of rabbits. The success of rabbit farming greatly depends upon the selection of suitable rabbit breed.

Choose Rabbit Breeds

There are many rabbit breeds available throughout the world. Among those breeds Dark Gray (internal), Fox, Dutch, New Zealand White, New Zealand Black, New Zealand Red, Belgium White and Chinchilla etc. are highly productive and popular breeds. We can choose proper breed for our production, depending on the availability of breeds in our area.

Rabbit Farming Method

We can start raising rabbits in two types of raising methods.
They are Deep litter and cage farming methods.

Deep Litter Method: This method is suitable, if we want to raise a few numbers of rabbits. Concrete floor is more suitable for deep litter system. Make 4 to 5 inches depth litter husk, hay, straw or wood shavings. In this method, we can raise a maximum of 30 rabbits in a house. Keep the male rabbits in a separate room from the female. In deep litter system, risks of diseases are high. And sometimes, it may seem very difficult to manage the rabbit in this system.

Cage Method: For commercial rabbit farming business, cage method is the best. In this system the rabbits are kept in a cage, which are made with wire or iron plate. Cage system is very useful for raising a maximum number of

rabbits. Keep sufficient space and necessary facilities, inside every cage. Keep the male and female rabbits separated from each other. Keep them together in a separate cage during breeding period.

Steps in Rabbit Farming

Step 1: Building a Hutch

We can make outdoor hutch for rabbits. They sit five feet off the ground in metal cages. The sides are made of 1x2 wire and the floors 1/2x1. Rabbits need steady flooring to keep their feet healthy. Diseased animals are not good breeders.

Step 2: Food and Water

The feeding materials that are most used is pellets, potato skins, as well as oats and varied vegetables. Rabbits love carrots. Hay is important.

Water

They suck water not lick it up like cats. We can use water bottles to feed them. The rabbits press the bottle with their teeth or face and the water comes out. It stops when it's not being pressed. They hook on the metal cages and are easily removed.

Step 3: Breeding Stock

When looking for breeding stock look at the posture of the rabbits. They should be well proportioned not hunched or weirdly long. Look for features that are desirable like bright eyes perky ears and good muscles. Depending on the coat it can be very easy to see what the loin looks like and that can be a good indicator. Females should have a nice neck; they have kind of a puffy snood deal going on. They should be alert and assertive but not mean and certainly not overly excited. Successful breeding, kindling, and raising of the kits all depend on their instinct and attitude. Males or bucks should be big, healthy, alert and a little aggressive. Not aggressive in demeanor, but during breeding.

Step 4: Time to Breed and Get Ready to Kindle.

Nest boxes made of different material can be used. We can use wooden boxes that are made with plywood and some wire for the bottom. Good clean boxes are important to keeping the kits healthy and the doe from getting an infection in her teats. After each use clean those with a mild cleaner or diluted solvent then let them dry completely in the sun if possible.

Step 5: Babies!

Between 30 and 34 days after the first breeding date is when the doe will give birth. The babies will be hairless with closed eyes and ears the first week to ten days depending on the breed size. They will get hair before their eyes open.

Fig. New liter of kits

Fig. After 2 days

Fig. Day 4

Fig. Day 6

Fig. Day 7

Fig. Day 14

They will shuffle and make noises in the box, its uncanny how strong they are. Rabbits have delicate digestive systems so I keep an eye out for diarrhea and try to get them eating pellets and hay more than the greens. I give

them a wide variety and lots of it. Feeding and nursing does and 8 kits requires a lot of fodder.

Step 6: The Bad, and the Worse.

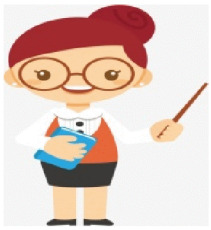
Sometimes the doe will cannibalize her kits. The cause might be stress, or not enough food or water, or she might just be a cannibal. Watch for the same behaviour in subsequent births and if the does continues, then it's time to get rid of her. Sometimes a doe will have her kits outside of the box. If we're lucky we'll get to them before they freeze to death. If they are born outside they may crawl out of the cage and drop to their doom. I check my does early in the morning if I can when they are expected to kindle, and as soon as I get home from work. I've only been able to successfully save one batch of kits from freezing. Death will happen, despite best intentions.

The first three days are critical for the kits; if they can get past that threshold then incidents of death from exposure are less likely.

As the kits get older, keep a mental or written log of their features, their attitudes, and anything that might be useful to monitoring their development. Make sure the doe isn't spending a lot of time in the nest box. I've had two kits

crushed to death by their mothers. It's pretty grisly. Keep the box in until after the kits are weaned. If the doe can't get a respite from sucking babies she might lash out. I lost two babies that way. One's neck had been broken the other had been kicked so hard it was paralyzed and died an hour later.

The best thing to do is keep the cages, boxes, food and water clean, mitigate where possible and let nature take care of the rest. At 2 to 3 months the babies will have put on enough weight and be ready to harvest.



Evaluation

1. What are the steps included a building a hutch?
2. Which are the most used rabbit foods?
3. What is deep litter method?
4. What is cage method?

Follow Up

- Construct a rabbit cage in your home
- Visit a rabbit farm nearby and conduct an interview with the farmer

SUB UNIT – IV

RABBIT DISEASES

Rabbits are prone to diseases. The more common problems/ diseases that we see in domesticated rabbits are:

Swellings

These may be due to abscesses — common around the head in particular — or tumours. In most cases, abscesses and tumours appear gradually over weeks. But you may only notice them when they reach a certain size. If you discover any unusual lumps or bumps on your rabbit you should contact your vet as soon as possible.

Loss of balance or head tilt

Head tilt is often caused by bacterial infections of the middle and inner ear or infections of the brain. Another common cause is the parasite Encephalitozoon cuniculi which is a significant cause of disease and can, occasionally, pass to humans. Once a rabbit has E. cuniculi., it passes infectious spores in its urine. Transmission to another rabbit occurs by eating these spores in contaminated food and water. If your rabbit has been affected it may struggle to stand up and its head may circle continuously in one direction. Rabbits should be kept as quiet as possible with dimmed lighting to avoid self-injury occurring.

Myxomatosis

Myxomatosis is a virus spread by biting insects including fleas and mosquitoes. It killed 99% of the UK's rabbit population when it arrived in

the country in 1953. It causes a gradual swelling of the area around the eyes, ears, anus and genitals and can be fatal. You should always get your rabbit vaccinated by your vet to prevent infection. But if you do see any of the signs mentioned, then you should see a vet immediately.

Viral haemorrhagic disease

VHD is a virus spread between rabbits by direct and indirect contact such as contaminated feed. In unvaccinated rabbits it's fatal and sometimes there are no warning signs. In rabbits that survive the first few days after infection, diarrhoea with blood is often seen.

Paralysis of one or more limbs

Paralysis of one leg may be associated with a fracture, nerve damage or a dislocation. Paralysis of both hind legs is more likely to be associated with a spinal injury such as a fracture or dislocation. These sorts of injuries are common in rabbits. Any rabbit showing signs of paralysis should be seen immediately.

Breathing difficulties in rabbits

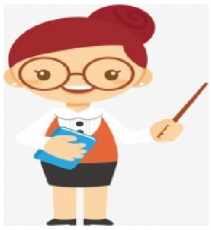
If you notice a discharge from your rabbit's eyes and nose as well as noisy breathing, your rabbit breathing fast, or open-mouthed breathing, you should contact either your own vet or, out of hours, your nearest Vets Now pet emergency clinic immediately. These may indicate respiratory infections or heat stress, which can be serious.

Ear mites

Ear mite infestation in rabbits is caused by the parasite Psoroptes cuniculiis. The main symptom is skin scales on the inner ear, which turn into larger, thicker crusted lesions with surrounding hair loss. Ear mites are generally not an emergency but if left untreated the lesions can become infected, which can cause loss of balance and hearing. If your rabbit has ear

mites you may see itching around the ear, head and neck, head shaking and a thick beige fluid in the ear canal.

- Overgrown teeth, Hairballs, Uterine tumours.etc. are the other diseases noticed in rabbits



Evaluation

1. What are the common rabbit diseases?
2. What is VHD?
3. What is miximatosis?

Follow Up

- Collect more information regarding rabbit diseases
- Make a poster on rabbit diseases

SUB UNIT – V

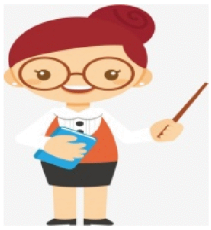
MARKETING OF RABBITS

Rabbit meat possesses high nutritive value. Rabbit are mainly raised for the making profit by selling their meat and also raise as a lovely pet. Fur is also obtained as an important by product. So, raising rabbits is really enjoyable and profitable business. This business does not require much capital as well space as like other cattle farming. The price of 1Kg rabbit meat cost more than 250 Rs. This business does not require much capital as well space as like other cattle farming. And, within a short period, you can achieve great profit with this. There are two methods of raising rabbits, both of them requires shelter to give protection from the predators and other elements. A good storage of fodders is also required for starting rabbit farm. Anyone can start this business with having only a few rabbits only.

Rabbit meat is categorized as a white meat, there is a great demand for rabbit meat in the market. Eating rabbit meat is also beneficial to us because of low fatty acids content and high protein content present in it.

In some areas, marketing rabbit products is not so easy. So it will be better, if we determine were marketing plan before starting. We can try were local markets or nearest town.

Through proper care and management, we can make maximum profit form were rabbit farming business. Always try to take good care of wer animals. Feed them quality nutritious food, keep their house clean and purchase healthy breeds for starting. Thus we can make rabbit farming business highly profitable.



Evaluation

1.Why do we rear rabbits?

2. What is the price of 1 Kg rabbit meat?

3. What is the scope of marketing rabbits?

Follow Up

- Collect more information regarding marketing of rabbits
- Visit a rabbit farm and conduct an interview with the farmer regarding marketing of rabbits

INSTRUCTIONAL PACKAGE ON MEDICINAL PLANT CULTIVATION

Objectives

By learning these content areas, the student will be able to

- Identify selected medicinal plants - its taxonomic characteristics, parts used, basic uses and the different aspects of its cultivation.
- explain uses and therapeutic values of medicinal plants
- Identify different habitats for the cultivation of different medicinal plants.
- Collect details for the cultivation of medicinal plants.
- Explain the need and importance of medicinal plants cultivation.
- Internalise values like respect and love of Nature, preservation and transmission of cultural heritage etc.
- organise activities related to medicinal plants cultivation.
- Predict the economic profit from medicinal plants cultivation.

Taking into account the importance of Medicinal Plants Cultivation, and viewing it from its utilisation point, concrete and effective steps should be taken to protect this industry, by taking on the cultivation of medicinal plants on a large scale. Both the Kerala government and the Central government are giving grants / financial assistance up to 100%. Even those who experience the paucity of land / space need not feel discouraged. They can carry out Medicinal Plants Cultivation in plastic sacks, covers etc. **Medicinal Plants Cultivation** is therefore, a very interesting income generating activity and an ideal agriculture- based vocation for self-employment. Now, we can try to understand more about its details.

Content

SUB UNIT – 1

MEDICINAL PLANTS: STATUS AND USES

Mankind is dependent upon plants not only for food, but also for most of the necessities and comforts, which make modern civilization possible. Moreover, man has used plants since pre-historic times for alleviating pain and curing different forms of illnesses. 'Medicinal Plants' are specialised crops having medicinal value and 'Medicinal Plants Cultivation' is gaining importance day by day. It is a very interesting income - generating activity and an ideal and profitable agriculture - based vocation for self-employment. Now let us discuss about the Medicinal plants that we have noticed in our immediate environment - the waysides, in the fields, near marshy places, near hills and mountains. We may also have some awareness about the medicinal values of some of these plants. **(*Teacher-guided discussion on 'Medicinal Plants' follows, leading to the preparation of a list of medicinal plants by students.*)**

ACTIVITY 1

Familiarising some common and local medicinal plants

DISCUSSION PHASE

Students discuss in groups about common medicinal plants. Teacher guides them to discuss various aspects of medicinal plants ensuring participation of all students.

PRESENTATION PHASE

A student from each group presents a consolidated form of their discussion

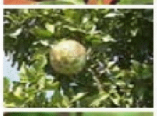
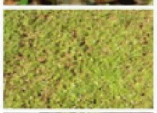
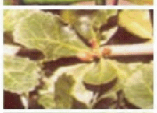
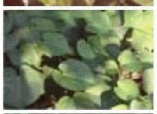
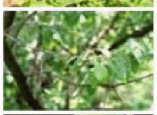
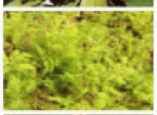
More about medicinal plants

Medicinal plants, also called medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. Plants synthesise hundreds of chemical compounds for functions including defence against insects, fungi, diseases, and herbivorous mammals.

- Rich resources of ingredients in drug development. Most of the drugs thus formulated are free of side effects or reaction.
- Important sources of nutrition. Some of these plants include ginger,green tea, walnut, aloe, pepper, turmeric etc..
- Used in natural dye, pest control, food,perfume etc..

Have you ever found your grandma running after a doctor or medical store for every now & then? We have so many wonderful natural remedies all around for any burns, cut, cold, fever, sneezes and more.

It is very important to have medicinal plants around the house because you never know when you might need them. So here is a list of plants that have the highest medicinal value compared to the other million species around the world worth planting around the house.

Plant	Common name / Maturity period	Botanical Name or Family	Parts Used	Average Price(Rs. / Kg)	Medicinal Use
	Amla (T)After 4th year	Emblica officinalis Fam - euphorbiaceae	Fruit	Rs 15 - 45/kg	Vitamin - C, Cough , Diabetes, cold, Laxativ, hyper acidity.
	Ashok (T)10 years onward	Saraca Asoca Fam : Caesalpinanceae	Bark Flower	Dry Bark Rs 125/kg	Menstrual Pain, uterine, disorder, Deiabetes.
	Aswagandha (H), One year	Withania Somnifera Fam: Solanaccae	Root, Leafs	Rs 140/ Kg	Restorative Tonic, stress, nerves disorder, aphrodiasiac.
	Bael / Bilva (T)After 4-5 year	Aegle marmelous Fam: Rutaccae	Fruit, Bark	Fruit - Rs 125 / kg Pulp - Rs 60 / Kg	Diarrrhoea, Dysentry, Constipation.
	Bhumi Amla (H), with in one year	Phyllanthous amarus Fam : euphorbiaccae	Whole Plant	Rs 40 / Kg	Aenimic, jaundice, Dropsy.
	Brahmi (H) Indian penny worth/one year	Bacopa,Monnieri Fam: Scrophulariaccae	Whole plant	Rs 20 per kg	Nervous, Memory enhancer,mental disorder.
	Chiraita (high altituted) with in one year (H)	Swertia Chiraita Fam : Gentianaccae	Whole Plant	Rs 300-350 / per kg	Skin Desease, Burning, censation, fever.
	Gudmar / madhunasini, after Four year (C)	Gymnema Sylvestre Fam: Asclepiadaccae	Leaves	Rs 50 -75 per kg	Diabetes, hydrocil, Asthama.
	Guggul (T)after 8 years	Commiphora Wightii Fam: burseraccae	Gum rasine	Rs 80 - 100 per kg	Rheuma tised, arthritis, paralysis, laxative.
	Guluchi / Giloe (C)With in one year	Tinospora CordifoliaFam	Stem	Rs 20 - 25 per kg	Gout, Pile, general debility, fever, Jaundice.
	Calihari / panchanguliaGlori Lily Five years	Gloriosa superba Fam: Liliaccae	Seed, tuber	Rs 60	Skin Desease, Labour pain, Abortion, General debility.
	Kalmegh/ Bhui neem (H) with in one year	Andrographis PaniculataFam : scanthaccae	Whole Plant	Rs 12 - 20	Fever, weekness, release of gas.
	Long peeper / Pippali (C) after two to three years	Peeper longum Fam : Piperaccae	Fruit, Root	Rs 100 - 150 per kg Root - 150 per kg	Appetizer, enlarged spleen , Bronchities, Cold, antidote.
	Makoi (H)Kakamachi/ With in one year	Solanum nigrum Fam: Solanaccae	Fruit/whole plant	Rs 40 per kg Seed - 200 per kg	Dropsy, General debility,Diuretic, anti dysenteric.
	Pashan Bheda / Pathar Chur (H)One year	Coleus barbatus Fam : Lamiaccae	Root	Rs 40-50 per kg	Kidny stone, Calculus.
	Sandal Wood (T)Thirty years onward	Santalum Album Fam: santalinaccae	Heart wood , oil	Rs 350 per kg	Skin disorder, Burning, sensation, Jaundice, Cough.
	Sarpa Gandha (H)After 2 year	Ranwolfia Serpentina Fam: apocynaccae	Root	Root - Rs 60 per kg Seed - Rs 300 per kg	Hyper tension, insomnia.
	Satavari (C)After 2-3 year	Asparagus Racemosus Family: liliaccae	Tuber, root	Rs 20 -50 per kg	Enhance lactation, general weekness, fatigue, cough.
	Senna (S)With in 1 year	Casia augustifolia Fam: Liliaceae	Dry Tubers	Rs 500/kg seed Rs1200/kg dry	Rheumatism, general debility tonic.

ACTIVITY 2

The students were divided in to 8 groups and each group was allotted with the following task

- Students were instructed to select 5 plants from the following list of plants

LIST OF COMMON MEDICINAL PLANTS

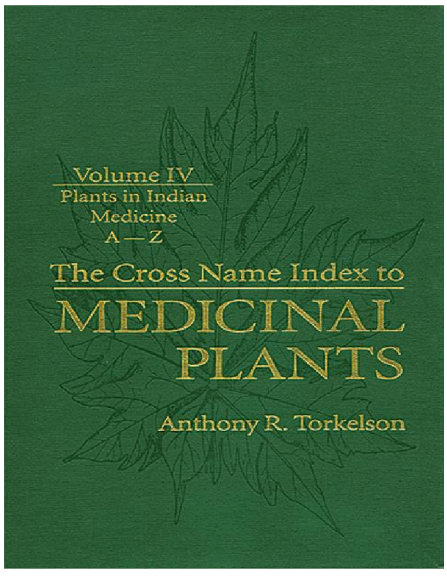
Kurunthotti	(Sida humilis)
Kodangal	(Centella asiatica)
Garudakkodi	(Aristalochia indica)
Tulsi	(Ocimum sanctum)
Chittamruthu	(Tinospora cordifolia)
Brahmi	(Bacopa monneiri)
Narunandi	(Hemidesmus indicus)

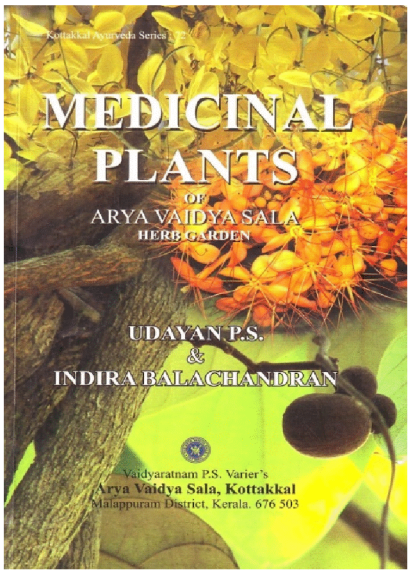
- Each group was instructed to collect details of the plants from neighbourhood, books, internet and interview with farmers and experts in the field
- Instructed to collect seeds/ stem/ leaves of medicinal plants

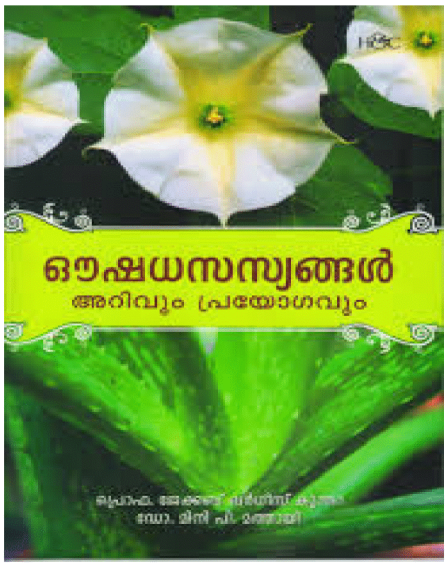
PRESENTATION PHASE

Each group presents the details collected about medicinal plants

Reading materials for extrapolated learning







Know more about medicinal plants

Medicinal Plants: Status and Uses

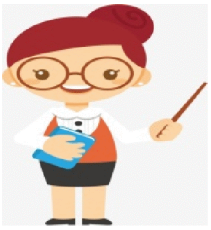
In the modern age, chemical and pharmaceutical investigations have added a great deal of status to the use of medicinal plants by revealing the presence of active principles and their actions on human and animal systems. For the last 50 years or so, man has relied almost entirely on plants to treat all manner of illness, from minor problems such as cough and cold

to life–threatening diseases such as tuberculosis, malaria and cancer. Demand for herbal medicine is increasing day by day, as those medicines have no side effects. Even though, there are billions and billions of medicinal plants available in India, the commercial prospects of medicinal plants are rather dim. India's share in this trade is practically insignificant, compared to USA which imports medicinal plants worth about several billions dollars annually. People in Europe, North America and Australia are consulting trained herbal professionals and are using the plant medicines. So, if the medicinal plants could be cultivated scientifically and with proper care, we can expect a flow of foreign currency from other nations too.

Significant uses of Medicinal Plants

Medicinal Plants have several significant uses like the following:

- Medicinal Plants are immediate and relatively harmless sources of medicines, which can be used for the treatment of many ailments and for improving the body's ability to remove toxins.
- Medicinal Plants help the nervous system to function effectively.
- Herbal medicines work to encourage the blood circulation in a proper way.
- Medicinal plants help to fight against infections, encourage blood clotting during injuries and help to heal wounds. Medicinal plants are the rich source of a wide range of essential elements, which are needed for living organisms.
- They provide good supply of vitamins and minerals.
- Medicinal Plants are being used for improving the quality of diet and for sustaining and regulating good health.



Evaluation

1. Name few plants which are most useful to us?
2. What are the uses of Medicinal Plants?
3. Give the scientific names of any two common medicinal plants?
4. What are the uses of Tulsi?
5. Name two diseases which can be cured by medicinal plants?

Follow Up

- Collect information about some common indigenous plants in your locality which are therapeutically important. Make a chart, showing their uses.
- List out the names and uses of medicinal plants seen in your school campus.

SUB UNIT – 2

FACTORS INFLUENCING THE CULTIVATION OF MEDICINAL PLANTS

Cultivation of medicinal plant is gaining ground because of the sky rocketing prices of allopathic medicines. Now a day's the importance of cultivation of medicinal plants is increasing steadily due to the side effects of chemical and artificial medicines that is creating awareness among the people worldwide. Cultivation of medicinal plants is economically very attractive.

Several factors like soil, climate and season, method of propagation, method of cultivation, collection and harvesting, storage and sales potential and marketing position influence the cultivation of medicinal plants. Now let us discuss about the details of each of these factors. ***(Teacher - guided discussion is followed by preparation of brief notes on each factor discussed.)***

Students were divided into 8 groups. Each group is instructed to identify and prepare short notes on factors affecting medicinal plant cultivation.

DISCUSSION PHASE

Students discuss in groups about factors affecting medicinal plants. Teacher instructs the students to relate the topic of discussion with common crop cultivation.

PRESENTATION PHASE

A student from each group presents major points evolved from the group discussion. Teacher notes each new point on blackboard for consolidation.

CONSOLIDATION

With the help of a power point presentation teacher elaborates the different factors influencing cultivation of medicinal plants.

The major factors affecting cultivation of medicinal plants include:

1. Soil : Type of soil and quantity of soil are the important limiting factors in propagating the Medicinal Plants; hence it is essential to know that the species selected for cultivation will do well under the type/condition of soil which the plant prefers.

2. Climate & Season : Different Medicinal Plants need different type of climatic conditions and seasons for their growth and hence these should be given due importance.

3. Method of propagation : Medicinal Plants can be propagated either from seeds or by cutting, budding, grafting or layering. So, knowledge of different types of propagation is an essential aspect in the cultivation of Medicinal Plants.

4. Method of Cultivation : Procedures such as preparation of land, application of fertilizers, manures and insecticides, irrigation, weeding etc should be carefully done for propagating the Medicinal Plants.

5. Collection and Harvesting : As far as Medicinal Plants are concerned, collection and harvesting are to be given due importance. Certain rules for collection of drugs are in practice and they are listed below:

a. Roots, rhizomes and barks are collected in late autumn or early spring, when the vegetative processes have ceased.

b. Leaves or flowering tips are collected about the time of development of flowers and before the maturing of the fruit and seed. At this time, the photosynthetic activity is at its maximum and the *content of the active principle is also high.*

c. Fruits are collected when fully grown, but unripe.

d. Flowers are collected prior to or just about the time of pollination.

e. Seeds are collected when fully mature and if possible before the bursting of fruits.

6. Storage : Proper storage and preservation methods are essential for maintaining a high degree of quality of the drug. The storehouses should be rodent - proof, cool, dark and well ventilated with dry air. The drug must be well packed taking into consideration its special properties. Care must be taken to keep them in a place of low temperature and freezing temperature.

7. Marketing : If a plant is selected for cultivation, it is necessary to know which part of the plant has demand in the market, its sales potential and market position. Knowledge about '*market survey'* is also essential.

By 'market survey' we mean trying to know the names of buyer/ company/ exporters, searching the sale potential and market position, and by meeting persons through internet etc.

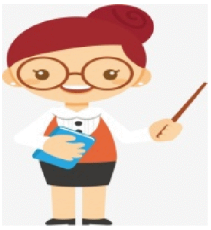
ACTIVITY 2

Students along with the help of teacher set up a medicinal plant garden in the school compound. (Students chose 15 medicinal plants for setting garden. Plant saplings were collected from nearby botanical garden; proper place for garden was selected in the school compound and replanted the saplings carefully).

Things to know……

The following steps would also be helpful in making Medicinal Plants Cultivation a grand success:

1. Conducting visits to other successful farms of Medicinal Plants Cultivation.
2. Making a critical self-evaluation of one's ability to take correct decisions regarding the following.
    a. the time that he / she can spare for cultivation
    b. type of land needed for Medicinal Plants Cultivation and soil quality.
    c. irrigation facilities and climatic conditions of land (Rainfall, Wind Velocity etc.)
    d. type of fertilizers needed for Medicinal Plants Cultivation.
    e. Pesticides needed for Medicinal Plants Cultivation.
3. Reading magazines, research papers and maintaining contacts with research institutions relating to Medicinal Plants Cultivation.
4. Exploiting the possibilities of cultivating those medicinal plants, which are banned from export point of view, since this will pay us more.
5. Knowing the market position for different types of medicinal plants.



Evaluation

1. What are the major factors influencing the growth of medicinal plants?
2. What is meant by ‘market survey’?
3. How can we make Medicinal Plants Cultivation a grand success?
4. Which is the most appropriate time for harvesting leaves and flowers?
5. Name a few propagation methods of medicinal plants?

Follow Up

- Visit medicinal plants cultivating farms, observe and collect information regarding the different factors influencing the cultivation of medicinal plants.
- Collect more information regarding the marketing position of different medicinal plants by consulting with persons who are engaged in Medicinal Plants.

SUB UNIT – 3

CULTIVATION OF MEDICINAL PLANTS

Medicinal Plants Cultivation, as a gainful self-employment, may be a new venture for most of us. Therefore, as beginners, it should be done on a smaller scale and care should be given in selecting the right type of medicinal plants for cultivation. Generally, selection of Medicinal Plants Cultivation is done on the basis of certain relevant factors like utilitarian value of the plant, climate and season, availability of raw materials from the locality, rapid growth potential and marketability. Taking these factors into consideration, let us make an attempt to select a few medicinal plants for cultivation.

ACTIVITY 1

Through Teacher guided discussion three medicinal plants viz., Asparagus, Neelamari and Tulsi are selected for learning about the different modes of medicinal plant cultivation.

Let us explore.....

Now let us examine each of these five medicinal plants in detail, so that we can be familiar with the habitat / distribution, identifying features, uses and different aspects of cultivation of these plants.

ASPARAGUS (SHATAVARI)

BOTANICAL NAME : ***ASPARAGUS RACEMOSUS***

Family : Liliaceae

Shatavari Plant

Local Names : Shatavari, Shatapadi, Bahusuta, Atirasa, Bhiru, Indivari, Mahodari, Narayani, Shataveerya, Pivari, Shatamooli, Urdhwakantika, Rishyaporka.

REGIONAL NAMES

English	:	Wild asparagus
Hindi	:	Shatavar, Shatamuli
Malayalam	:	Shatavari, Sadavali

.

Fig. Shatavari Stem

Fig.: Satavari -Inflorescence

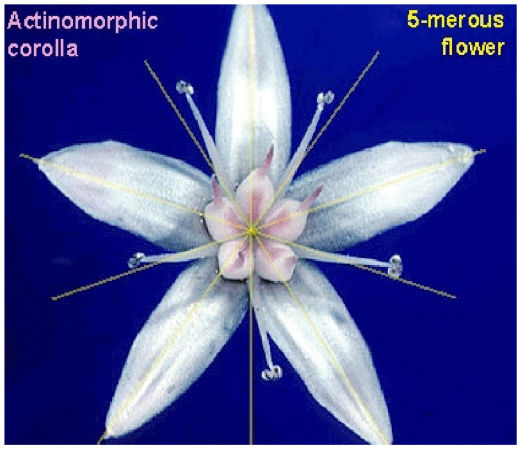


Fig. 3.66 Symmetry of the Flower

Reproductive part : *Seeds*

Useful part : *Tuberous root*

Specific uses of roots of *Asparagus* : The roots of *Asparagus* are bitter and sweet. These roots are specifically useful in the treatment of nervous disorders, *dyspepsia, diarrhoea, dysentery, tumours*, burning sensation, *opthalmopathy, inflammation, nephropathy, hepatopathy, throat infection, tuberculosis, bronchitis, hypertension, abortion* and *general debility.*

Shatavari Products

CULTIVATION OF ASPARAGUS (SHATAVARI)

Shatavari Cultivation

Soil and Climate : Fertile moist sandy loam soil is ideal for the cultivation of *Asparagus* though it grows in a wide range of soils. Better root development is observed in soils in increased proportion of sand. However, a decline in the yield of the crop is noted in soils containing previous years residue of the roots. It is a crop of tropics and requires optimum temperature of 10-40^{0}c with plenty of sunshine and annual rainfall of 50-100 cm. It prefers warm, hot and humid climate.

Period : 2 years

Improved varieties : white and yellow colour types are improved varieties of *Asparagus (Shatavari).*

Season for Cultivation : The best time for direct sowing is May to July.

Land Preparation : Before cultivation, the land should be ploughed twice and the field should be cleaned thoroughly off weeds. About 25 tonnes per hectare of cow dung manure is also to be added. Ridges and furrows are opened at 45cm apart and planted 15 cm within each row.

Mode of propagation : Asparagus plant is best grown from its tuberous roots, eventhough it can be successfully propagated through seeds also. Since root tubers are of commercial value, seed propagation provides economic advantage to the farmers.

Seeds and sowing : About 3-4 kg seeds are required for one- hectare land. The seeds are sown during May-June in well prepared raised nursery beds of 5m x 1m and 20 cm high. Seeds have to be sown in lines 3 - 4 cm apart and covered with thin layer of fine sand. The beds are lightly watered. The seeds take 15 - 20 days to germinate. The germination percentage is 70 - 80 %. The nursery duration is for 2-3 months.

Transplanting : The best time for transplanting is July-August Seedlings are transplanted from beds when 5 cm in height, into polybags. After 2 - 3 months, they should be planted in the main field in 45 cm cubic pits at a spacing of 2 feet.

Manures and fertilizers: A dose of FYM (farm yard manure) for 20 per hectare is recommended. However, the recommended fertilizers schedule is not yet been standardised so far. The fertilizers are applied in the soil near the root system, after the plants are established. Application of N, P_{2O5} and K_2O at 60:30:30 kg/ ha increases the root yield.

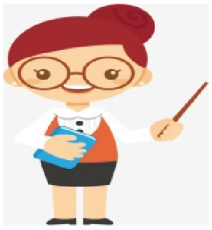
Irrigation : Shatavari, in its natural habitat, requires optimum moisture content for its normal growth and development. Looking into the plants water requirements, irrigation is given once in 4 days interval in summer and ten days interval during winter.

Weeding : Weeding is required at fortnightly intervals. However, in the field conditions, weeds like cynadon-dactylon and parthenium were noticed.

Pest and Diseases : No major diseases and pests were observed under field condition, except snails and mites which can be controlled by 0.07% Endosulfan.

Harvesting and Storage : The crop is ready for harvesting after 14-18 months of planting. The best time for harvesting is October to December. The crop is harvested manually by

digging and uprooting the individual plants. The fresh root tuber barks are to be removed, by making a long incision in the root. The central canal threat is to be removed and then dried in shady place for 3- 4 days, yielding 10-12% of dry tubers. The dried tuberous roots are to be stored in gunny bags.



Evaluation

1. Which is the best suited time for Asparagus cultivation?
2. What is the scientific name of Asparagus?
3. Explain the common medicinal uses of Asparagus?
4. What are the different products obtained from Asparagus? type of seed in Nilamari?
5. Briefly explain the different steps in the cultivation of Asparagus?

COMMON INDIGO (NILAMARI)

BOTANICAL NAME : *INDIGOFERA TINCTOREA*

Indigofera tinctoria

Local Names : Nil, Nilika, Guli

Regional Names:

English	:	Common Indigo, Indian Indigo, True Indigo, Dried Indigo
Hindi	:	Nil
Malayalam	:	Nilam, Amari, Nilamar

Root nodule of Indigofera

Indigofera Stem and Leaves

Indigofera Flower

Indigofera Plant bearing Pod

Indigofera Seeds

Useful Part : Whole plant

Specific Use: The roots, stems and leaves are bitter, thermogenic, laxative, *trichogenous, expectorant, antihelminthic,* tonic and diuretic, and are useful for promoting the growth of hair and in *gastropathy, splenomegaly, cephalalgia, cardiopathy,* chronic bronchitis, asthma, ulcers and skin diseases. The juice extracted from the leaves is useful in the treatment of *hydrophobia*. An extract of the plant is good for epilepsy and neuropathy. The plant possesses anti-toxic property.

'Nili' a reputed drug produced from this plant, is used in Ayurveda for the promotion of hair growth and it forms a major ingredient in preparations like 'nilibhringadi oil'. This plant is the original source of *natural indigo*. A paste of indigo, the dye extracted from the leaves is given in liver complaints and nervous diseases.

A paste made with warm water applied to the pubic regions relieves retention of urine; the dye is a soothing balm for burns and scalds, insect stings and animal bites; its powdered form is applied to ulcers and boils and its powder is dusted on ulcers to promote healing.

Paste of Nilamari

Mehandi

Neeleebhringadi oil

Indigofera Products

CULTIVATION OF INDIGOFERA TINCTORIA

Indigofera Cultivation

Soil and Climate : Nilamari grows well in plains as well as in hilly areas as it requires good sunlight. Sandy loam soil is the best for the cultivation of Nilamari. It can be cultivated in coastal sandy soil too. Clayey soil where there is water logging, is also suitable for its cultivation. It can withstand temperature up to 40^{o}c provided adequate soil moisture could be maintained.

Season : The seeds can be sowed anytime, but the best season for sowing is April-May and September-October.

Land Preparation : Manipulate the soil with tools and equipments so as to create a favourable condition for the satisfactory germination of seeds of plants. For Common Indigo, prepare the soil to fine tilth by ploughing two three times, in order to spread the roots of plants in the soil.

Seeds and Sowing : This is usually propagated by seeds. A single dried fruit of Indigo contains 10 to 15 seeds. Seeds are very small and the seed rate is 3 kg per hectare. Seeds require pre-treatment for good germination, as the seed coat is hard. Seeds are mixed with sand and ground gently to break the seed coat. An alternate method for enhancing

germination is dipping the seeds in boiling water for a second. After pre-treatment, seeds are broadcasted in raised lands or in pits. Broadcast the seeds preferably mixed with sand 2 to3 times its volume to ensure uniform coverage. The seed beds should be covered with straw and irrigated. The seeds germinate within a week. Seedlings are ready for transplanting after one-month. Transplant the seedlings which grow up to 10 to 15cm, in pits of one feet length and one feet breadth at a distance of 80 cm.

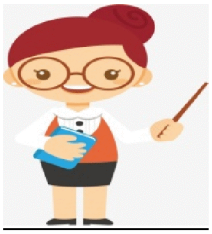
Manuring : Bio-fertilizers are best suited for Nilamari. Cattle manure should be applied at the rate of 10 tonnes per hectare as basal dressing and incorporated into soil along with last ploughing.

Irrigation : Irrigate the plants daily. Nilamari shed their leaves during winter and summer season. So, during these seasons, the plants have to be irrigated twice a day.

Weeding : Weeding has to be done two times, 3 weeks after sowing and 6 weeks after sowing.

Harvesting and yield : Plants starts flowering 2 to 3 months after sowing. Harvesting is done by cutting the plants at this time, at a height of about 10 cm from ground level. Irrigate plants after harvest. Subsequent harvest can be made at 1.5 to 2 months interval. Four to five cuttings can be taken in a year depending on the growth. During the first year 3 tonnes leaves could be obtained per hectare.

Post harvest handling and value addition : A few plants per plot are left without cutting to set seeds. Ripe pods are to be harvested in the early morning to prevent loss of seeds by shattering harvest.



Evaluation

6. What is the botanical name of Nilamari?
7. What is the name of the drug produced from Nilamari?
8. Explain the common medicinal uses of Nilamari?
9. What is the type of seed in Nilamari?
10. Briefly explain the different steps in the cultivation of Nilamari?

Follow Up

- Visit a Nilamari farm and make a report on the weeding, irrigation, harvesting techniques etc.
- Collect the names of ayurvedic products in which Nilamari is used as basic ingredient and make a chart showing its specific uses.

OCIMUM (TULSI)

BOTANICAL NAME	:	***OCIMUM SANCTUM***
Family	:	Labiatae / Lamiaceae

Fig.: Ocimum sanctum

Local Name: Tulsi, Surasa, Gouri, Shyma, Devadundubhi, Bahumanjari, Bhutaghnee, Apetarkshasi

Regional Names

English	:	Holy basil, Sacred basil
Hindi	:	Katutulsi, Tulsi
Malayalam	:	Tulsi, Karuttatrttavu, Krishna Tulsi, Niella tirt

Ocimum Root

Ocimum Leaves and Stem

Inflorescence of Ocimum

Seeds of Ocimum

Useful part: whole plant; roots, seeds, leaves and flower.

Specific Uses: Ocimum oil finds diverse uses in the perfumery and cosmetic industries as well as in indigenous system of medicine. It has notable ability to reduce blood sugar levels and blood pressure and prevents peptic ulcers and other stress related conditions like hypertension, colitis and asthma.

It is used in *cardiopathy, haemopathy, hepatopathy, leucoderma, bronchitis, vomiting*, *gastropathy* in children, *fever*, *lumbago, opthalmia,* genital-urinary disorders, ringworm, *verminoses* and skin diseases.

The leaves and seeds of this plant have medicinal value. The juice extracted from the leaves are used to treat digestive complaints, *bronchitis* and *catarrh* and also administered to cure ringworm and skin diseases.

The juice of leaves is dropped in ears to relieve earache; to cure common cold, decoction of leaves is prescribed; decoction of root is used in *malarial fever*; the oil extracted from leaves has the property to destroy insects and bacteria. The fresh roots are ground with water and applied to stings of wasps, bees and bites of worms and leeches.

Tulsi Products

100 gms of Tulsi are needed to prepare 1 litre extract. The leaves should be soaked in water overnight. The next day the leaves are ground and the extract is filtered. To this, 1 ml of Khadi soap solution is added and stirred properly. This can be sprayed in the morning hours for effective control of pests.

CULTIVATION OF OCIMUM SANCTUM

Fig. Ocimum Cultivation

Types and varieties: Two types of *Ocimum sanctum* are under cultivation; the **green type** (Sri Tulsi) is the most common, the second **dark type** (Krishna Tulsi) bears purple leaves and is preferred in the trade for its higher potency of the drug.

Soil: It thrives well on a variety of soil. Rich loam to poor laterite; saline and alkaline to moderately acidic soil are well suited for its cultivation. Well drained soils aid in better vegetative growth. Water logged conditions can cause root rot and result in stunted growth.

Climate: Ocimum has wider adaptability and can be grown in warm and humid climate. The plant can be grown under partially shaded condition but it yields less oil. It flourishes well during summer and monsoon months when the temperature is moderate to high and when there is annual rainfall ranging from 500 to 1200mm. Long days and high temperature have been found favourable to the plant growth and oil production. The plant is moderately tolerant to drought and frost.

Season: The nursery can be raised on the third week of February and transplanting is generally started in the middle of April. This can be undertaken in the month of March, if the seedlings are raised in beds. The crop remains in a dormant state during winter season (December to February), but can withstand cold and arid conditions.

Land preparation : The land is brought into a fine tilt and laid out into convenient sizes for irrigation. It is preferable to add 15 tonnes per hectare of farm yard manure (FYM) during the preparation of the land.

Seeds and Sowing : The plant is propagated through seeds. The seed should be sown 2 cm deep in the nursery beds. After sowing the seeds in the nursery a mixture of FYM and soil is thickly spread over the seeds and irrigated with a sprinkler hose. The seed rate is about 125 gm per hectare. The seeds germinate within 8-12 days and the seedlings are ready for transplanting in about 6 weeks time, at the 4-5 leaf stage. A spray of 2% urea on the nursery plants (15 to 20 days before transplanting) helps in raising very healthy plants for transplanting. When 6-10cm tall, the seedlings are transplanted in the field at 40-60 cm spacing in rows.

Manuring: At the time of planting, apply 10-15 tonnes FYM. A medium fertilizer dose of 40:40:40 kg per hectare of N, P_2O_5 and K_2O is recommended for economic yield, though good response has been received up to 120:100:100kg per hectare.

Irrigation: Irrigation depends upon the moisture content of the soil. In summer three times irrigation per month is necessary, whereas, during the remaining period, it should be done as and when required, except in the rainy season when no irrigation is necessary. Altogether, about 12-15 irrigations per year are sufficient.

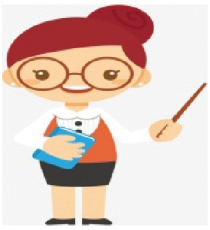
Weeding: The first weeding is done one month after planting, and the second weeks after the first. After this, no further weeding is required as the plants become bushy, thereby naturally suppressing the weeds.

Diseases and pests : The plant is susceptible to powdery mildew caused by *Oidium* Spp; seedling blight caused by *Rhizoctonia solani* and root rot caused by *Rhizoctonia bataticola*. Powder of mildew can be controlled by spraying wet Sulphur (4g/l of water), and the latter two diseases are managed by improved phytosanitary measures and by drenching the nursery – beds with a solution of mercurial fungicide.

Among the insects, the larva of leaf rollers sticking to the under surface of the leaves fold them backwards length-wise, then webs them. Malathion (0.2%) may be sprayed to control this insect.

Harvesting and yield : The crop is harvested when it is in full bloom. The first harvest is obtained 90-95 days after planting. Afterwards, it may be harvested at every 65-75 days interval. Harvesting should be done on bright sunny days in order to obtain good quality oil yield. It is not desirable to harvest the crop if it has rained the previous day.

The crop should be cut 12-20cm above the ground level. The harvested product may be allowed to wilt in the field itself for 4-5 hrs to reduce the moisture content and the bulkiness. About 5 tonnes per hectare of fresh herbage can be obtained twice or thrice a year.



Evaluation

1. What is the botanical name of Tulsi?
2. What are the major diseases affected by Tulsi/
3. What are the factors that we bear in mind while harvesting Tulsi?
4. Explain the major medicinal uses of Tulsi?
5. Briefly explain about the 'cultivation of Tulsi'.

Follow Up

- Conduct a seminar on the topic "Importance of Tulsi as a Courtyard Medicine".
- Collect more information regarding the significance of Tulsi as both ornamental and medicinal plant in the garden.
- Write an article about the "traditional significance of Tulsi" and present it in your class.

INSTRUCTIONAL PACKAGE ON FOOD PRESERVATION

Objectives

By learning these content areas, the student will be able to

- Identify selected food preservation techniques explain uses and therapeutic values of medicinal plants
- Identify different methods of preservation
- Collect details regarding food preservation techniques
- Explain the need and importance of food preservation
- Organise activities related to Food preservation
- Understand the preparation of fish cutlet
- Identify the ingredients used for making fish cutlet
- Describe the concept making fish cutlet
- Predict the economic profit from food preservation techniques

Food preservation is the process of treating and handling food to stop or slow down food spoilage, loss of quality, edibility or nutritional value and thus allow for longer food storage. It refers to any one of a number of techniques used to prevent food from spoiling. It includes methods such as canning, pickling, drying and freeze-drying, irradiation, pasteurization, smoking, and the addition of chemical additives. Food preservation has become an increasingly important component of the food industry as fewer people eat foods produced on their own lands, and as consumers expect to be able to purchase and consume foods that are out of season.

Preservation usually involves preventing the growth of bacteria, fungi such as yeast, and other micro-organisms, as well as retarding the oxidation of fats which causes rancidity. The vast majority of instances of food spoilage can be attributed to one of two major causes: ie. the attack by pathogens (disease-causing microorganisms) such as bacteria and molds, or oxidation that causes the destruction of essential biochemical compounds and/or the destruction of plant and animal cells. Most disease-causing organisms require a moist environment in which to survive and multiply.

Now a day's several method are used for preserving food in order to reduce or eliminate one or the other (or both) of these causative agents. The specific technique adopted depends on the properties of the food being preserved. Drying is a natural technique for preventing spoilage. The freezing process also permitted the marketing of precooked food, sold ready to heat and serve.

METHODS OF FOOD PRESERVATION

Food preservation, any of a number of methods by which food is kept from spoilage after harvest or slaughter. Such practices date to prehistoric times.

Teacher-guided discussion on 'Food preservation' follows, leading to the preparation of a list of food preservation methods by students.

ACTIVITY 1

Teacher divides the class into three groups. Each group is asked to discuss about common food preservation methods and prepare a list of it.

DISCUSSION PHASE

Students discuss in groups about common food preservation methods. Teacher guides them to discuss various aspects of food preservation ensuring participation of all students.

PRESENTATION PHASE

A student from each group presents a consolidated form of their discussion

More about Food Preservation

Several methods are used for preserving food. Following are the most important and commonly used preservation techniques.

1. Canning

Canning is a method of preserving food in which the food contents are processed and sealed in an airtight container. Canning provides a shelf life typically ranging from one to five years, although under specific circumstances it can be much longer.

2. Freezing

Freezing is a phase transition in which a liquid turns into a solid when its temperature is lowered below its freezing point. In contrast, solidification is a similar process where a liquid turns into a solid, not by lowering its temperature, but by increasing the pressure that it is under. The process is less effective in food preservation than are thermal techniques such as boiling

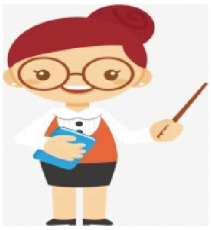
because pathogens are more likely to be able to survive cold temperatures than hot temperatures. In fact, one of the problems surrounding the use of freezing as a method of food preservation is the danger that pathogens deactivated (but not killed) by the process will once again become active when the frozen food thaws.

3. Drying

Drying is the process of using heat to remove a liquid (such as water) from a material that contains the liquid. Drying can be accomplished by various techniques, ie, heated air drying, Natural air drying, Freeze drying, Dielectric drying etc.

4. Salting

Salting is the preservation of food with dry edible salt.[1] It is related to pickling in general and more specifically to brining (preparing food with brine, that is, salty water) and is one form of curing. It is one of the oldest methods of preserving food.



Evaluation

1. What are the different food preservation techniques?
2. What is Canning?
3. Why do we preserve food?

Follow Up

- Collect more information regarding food preservation techniques
- Try out any two preservation techniques at home

FISH PICKLING

Top quality fresh fish are essential for fish preservation. Fish Pickles are the most popular item. Besides domestic market pickles have an export potential also. You can start this business from your home location.

Fish pickle making business can be initiated as small scale and home scale basis. This is considered as one of the most profitable small business manufacturing ideas in business and also you can be operated this as part-time basis.

This business demands a small start-up capital investment. Thus allows you to get into a business with taking a minimum risk. There is a huge demand for the fish pickle in our country. The production process is simple and the product has an immense market opportunity for export also. This is an easily scalable business. As your business grows, you can easily go for nationwide expansion.

PREPARATION

Bindu : Hai students

We all know that pickle is a delicious food item in our meal.

In India, pickles are made from mango; lime, gooseberry etc are very popular. It is consumed at large by all sectors of people.

Fish pickles are also very popular.

India exports large quantities of fish pickles to Middle East and other parts of the world.

It's a good appetizer food item.

Let us study how to make a fish pickle

Let's see the ingredients used for making fish pickle

INGREDIENTS

- Fish meat ½ Kg
- Green chilly 4 Nos
- Garlic peeled 2 or 3 Pod
- Ginger peeled 1 Large piece
- Chilli powder 2 ½ Table spoon
- Pepper powder ½ Table spoon
- Turmeric powder ½ Table spoon
- Gingelly oil ½ Cup
- Vinegar 2 ½ Table spoon
- Salt To taste
- Sugar
- Asafoetida
- Curry leaves

- Researcher: Fish pickle can be made with tuna, sardine, butter fish (moda), seer fish, prawns, anchovies, promphret etc except mackerel. The commonly used fish is tuna.

- Miss : At first, fillet the fish and remove the skin.

  Cut the fish in to small pieces.

- Researcher : What about the size of pieces?

- Miss : Cut the fish in to small cubes

  Marinate them with paste of 1 tsp red chilly powder,1/2 tsp pepper powder, 1/4 tsp turmeric powder, and salt.

- Fry it in oil till the colour turn to golden brown, remove from oil and keep aside.

- Researcher : Now the fried fish is ready. The first phase for preparing fish is over, isn't it?

- Miss: Yes, now all other ingredients expect turmeric and chilli powder, are gently fried in the same oil, in a frying pan, used for frying fish.

- Turmeric and chilli powder are then added followed by fried fish.

- Mix well and add sufficient quantity of boiled cooled water just to cover the materials.

- If saltiness is not sufficient remember more salt should be added.

- Researcher : After this cool the contents and to be packed in airtight glass bottles.

  Acid resistant pilfer proof caps are used to seal the bottle.

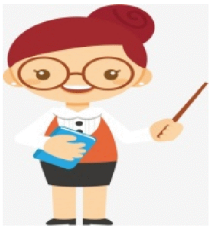
  Now you are getting a healthy fish pickle.

- Researcher: Aging of pickle is very important. The shelf life of fish pickle is one year under tropical condition

Advantages of Food preservation

The following are the advantages of food preservation

- Food preservation prevents the food from being spoiled by the action of enzymes and microorganisms.
- Food preservation increases the safe storage period of foodstuffs. It increases the availability of out of season foodstuffs.
- It increases the availability of various foodstuffs even at distant and not easily approachable places. In other words, it makes the transportation of the food materials easier.
- Food preservation makes up for the deficiencies in the diet.
- Increased shelf-life
- Decreased hazards from microbial pathogen
- Decreased spoilage (microbial, enzymatic)
- Inactivation of anti-nutritional factors
- Ensured round the year availability of seasonal foods
- Perishable foods that can be transported to far-off distances from the site of production
- Increased availability of convenience foods (e.g. Ready-to-serve beverages, Instant mixes etc.)
- Increased variety of foods, some with enhanced sensory properties and nutritional attributes.
- Preservation in some cases produces a different form of the products which are of great importance in various cuisines. E.g. raisins, squash and wines made from grapes.



Evaluation

1. Which are the commonly used fishes for pickling?
2. What are the ingredients of fish pickling?
3. How long can fish pickles be kept without being spoiled?

Follow Up

- Collect more information regarding variety of fish pickling
- Prepare fish pickle at home

Appendix - V

RATING SCALE FOR EXPERTS

SCERT,Kerala
Poojappura

Dear Sir / Madam,

You may be aware that the present system of education is often criticized as unsuitable for preparing the individuals for occupational roles. As a Biology teacher, you will agree with me that most of the Biological concepts / aspects that are to be learnt by secondary school students are actually inherent in certain agriculture - based vocations, which the students are familiar with. As such, any conscious attempt made by the teacher to link the Biological concepts with the vocations may lead to the development of vocational interest in students. But the teachers, in general, do not make any conscious effort to link the Biological concepts with familiar vocations and thereby develop vocational interest in students. One of the major reasons for this may, perhaps, be that teachers do not know how to link the Biological concepts with the agriculture – based vocations. In this context, as a part of SCERT, Kerala funded project, I have prepared instructional packages relating to three of the agriculture- based vocations viz.,' Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food Preservation'.

The Rating Scale provided herewith is meant for assessing the suitability of the instructional materials prepared for the simultaneous learning of Biological concepts at secondary level and promotion of vocational interest in students, with respect to the two agriculture- based vocations identified viz., 'Rabbit Farming,' 'Medicinal Plants Cultivation' and 'Food Preservation. Kindly go through the study materials provided and indicate your opinion regarding the different aspects of evaluation, by putting a tick (✓) mark in the appropriate column of the Evaluation Schedule provided here with.

Thanking you,

Yours faithfully

Thiruvananthapuram

Dr. Bindu.S

RATING SCALE FOR EXPERTS

This Rating Scale for Experts is meant to assess the **suitability** of the instructional materials prepared for learning of the Biological concepts at secondary level and promotion of **vocational interest** in students, with respect to the three agriculture-based vocations identified viz., '**Rabbit Farming,**' '**Medicinal Plants Cultivation**' and Fish **Preservation**. Kindly go through the study materials provided and assess the extent of suitability of the materials, by using a tick mark (✓) in the appropriate place under each vocation identified, to indicate your opinion regarding the different aspects of evaluation.

	ASPECTS OF EVALUATION	**RESPONSES OF TEACHERS**					
		Rabbit Farming			**Medicinal Plants Cultivation**		
		GE	**SE**	**NA**	**GE**	**SE**	**NA**
1	*Possibility* of learning the Biological concepts through the instructional packages prepared relating to the vocation identified.						
2	*Possibility* of promoting vocational interest in Biology students at secondary level through the instructional packages prepared relating to the vocation identified.						
3	*Feasibility* of equipping the students for self-employment through the instructional packages prepared relating to the vocation identified.						
4	*Scope* of the instructional packages for						
	a) making Biology learning more interesting						
	b) developing scientific attitude						
	c) stimulating independent thinking						
	d) interacting with the community						
5	*Relevance* of the instructional packages prepared in the present educational context.						
6	*Overall* assessment of the instructional packages with respect to their suitability for the simultaneous learning of the Biological concepts and promotion of vocational interest in Biology students at secondary level.						

	ASPECTS OF EVALUATION	RESPONSES OF TEACHERS		
		Food Preservation		
		GE	SE	NA
1	*Possibility* of learning the Biological concepts through the instructional packages prepared relating to the vocation identified.			
2	*Possibility* of promoting vocational interest in Biology students at secondary level through the instructional packages prepared relating to the vocation identified.			
3	*Feasibility* of equipping the students for self-employment through the instructional packages prepared relating to the vocation identified.			
4	*Scope* of the instructional packages for			
	a) making Biology learning more interesting			
	b) developing scientific attitude			
	c) stimulating independent thinking			
	d) interacting with the community			
5	*Relevance* of the instructional packages prepared in the present educational context.			
6	*Overall* assessment of the instructional packages with respect to their suitability for the simultaneous learning of the Biological concepts and promotion of vocational interest in Biology students at secondary level.			

Note: **GE-** To a great extent; **SE** – To some extent; **NA** – Not at all

Appendix - VI

ACHIEVEMENT TEST IN BIOLOGY

Time : 1 hrs.

Max : 30 marks

Answer all questions

Section A

Choose the correct answer from the bracket. Each question carries 1 mark.

1. A sacred herb is ……

   A. Ramacham

   B. Tulsi

   C. Brahmi

   B. Neelamari

2. The best season for planting Ramacham is ….

   A. September

   B. August

   C. December

   D. Januar)

3. Satavari is a ----

   A.Leaf'

   B. Stem tuber

   C. Root ruber

   D. Rizome)

4. In Nilamari, the useful part of the plant is ….

   A.Stem

   B. Leaf

   C. Root

D. Whole plant)

5. Ramacham is a ....

A. Annual plant

B. Perennial plant

C. Biennial plant

D. Polycarpic plant)

6. Reproductive part of Asparagus is ---

A. Stem

B. Seed

C. Root

D. Schizocarp

7. Subodhak is a variety of ....

A. Shatavari

B. Ramacham

C. Brahmi

D. Nilamari

8. Nilamari is a major ingredient of an ayurvedic preparation called....which is used for hair growth .

A. Adnate

B. Basifixed

C. Dorsifixed

D. Versatile)

9. The soil ideal for the cultivation of Tulsi is .....

A. Monocarpellary

B. Bicarpellary

C. Tricarpellary

D. Polycarpellary,

10. The stem of Vetiver is a .....

A.Rhizome

B. Corm

C. Stem tuber

D. Bulb)

11. Which among the following fish is salted in whole

A.Mackerel

B. Pink Perch

C. Silver belly

D. Cod

12.The fishes are immersed in a solution of salt water

A.Dry salting

B. Wet salting

C. Kench salting

D.Colombo salting

13. Choose the odd one from the following-

A.Fish liver oil

B. Fish meal

C. Fish cutlet

D. Fish glue

14. Which one of the following is not a ingredient for making fish pickle?

A.Turmeric powder

B. Chilli powder

C. Potato

D. Garlic

15. From the following select the most suitable packing material for fish pickle.

A.Duplex carton

B. Glass jar

C.Tin can

D. Fiber board

16. The fish product that can be preserved in vinegar and directly served in dining table

A.Fish cutlet

B. Fish Ball

C. Fish curry

D. Fish pickle

17. Steps in the preparation of fish pickle are given below. Arrange them in the correct order

a) Green chilly, garlic, ginger are gently fried in the same oil, in a frying pan, used for frying fish

b) Add Turmeric and chilly powder and mix well.

c) Marinate the fish pieces with paste of 1 tsp red chillypowder,1/2 tsp pepper powder, 1/4 tsp turmeric powder, and salt.

d) Cut the fish in to small cubes

e) Fry fish in oil till the colour turn to golden brown, remove from oil and keep aside.

A. (a,c,d,b,e) B. (c,e,a,d,b)

C. (d,c,e,a,b) D. (b,d,a,c,e)

18. What is the shelf life of fish pickle under tropical condition?

A.3 year

B. 2 Months

C. 5.months

D. 1 year

19. Production of mycotoxinsin salted fish is caused by which type of microorganism

A. Fungi

B. Bacteria

C Mould

D. Yeast

20. Storage life span of fish cutlet under $^{-}20^{0}$C

A.1 year

B. 2 months

C. 6 months

D. 7 months

21. Agricultural practice of breeding and raising domestic rabbits are known as---
---

A. Apiculture

B. Cuniculture

C. Sericulture

D. Floriculture

22. The more suitable floor for deep litter system is----

A. Concrete floor

B. Mud floor

C. Wooden floor

D. Plastic floor

23. The gestation period of rabbit is ----

A. Six months

B. Three months

C. 28 days

D. 45 days

24. For commercial rabbit farming business, the best of rearing rabbit is

A.Cage method

B. Litter method

C. Deep litre method

D. Separating male and female method

25. The diet rabbit should be rich in

A. Fat

B.Protein

C. Fibre

D. Carbohydrate

26. A protozoan disease of rabbit is

A.Abscesses

B. Coccidiosis

C. Pneumonia

D. Rhinitis

27. Rabbit is a ----

A. Herbivore

B. Omnivore,

C. Carnivore,

D. Cunnivore

28. The average age of a rabbit for first mating is---

A. 5-7 months

B. 5-8 months

C. 6-7 months

D. 6-8 months

29. A variety of rabbit reared for getting wool

A. Chinchilla

B. Angora

C. New Jercy

D. White Gaint

30. The year in which Kerala Agriculture University set p the ICAR project for rabbit farming in the year

A.2010

B.1998

C. 1984

D.2000

(30x 1=30 Marks)

Appendix VII

List of Experts

1	Dr. P.V. Arunodaya, Veterinary Surgeon, Veterinary dispensary, Kalluvathikkal (PO), Thiruvananthapuram.	2	Dr. Sobha V. K Assistant Professor Govt College of Teacher Education Thiruvananthapuram.
3	Dr. A.S. Anilkumar, Professor (Agronomy), Instructional farm, Agriculture College, Vellayani, Thiruvananthapuram.	4	Dr. Biju C Assistant Professor Department of Botany SN College, VArkala, Thiruvananthapuram.
5	Dr. D. Geetha, Professor (Plant pathology), Instructional farm, Agriculture College, Vellayani, Thiruvananthapuram.	6	Dr. Exemmal. J. Former Dean, Department of Education, University of Kerala, Thiruvananthapuram.
7	Chandrika Devi Amma I. Former Principal Mount Tabor College of Teacher Education, Pathanapuram, Pathanamthitta	8	Dr. Amrudha A HSA, GHHS, Varkala, Thiruvananthapuram
9	.Dr. Aruna Devi Associate Professor Department of Zoology University College, Thiruvananthapuram	10	Dr. Jayachithra Assistant Professor Department of Zoology Govt. Womens College, Thiruvananthapuram