Dear Teachers,

This Teacher’s Sourcebook on Agriculture (Plant Protection) introduces the teacher to the main principles and practices of the revised pedagogy which is activity-based, process-oriented and learner-centred.

The realisation that learning is not mere storing information in memory and that real learning is construction of knowledge through observation, comparison, classification and analysis has led us to give a new thrust to the teaching-learning process at Vocational Higher Secondary level to make it more meaningful and learner-friendly.

This sourcebook has been developed primarily for the benefit of teachers who teach Agriculture (Plant Protection) at Vocational Higher Secondary level. The subject matter has been dealt with utmost care, in tune with the revised curriculum and pedagogic principles. It is hoped that this book will enable the teacher to provide suitable learning activities for effective learning.

The success of the approach depends upon the vision and commitment of the teacher. They are expected to make use of this sourcebook at all stages of their teaching process. It is also expected that the teacher would seek help and guidance from other sources like libraries and websites.

Hope that this sourcebook will help the teacher to develop the skills and experience required for effective classroom transaction.

Creative criticism and suggestions for improvement are most welcome.

With regards,

Thiruvananthapuram
July, 2006

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APPROACH

SIGNIFICANCE OF VOCATIONAL EDUCATION

The ultimate aim of education is human refinement. Education should enable the learner to formulate a positive outlook towards life and to accept a stand, which suits the well-being of the society and the individual as well.

The attitude and potential to work has determined the destiny, progress and cultural development of the human race. As we all are aware, the objective of education is to form a society and individuals having a positive work culture. The educational process expected in and outside our formal schools should concentrate upon inculcating concepts, abilities, attitudes and values in tune with these work culture. Hence vocationalised education cannot be isolated from the main stream of education. In another sense, every educational process should be vocationalised. However due to our inability to utilize the resources wisely, scarcity of job opportunities is a severe issue of the present society. For overcoming this deep crisis, emergent techniques have to be sorted out and appropriate researches have to be seriously carried out. It is in the sense that the content and methodology of Vocational Higher Secondary Education have to be approached. The need for meaningful linkages between the world of work and world of education is well recognized. The essence of the recommendations made by various commissions and committees is that the vocationalisation should be the main feature of the future system of education at the higher secondary stage; it can be extended to school level also.

Vocational education is system of education, which intends to prepare students for identified occupations, opening several areas of activities. The Vocational Higher Secondary course was envisaged as a part of the National Policy on Education with the noble idea of securing a job along with education. The relevance of vocational education is very great in this age of unemployment. This education system, which ensures a job along with higher education, stands aloof from other systems of education.

This education imparts the life skills required by the youth to enter the world of work and assuming the responsibilities of adulthood. As per the expert meeting report (2001) of UNESCO, the life skills are grouped under four categories. They are
1. Skills for personal fulfilment
2. Skills for living in society
3. Skills for dealing with changing economies
4. Skills for dealing with changing work patterns.

Vocational Education ensures fulfilment of manpower requirement for national development and for social security for the citizens through self-employment. It also helps to reduce the migration of rural youth to urban areas and thus helps in rural development.

The learners of Vocational Education get an opportunity to avail one year apprenticeship training in industries to improve their practical skill. During the course of study, on the job training (OJT) for 10 days in a year is arranged to improve the skill and efficiency of the learner. This education system motivates the attitude towards self –employment through Production Cum Service Training Centres. (PSTC)

OBJECTIVES OF VOCATIONAL EDUCATION

The National policy on education has accorded very high priority to the program of vocationalisation of education, considering the following objectives.

1. To fulfil national goals of development and the removal of unemployment and poverty.
2. To impart education relevant to increased production and productivity, economic development and individual prosperity.
3. To make available skilled work force at all levels to alleviate the rural unemployment and for the development of nation.
4. To develop environmental awareness to ensure sustainable development.
5. To develop vocational aptitude, work culture, values and attitudes of the learners so as to enrich the productivity of the nation.
6. To develop entrepreneurial competencies and skills of learners for self-reliance and to undertake gainful self-employment.
7. To facilitate the expansion of higher education and explore future opportunities through innovative guidance and programmes.
8. To develop vocational competencies, creative thinking in the related areas and facilitate training.
9. To create awareness on mental, physical and social health.
10. To acquire awareness about different job areas and to provide backgrounds for accruing higher level training in subjects concerned.

**Learning**

Learning is construction of knowledge through a continuous mental process. It is advancement through adding and correcting in the light of comparing the new issue with the previously learned concepts. Learning is an intellectual process rather than the mere memorization of facts. Learning is a conglomeration of a variety of activities like problem solving, finding out co-relations, prediction, arriving at conclusions, rational as well as critical thinking, finding applications, grouping for other possibilities and extracting the crux when opportunities are provided for intellectual processes learning will become effective and intellectual ability will get strengthened.

**Theoretical foundations of learning**

Education is the best device that can be adopted for creation of a new society. It should be democratic in content and process and should acknowledge the rights of the learner. It should also provide opportunity for better citizenship training. The concept of equality at all areas should get recognition in theory and practice. There should be conscious programme of action to develop nationality, humanness and love against the encroachment of sectarianism of caste and religion. The learner should become cognisant of the implications of privatisation, liberalisation, globalisation etc.

They should develop a discrimination to use the acquired learning as a weapon for liberation.

They should be able to view education and life with the perspective of social well being.

A basic awareness of all the subjects needed for life is essential for all students.

The remnants of perspectives formed in us during the colonial period still influence our educational philosophy. The solution to the present day perplexities of the society, which approaches education on the basis of competitions and marketisation, is only a comprehensive view of life.

It is high time that education was recognized on the basis of the philosophy of human education. The human approach to education has to reflect in its content, learning process
and outlook. The perspective of ‘learning to be’ and learning to live together as expressed by the UNESCO and the concepts of existential, intra-personal and interpersonal intelligence.

The basis of new approaches on curriculum and teaching-learning process are derived from the developments that took place in the east and west of the world.

When we begin to see the learner at the centre of the learning process, the teaching process has to be changed timely. It is the result of the rapid growth and development of Science and Technology and Pedagogy. If we want to undergo the changing process, we have to imbibe the modern hypothesis regarding learner that they have

- Great curiosity
- Good imagination
- Numerous other qualities and interests
- Independent individuality
- Interest in free thinking and working in a fearless atmosphere.
- Interest in enquiring and questioning.
- Ability to reach conclusions after logical thinking.
- Ability for manifest arid establishes freely the conclusions arrived at.
- Interest for recognition in the society.
- Determination to face the interference of society and make components which is a part of social life.

When we consider the learning system, the domains to be stressed in education according to the modern development become relevant.

**The knowledge domain consists of:** -

- Facts
- Ideas
- Laws
- The temporary conclusions and principles used presently by scientists.

The learning is a process. The continuous procedure we undergo to reach a particular goal is called the process. The skills, which are parts of the process to analyze the collected ideas and proofs and come to a conclusion, are called process skills. Some important
**process skills** are,

- To observe
- To collect data and record
- To classify
- To measure and prepare charts
- To experiment
- To predict
- To recognize and control the variables
- To raise questions
- To generalize
- To form a hypothesis and check.
- To conclude
- To communicate
- To predict and infer
- To use tools.

*Observation* is the process of acquiring knowledge through the senses. It is purely objective oriented. Learning experiences, which provide the use of all the senses, may be used.

The process of grouping is known as *classifying*. Starting from simple groupings of data, it can extend to the level of classification into minute sub-groups.

In addition to this, consider the skills related to creative domain also, they are

- To visualize
- To connect facts and ideas in new ways.
- To find out new and uncommon uses of objects
- To fantasize
- To dream
- To develop creative isolated thoughts
Creativity is an essential component of process and activities. The element of creativity is involved in finding out problems, formation of hypothesis, finding ‘solutions’ to problems etc. Through activity oriented learning experiences, opportunities to express creativity can be created.

Again, the following factors consisting in the **attitudinal domain** are also important as:

- Self-confidence
- Love for scientific knowledge
- Attitude to know and value history
- Respect human emotions
- Decide with reasonable present problems
- Take logical decisions regarding personal values

‘Hypothesis’ is a temporary conclusion drawn using insight. Based on knowledge and experiences relating to the problems the causes and solutions can be guessed.

As regards the **application domain** the important factors are the ability to:

- observe in daily life examples of ideas acquired.
- take the help of scientific process to solve the problems of daily life.
- choose a scientific life style
- connect the ideas acquired with other subjects.
- integrate the subjects with other subjects.

Some basic stands have to be taken on the new scientific knowledge about intelligence learning and teaching. When such basic concepts are accepted changes are required in the following factors.

- The vision, approach, structure and content of the curriculum.
- The vision, approach, structure and content of the textbooks.
- Role of the teacher and the learner.
- Learner atmosphere, learning materials and learning techniques.

Some scientific perspectives accepted by modern world in educational psychology are given below.
Constructivism

This approach puts forward the concept that the learner constructs knowledge. New knowledge is constructed when ideas are examined and practiced in new situations relating them with the previously acquired knowledge and experience. That is assimilated into the cognitive structure of one’s knowledge. This method, which gives priority to critical thinking and problem solving, provides opportunity for self-motivated learning.

Social Constructivism

Social constructivism is a sub section of constructivism. Knowledge is formed, spread and imbibed and it becomes relevant in a social environment. Interactive learning, group learning, co-operative participatory learning, all these are concepts put forward by social constructivism.

The main proponent of constructivism are Piaget, Vygotsky and Bruner.

Discovery learning and interactive learning have prime importance. Learning takes place as a part of the attempt for problem solving. The activities of a learner who confronts cognitive disequilibrium in a learning situation, and when he tries to overcome it leads to the renewal of cognitive structure. It is through this process construction of new knowledge and the assimilation of them takes place. Observation and enquiry are unavoidable factors. The learner advances towards new areas of acquisition of knowledge where he tries to compare his new findings with the existing concepts.

Learning is a live mental process. Rather than the ability for memorization of facts cognitive process has to be given emphasis. The process of problem analysis, elucidation, critical thinking, rational thinking, finding out co-relation, prediction, hypothesis formation, application, probing for other possibilities, extracting the crux and other processes are of critical importance in learning.

Constructivism gives greater predominance to co-operative learning. Social and cultural factors influence learning. Sharing of knowledge and experience among learners, collective enquiry, assessment and improvement, group activity and collaborative learning by sharing responsibilities with the objective of public activity, provide opportunity for effective learning.

In learning internal motivation is more important than external motivation. The learner should have interest and initiative in learning. Learning situation should be capable of forming a sense of ownership in the learner regarding the learning process.
Learning is not a linear process. It progresses in a spiralled way advancing deeper and wider.

**NEW CONCEPTS OF LEARNING**

1. **Discovery Learning**

   The teacher has to create a motivating atmosphere for the learner to discover concepts and facts, instead of listening always. Creating occasion to progress towards discovery is preferred. Instead of telling everything before and compelling to initiate the models, situations are to be created to help the children to evolve models themselves.

2. **Learning by discussion**

   Discussion leads to learning is Burner’s theory. Here discussion is not opposing each other. It is a sharing on the plane of ideas. New ideas are arrived at by seeking explanations, by mutual giving and taking of ideas and by problem solving.

3. **Problem solving and learning**

   Only when the learner feels that some thing is a problem to be solved that he takes the responsibility of learning it. It is an inborn tendency to act to solve a problem that causes cognitive disequilibrium in a particular area. It is also needed to have confidence that one is capable of doing it. The problems are to be presented in consideration to the ability and level of attainment of the learner.

4. **Collaborative learning**

   This is the learning in which the responsibilities are distributed among the members of the group keeping common learning objectives. The common responsibility of the group will be successful only if each member discharges his duties. All the members will reach a stage of sharing the result of learning, equally through the activity with mutual understanding. The teachers who arrange collaborative learning will have to make clear the responsibilities to be discharged. This is possible through the discussion with the learners. Collaborative learning will help to avoid the situations of one person working for the whole group.

5. **Co-operative learning**

   This is the learning in which the learners help one another. Those who have more knowledge, experience and competency, will help others. By this exchange of resources
the learners develop a plane of social system in learning also. As there are no high ups and low ones according to status among the learners they can ask the fellow students doubts and for help without any hesitation. Care should be taken not to lead this seeking of help to mechanical copying. It should be on the basis of actual needs. So even while encouraging this exchange of ideas, among the members of the group cautious acceptance is to be observed as a convention. There should be an understanding that satisfactory responses should come from each member and that the achievement of the group will be assessed on the basis of the achievement of all the members

6. Zone of Proximal Development

Vygotsky observes that there is a stage of achievement where a learner can reach by himself and another higher zone where he can reach with the help of his teachers and peers and elders. Even though some can fulfil the learning activity by themselves there is the possibility of a higher excellence. If appropriate help is given, every learner can better himself.

7 Scaffolding

It is natural that the learner may not be able to complete his work if he does not get support at the proper time. The learner may require the help of the teacher in several learning activities. Here helping means to make the learner complete the activity taking responsibility by himself. The teacher has to keep in mind the objective of enabling the learner to take the responsibility and to make it successful.

8 Learning - an active mental process

Learning being a cognitive process, the teacher needs to know cognitive processes to facilitate the creation of learning opportunities. Learning can be made effective by providing learning experiences involving mental processes like

- Retrieves/recollects/retells information
- Readily makes connections to new information based on past experiences and formulates initial ideas/concepts.
- Detects similarities and differences
- Classifies/categories/organizes information approximately.
- Translates/transfer knowledge or understanding and applies them in a new situation.
- Establishes cause-effect relationships
· Makes connections/relates prior knowledge to new information/applies reasoning and draw inferences
· Communicates knowledge/understanding through different media.
· Imagines/fantasies/designs/predicts based on received information
· Judges/appraises/evaluates the merits or demerits of an idea/develops own solutions to a problem.

9. Intrinsic Motivation

Intrinsic motivation is given more importance than extrinsic motivation. The teacher has to arouse the internal motivation of the learner. A person internally motivated alone can immerse in learning and own its responsibility.

10. Multiple intelligence

The Theory of Multiple Intelligence put forward by Howard Gardener has created a turning point in the field of education. The National curriculum documents has recommended that the curriculum is to be designed taking into consideration of this theory.

MAIN FACTORS OF THE INTELLECT:

1. Verbal/linguistic Intelligence

Ability to read and write, making linguistic creations, ability to lecture competence to effective communication, all these come under this. This can be developed by engaging in language games and by teaching others.

2. Logical/mathematical Intelligence

Thinking rationally with causes and effect relation and finding out patterns and relations come under this area. Finding out relations, explaining things, sequential and arithmetical calculations etc. are capable of developing this area of intelligence.

3. Visual/spatial Intelligence

In those who are able to visualize models and bringing what is in the imagination into visual form and in philosophers, designers and sculptors this area of intelligence is developed. The activities like modelling using clay and pulp, making of art equipments, sculpture, and giving illustrations to stories can help the development of this ability.
4. Bodily Kinaesthetic Intelligence

The activities using body language come under this. This area of intelligence is more developed in dancers and actors who are able to express ideas through body movements and in experts in sports, gymnastics etc.

5. Musical Intelligence

This is an area of intelligence, which is highly developed in those who are able to recognize the different elements of music in musicians and in those who can here and enjoy songs. Playing musical instruments, imitating the songs of musicians, listening silently to the rhythms and activities like this are capable of developing this area of intelligence.

6. Interpersonal Intelligence

Those in whom this area of intelligence is developed show qualities of leadership and behave with others in a noble manner. They are capable of understanding the thought or others and carrying on activities like discussion successfully.

7. Intrapersonal Intelligence

This is the ability to understand oneself. These people can recognize their own abilities and disabilities. Writing diaries truthfully and in an analysing way and assessing the ideas and activities of others will help developing these areas of intelligence.

8. Naturalistic Intelligence

A great interest in the flora and fauna of the nature, love towards fellow beings interest in spiritual and natural factors will be capable of developing this area.

9. Existential Intelligence

The ability to see and distinguish ours own existence as a part of the universe, ability to distinguish the meaning and meaninglessness of life, the ability to realize the ultimate nature of mental and physical existences, all these are the peculiarities of this faculty of intelligence.

EMOTIONAL QUOTIENT

The concept of emotional intelligence put forward by Daniel Golman was used in framing the new curriculum. The fact that one’s Emotional Quotient (E.Q) is the greatest factor affecting success in life is now widely accepted. The teacher who aims to focus on improving the emotional intelligence of students need to concentrate on the following.
i) **Ability to take decisions**

Rather than imposing decision on students while planning and executing activities, the students may be allowed to take part in the decision making process. Taking decisions through open discussion in the class, inviting students suggestions on common problems etc. are habits to be cultivated.

ii) **Ability to reach consensus**

- When different opinions, ideas and positions arise, the students may be given the responsibility to reach a consensus.

- Imagining what would be the course of action in some situations, allowing to intervene in a healthy way in problems between individuals.

iii) **Problem solving**

- Developing the idea that there is reason and solution to any problem.

- Training in finding reasons for problems.

- Suggesting solutions through individual or group efforts.

- Discussing social problems.

- Analyzing the shortcomings in methods to solve problems.

Whether plastic can be banned within school premises can be given as a problem. Group discussion will provide reasons and solutions. Problems, which can influence classroom learning and for which the learner can actively contribute solutions need to be posed.

- Self criticism, evaluation

- Ability to face problem-situation in life

- Thinking what one would do if placed in the situation of others, how one would respond to certain experiences of others - All these foster the growth of emotional intelligence.

iv) **Life skills**

Life skills need to be given a prominent place in education. W.H.O. has listed: skills required for-success in life.

- Self awareness

- Empathy

- Inter personal relations
- Communication
- Critical thinking
- Creative thinking
- Decision making
- Problem solving
- Coping with emotion
- Coping with stress

The new curriculum addresses these areas.

Knowing the characteristics of the learner, role of the teacher and how to use the teachers’ handbook help the teacher to plan and effectively implement learning activities.

Role of a Teacher

In the earlier approach the teacher was mainly depending on the lecture method for teaching. But in the new method of education, the student centred approach is given more importance than the teacher centred approach. Under this changed scenario the teacher has to perform the following roles in the classroom.

The teacher should be

- A facilitator of learning
- A guide to the overall development of the student
- A good observer and motivator
- Able to consider the activities, needs, special features and age group of students at higher secondary level.
- Able to understand the limitations of learner and their learning problems.
- An instructional material developer
- A good communicator
- An innovator
- Able to raise leadership qualities and self confidence of the learner
- An authority in the concerned subject
- Able to arrest and sustain the attention of the learner
· Able to bring out and encourage the inborn talents.
· A resource manager to ensure the optimum utilization of resources.
· A systematic record keeper
· A controller to issue guidance to the students
· A person with high level of practical competency
· Able to correlate area of study with familiar environmental situations
· A self evaluator and good listener
· Able to create awareness in social problems
· A person with democratic and humanitarian approach
· A professional as well as a philosopher
· A good evaluator
· A good organizer and a friend.
· A co-learner as well as co-researcher
· Able to give assistance and advice in placement needs and self employment by giving moral and technical support
· Able to keep moral values
· A person equipped with skill for using new techniques of learning
· Optimistic and impartial

**Child friendly Class Room Atmosphere**

Learning can be effective and enjoyable only when the class atmosphere is according to the new conception of learning and the characteristics of higher secondary teacher.

· Class and seating are arranged in an attractive way
· Democratic nature is upheld
· Always active
· Students interact with teachers without fear
· Opportunity for a variety of activities
· Students allowed to involve interesting group activities
· Learning speed, learning style and differing levels of attitudes are considered.
   Help is extended whenever needed.
- Sufficient instructional materials are available
- These is freedom of expression, students share their ideas and experiences
- Students are given acceptance and encouragement
- Healthy atmosphere
- Needs of each students is given consideration.Happy and energetic atmosphere
- Teachers work considering the rights of students
- Problems handled in a patient way
- Teachers work at all events from the students view point

There will be students of various ability levels in any class because learning style, learning speed, varying exposure to language experiences, physical ad psychological problems and varying socio-cultural background.

The learning experiences provided must help to bring the low active to an expected level and extended the breadth and depth of the skills of the high active.

By repeating experiences, introducing variations in a learning experience to suit different levels and if needed, formulating additional experiences the problem of varying ability levels can be tackled.

**Role of Learner**

The learner in second year has undergone a learner centred and process oriented learning experience up to first year. The learner at this age is in awakening stage and he is enthusiastic about environment. He needs recognition and encouragement from environment and also recognize as a grown up man. He is adequately competent to select vocational subjects according to his aptitude and interact and to acquire higher education and profession as he wishes. The aspirations about future life are framed in this particular age for seeming national and international job opportunities. Some of the peculiarities of learner at this stage are;

- Physical, intellectual and emotional planes are intensive, changes during the age and in their reflections can be observed
- Ability to enquire discover and establish cause effect relationship between phenomena
- Readiness to undertake challenges
Capacity to shoulder leadership roles
· Attempt to interpret oneself
· Susceptibility to different pressures
· Doubts, anxieties and eagerness about sex
· Imaging for social recognition

Needs of Learner
· To make acquaintance with a job or self employment through vocational education
· To acquire more knowledge in the concerned area through higher education
· To recognize and encourage the peculiar personality of the later adolescent period
· To enable him to defend against the unfavourable circumstances without any help

Role of learner
· Active participant in the learning process
· Act as a researcher
· Sharer of information
· Sharer of responsibilities
· Collect information
· Takes leadership
· Involves in group work
· Act as a co-participant
· Observes his environment
· Experiments and realize
· Make interpretations and draw inferences
· Mould himself in to an active contributor for the welfare of the society

Evaluation

In vocational higher secondary education, a new approach to education and evaluation should be made. Evaluation must be a systematic and continuous process. As the curriculum is based on vocational stream, capacity building is a most important part and it should be evaluated accordingly. The technical skills, interest in the particular field, communication skill, analysis, organizing and presentation skills etc has to be evaluated. The personal and
social qualities also have to be evaluated. Therefore, evaluation should be transparent, continuous and comprehensive.

**Supporting System**

In learner centred vocational education, a learning methodology has to be organized and a proper learning atmosphere is to be provided. Many organizations can support the learning activity. They are:-

1) **School Resource Group (SRG)**
   Comprising all teachers (vocational and non vocational) instructors, and lab assistants with academic head as the group leader.

2) **School support Group (SSG)**
   Comprising PTA president, members of local bodies, members of social clubs, subject experts etc who can contribute through guidance /technology /infrastructure /financial assistance etc.

3) **Parent Teacher Association (PTA)**
   Can provide adequate funds for field trips, production cum training centers (PCTC), exhibition, On Job training (OJT) etc.

4) **Local bodies**
   Grama Panchayat, district panchayat and block panchayat can provide infrastructure ie, class rooms, laboratory, library, seminar hall, audiovisual equipment etc.

5) **Subject club**
   All vocational teachers handling same vocational subjects should form a subject at regional level or district level. This will helps to share the knowledge and practical facilities, production and marketing of materials, service etc.

6) **Based on the Excellency, district wise nodal schools may be selected to provide facilities like central library, museums, video conferencing etc.**

7) **Institution Industry Interaction Project (III P)**
   This should be implemented in every institution to update knowledge this also helps for OJT , PCTC and field visit.
Monitoring system

Education is a kind of journey from darkness to light satisfying the needs and the wants of the individual and the society. The modernization of education through activity-oriented system enhances free thinking and working in a fearless atmosphere. It is a qualitative process not a quantitative one this necessitates a proper monitoring system. The system of monitoring should have the following features.

1) It must be transparent
2) It must enrich the ideas of the facilitator through innovative process
3) It must be time bound and rational
4) It must motive the facilitator to adopt new strategies
5) It must be recordable and ensure effective feedback for the effective monitoring of the system; three levels of the mechanism should be set up.

1. School level monitoring group
2. Regional level monitoring group
3. State level monitoring group

Moreover a social auditing system is advisable to attain the objective effectively.

Features of learning process in the new system of education

In the new system of education the learning process should be modified in such a way as to enable the learner to construct the knowledge of his own through observation, cooperation, problem solving, social interaction etc. The learning process should consider the nature ability, social set up, inborn talents and subject selected by the learner. Therefore the learning process should be,

- A continuous mental process
- Simple learner must feel that he is able to undertake the task
- Enable the learner to attain the curriculum objective
- Interesting
- Suitable to the age and attitude of the learner
- Future possibilities
- Enable group activity
- Challenging
- Time bound
- Constructive and curiosity developing
- Possibilities for evaluation
- Capacity to generate independent thinking
- Ability to enquire, discover and establish cause effect relationship between phenomena.

**Learning Aids**

To make the teaching and learning process simple and effective, certain learning aids are necessary. Use of such aids for transacting a complex idea makes the classroom live and students get more and more involved. The advances in science and technology may be effectively utilized for this purpose. Some of the learning aids listed below.

- Multimedia
- Over Head Projector
- Computer
- Internet
- Liquid Crystal display Projector
- TV, VCD, DVD and tape recorders
- Working models
- Charts
- Slides
- Video Conferencing facility
- Library
- Text book
- Source book

**Society**

The new educational policy uplifts the social commitment of the learner. Therefore the society can also give some valuable contributions in this changing situation. The new system also ensures that the learner can perform certain useful services for the betterment of society. The social obligations can be illustrated as follows.
· To enrich social values, aptitude and ability in learner

· To develop entrepreneurial aptitude and ability which helps social welfare and self employment

· New system of education adopts OJT, PSTC etc as a part of vocational curriculum, which helps to make close contact with the society.

· The resources available from our society can be positively utilized to convene seminars, interview etc.

· Social organizations can help learners to make their education socially committed.

· The social clubs like NSS, Tourism club, CDO club, energy club etc functioning in schools can make direct link with the society

**Learning Approach**

A learner centred and activity based learning approach is to be adopted. The many sided intelligence of the students should be explored to gain in depth knowledge. The method of teaching should be based on the students needs, their expectations and interest. Their participation also should be ensured. For this we can adopt different strategies and techniques.

1. **Discovery learning**

   The teacher has to create an atmosphere that encourages the learner to discover ideas and facts on his own. For example, the teacher can assign the student to identify the characteristics of different insects. This gives an opportunity for the learner to observe different insects in their surroundings or they can collect information from different sources like internet and print media. Their observation can be consolidated in to the product.

2. **Co-operative learning**

   In this method, the learners learns by helping each other. The negotiations among peers take place here.

   For example, if we want to create awareness among the students about different methods of insect control commonly used in households, students can be divided in to different groups and a group discussion on the topic can be conducted. The ideas evolved from the discussion can be consolidated and presented in the class.
3. **Collaborative learning**

The two important aspects of this method of learning are sharing of ideas and negotiation among the learners. Suppose we want to deal with different types of formulations. Here also they can be divided into groups and the teacher can ask them to collect information on different pesticide formulations and their characteristics. Their observation can be consolidated and presented in the class.

4. **Socio-cultural related learning**

This method of learning pertains to the social and cultural aspects of the society. For example: An interview can be conducted by the learner to study the impact of pesticides on environmental pollution.
SUBJECT APPROACH

Uncertainty is the companion of Agriculture. A successful harvest depends on a number of factors like good agricultural practices right from selection of seeds to harvest and the right combination of climatic and soil conditions. But the most important among this list is the plant protection operations. No crop can be harvested successfully without tackling the problems caused by pest and diseases. Their damage continues beyond the main field to the storehouse and even to the kitchen shelves. The loss due to pest is approximately 30-50% of the total production.

Ever since man has started agriculture, pest and disease have been attacking crops. References of locust attack; rust and mildews are found in the Bible and other ancient literature like Vedas and Vriksha Ayurveda. The pest have engraved its capacity for mass destruction and power to change destiny in the history as Irish famine and the great Bengal famine.

Today, plant protection is a branch of science, which utilises the modern advancements in all other branches for the betterment of mankind by providing innovative solutions for tackling the problems caused by pest and diseases in crops.

In the vocational higher secondary level, the subject helps the learner to understand the basics of Plant protection, its importance and potentials. Moreover the learner gets an idea about different groups of pest, their morphological features, destructive stages, and nature of damage, symptoms and the possible management practices.

In this era of organic agriculture the learner is also exposed to environmental aspects of using pesticides, integrated pest management and biological control of pest and diseases. The course also aims at development of skills for the diagnosis of the filed problems caused by the pest, recommend and apply suitable control measures and the handling of various plant protection chemicals and equipments.

The knowledge and skills acquired by the learner help him to solve the field problems with confidence. As an agricultural extension worker or as a self-employed person in the field of agricultural consultancy services this confidence provides an edge over others to build a good career. Here the person himself and the society are mutually benefited and fulfills the ultimate goal of vocational education.

The subject thus provides the farmer, the society and the person practising it: an assurance. A ray of hope....
LEARNING STRATEGIES

In the modern era of globalization the introduction of new technologies ensure only the survival of the fittest. So it becomes a necessity to equip the leaness to face the growing challenges in the competitive world. Hence the traditional approach to learning is no more relevant in the present context. The teacher should use instructional techniques that motivate the learner to construct his own knowledge. Now the learners are not passive listeners, but they are the active participants in the construction of knowledge. Here the teacher–learner interaction should be given much importance.

In the new instructional strategy while selecting the methods of teaching, the social and psychological aspects of the learner is to be taken into consideration. The given activities for learning are only suggested one. It can be altered according to the discretion of the teacher.

To obtain the objectives, the new system of education is introduced in the Vocational Higher Secondary Education for attaining the objectives of the courses in this system, we can adopt the following strategies.

1. Assignment

Assignment is some specific work assigned to the learners as a part of their academic enrichment. There are learning activities undertaken as a continuation of class room activities to realize the curriculum objectives to a broader extent. They should be completed in time bound manner. They help to lead learner to higher level of learning from the present status. Challenging assignment can motivate the learners to involve in group dynamics and achieve fruitful results. The teachers may act as a guide.

Assignment may be given on individually or on group basis. Assignment includes preparation of notes, preparation of charts, models, collection, of materials from institutions etc. Assignment develop skills of reference, observation, enquire reporting etc. It ensure the effective utilization of leisure time of the learners.
2. Seminar

Seminar is a learning strategy involving an in-depth analysis of specific topic, preparation of a paper and presentation. The paper is presented by either one learner or a group of learners. After the presentation, there will be a discussion/interaction in which all the learners can participate. The learners get an opportunity to clear their doubts and make clarification. Seminar helps to develop communication skill and overcome stage fright.

Stages

1. Selection of Topic

The topic of seminar should be relevant to the subject of study

2. Assignment of topic to individuals learners or team

The topic may be assigned to each learner or subtopics may be given to a group of learners

3. Collection of relevant information

Information required for seminar can be collected from various sources namely books, magazines, internet, institutions, place and persons.

4. Preparation of draft paper

Based on the information collected the learner may prepare a draft paper and submit it to the teachers for comments. Revise the draft paper based on the comments of the teachers. The required draft is submitted for approval.

5. Program Scheduling

The date, time and venue of the seminar is fixed. A seminar leader may be selected from the learners

6. Seminar paper presentation

The learner/learners shall present the paper in the seminar. The teacher may function as the moderator during the initial stages.

7. Discussion / Interaction

A number of respondents from the learners make comments on the topic. This will be followed by a general discussion. All the group members should actively participate in discussion.
8. **Summing up deliberation**

   The moderator sums up the deliberation

9. **Evaluation / Feedback**

   Both teachers and learners evaluate the programme.

10. **Preparation of final report**

   A final seminar report is prepared covering all the additional points discussed and consolidated.

3. **Panel Discussion**

   It is a learning strategy in which a panel of experts are allowed to discuss a specific subjects under the control and direction of a moderator. Subjects can be divided according to the number of panel members. Number of panel members are fixed according to subdivision of points in the subject. Relevant materials and hand out may be given in advance to the learners. The monitor or moderator introduces the subject of discussion and invite a panel member to start the discussion. Each panel member is invited for discussion afterwards. After briefing by the panel members the question are raised from the audience and the panel members give suitable answer to them. A report should be submitted by each learner to the moderator.

4. **Project**

   Project is a self-learning strategy which can exert great influence on the overall development of the learner. Project as learning strategy is to be selected where a problem arises in any part of the curriculum. The learners may be divided into groups and assigned different aspects of the problem. Each group works independently. Specific aspects of the problem such as data collection, classification, analysis, report preparation and presentation is to be undertaken by each of the members. Even though the work is divided among the members, it must be ensured that the execution of each and every activity is done with the active participation of all. After analyzing data collected from different sources, the learner arrives at a conclusion, which helps to solve the problem. There by learner learns the topic though his own activity. The other advantage of this learning activities is that it helps the learner to scientifically handle any problematic situation. It helps in the development of scientific thinking and thereby builds up the learners aptitude for the subject.
Stages of the project

1. Selection of a topic

The project selected should be related to the curriculum and it should not be a project for projects sake. The topic or problem should arise from the curriculum.

2. Planning of the Project

   (A) Hypothesizing: Hypothesizing means making assumptions based on the available primary information.

   (B) Methods and Techniques: The methods and technique should be based on the aim and Hypothesizing of the project. The nature of the project, suitability of the tools, and the methods of learning should be related to each other.

3. Collection and Tabulation of Data

   The data may be primary, Secondary or tertiary. Either census or sambling method can be used based on the objective of the project. Suitable questionnaires are to be prepared for the collection of primary data.

   The collected data is to be classified and tabulated so as to make it easily understandable.

4. Analysis of data and formulation of conclusion

   By analyzing the data, the reliability of the hypotheses can be examined. Preparation of graphs and diagrams and maps will positively help the analysis. The similarities relations and differences gathered from the analyzed information would tell whether the hypotheses should be accepted or rejected.

5. Preparation of Report

   The cover page should have the title of the project, the period of study, name(s) of investigator/group, and the address of the school. The report should be structured in the following order.

   1. Title
   2. Preface
   3. Hypotheses and aim
   4. Methodology
   5. Sources of data
6. Analysis and conclusion

7. Suggestions (if any)

8. References

9. Appendices (Questionnaire, Observation schedule, check list Etc.)

6. Presentation of the Project

When the project is presented, the learner is being evaluated and accepted. During presentation ideas are shared with others. The project method promotes scientific self learning and makes him capable of solving the problem arising in real life situations.

5. Debate

Debate is a hot and interesting learning activity. A debate can be organized only on a topic on which there is difference of opinion. Therefore a topic suitable for debate has to be found.

Debate can be on relevant topic that is different and interesting to the learners and relevant to society. Learners with different opinion have to be identified for discussion. Those who have similar opinion should join together to form a side. Those who hold the opposite view with form the other side. It would be good to write down the topic of the debate and displayed in advance. There should also a person to control debate.

Learners should be given opportunity to absorb the ideas obtained from discussion and debate, develop the idea through reading and study, and to express them through writing or other means

Stages of Debate

1. Topic Selection

2. Selection of panels keeping in balance with intelligence, gender etc.

3. Selection of moderator

4. Collection of information guided by the teacher

5. Conducting the debate under the control of moderator by avoiding any sort of personal conflicts

6. Conclusion by the moderator expressing his final version or verdict.
6. Case Study

A case may be a person, institution or a community case study is an in depth analysis of an actual event or situation. It presents real pictures of situation with facts, objective information or data learners analyse the case to interpret, predict and resolve issues associated with it. The case study provides the learner an opportunity to analyse and apply concepts, data and theory taught from the class. Learners can work individually or in groups.

By studying realistic cases in the classroom, learners develop new insights into the solution of specific on- the - job problem and also acquire knowledge of the latest concepts and principles used in problem solving.

Case may be presented by the teachers or may be provided in print form.

A simple case study may have the following steps.

1. Collection of data
2. Conversion of data into information
3. Analysis of the case in groups
4. Presentation of the finding by each group leader.
5. Evaluation

In addition to the above mentioned learning strategies there are many other learning strategies which can be used in appropriate situations to enrich learning process such as Problem solving, Role play, Brain storming, etc

7. Brain Storming

This is the best method for solving creative problems. It facilitates generation of ideas quickly. Rules for conducting Brain storming.

1. No response is wrong - welcome every response.
2. Welcome as many responses as possible
3. No criticism is allowed
4. Allow to work on others idea

Steps in Brain storming

1. Presentation of the problem
2. Provide relevant information
3. Record the ideas put forth by the participants
4. Combine similar ideas
5. Evaluate each idea and solution
6. Selection of the best solution

If brainstorming is used as an instruction strategy, the last step is not essential

8. Discussion

Discussion is essential for the learner to share new finding, ideas and conclusion at each stage of learning with follow learners and teachers. In general discussion the teachers should guide the discussion though questioning and summarizing. The major steps involved are

1. Introduction initiated by the teacher
2. Development of discussion by giving lead points and follow up interactions
3. Transaction stage in which the key points are reviewed by the teacher and
4. Summarizing stage in which teacher provides additional support materials to ensure the achievement of the objectives

9. Group Discussion

Group discussion is an ideal method to develop Co-operation, democratic attitude, friendliness and compromising attitude which are the ultimate aims of education. During group discussion the teacher may observe each group and it needed help them to channellise the discussion towards the common objectives. All learners may be given opportunity to take part and express their ideas within a time limit. The conclusion reached may be entered by each learners. A group representative must present this during consolidation in which the teacher may correct or add information’s to ensure that all the relevant ideas have been covered

10. Collection

Collection is a continuous learning activity, which ensure complete participation of learners. The collected item may be materials, pictures, charts, ideas, data etc. Collection provides direct experience to learn. An exhibition of collected materials will help to strengthen the concept.

11. Practical works

Experimentation contains the process skill in an integrated way. In the new approach of curriculum the learner forms idea and comes to conclusion though process. The term
‘Practical ‘when associated with a science subject usually means an experiment. The objective of doing an experiment is to explore new ideas through investigation only. Its main purpose is to verify some principles associated with theory. The relevance of ‘practical’ in the traditional science subjects ends here. But this is not the case with ‘Vocational Practical’

The ultimate goal of a Vocational Education is to generate skill through continuous practice along with investigation and invention. Continuous practice transforms the unskilled to the skilled. This is the significance and importance of practical in the Vocational stream. Hence it is very crucial that Vocational teachers as well as instructor should understand the importance of vocational practical and act accordingly.

12. Quiz

Quiz programmes can be used as an interesting class room tool for transaction of curriculum objectives as well as to evaluate the effectiveness of transaction and achievement of learners.

For conducting a quiz programme a topic should be selected based on the above objective

The learners are asked to prepare question based on the topic individually. The next day / next hour the learners are grouped into 3-4 groups randomly. A question is raised by a particular team and the other teams to answer them if they can answer the question they get points for that if all other teams fail to answer the question raised by the 1st team the 1st team answer the question and explain the background if necessary. All the teams get equal number of chance to ask the question. Time limit is also prescribed for the conduction of the programme. The team who scores maximum points wins

All the participants can make notes on the questions asked answer and their explanation which help them in learning

13. Models

Models are used in learning process. It enhanced the leaning experience. This is based on the ‘seeing is believing”. It helps the learner a chance to see feel the model presented. Still models and working models help the learners to understand the structure, working principles, actual operation etc.
Several steps are involved

1. Feeling the problem
2. The teacher should plan the type of model according to curricular objectives.
3. Grouping the learners
4. Briefing the tasks
   - Aim
   - Need
   - Material required
   - Source & Materials
   - Cost of materials
   - Division of Labour
   - Guidance
   - Fixing of a time limit
5. Presentation by each group about
   (A) How the models were prepared
   (B) Details of
   - Expenses
   - Working and principles
   Finally Documentation of the process
6. Evaluation
   - By the other groups
   Later a consolidation by teachers is to be done.

14. Games

   Class rooms can be made attractive by introducing different types of games. Games should be interesting as well as informative some of suitable games are

1. Odd man out
2. Cross word puzzles
3. Match the following
4. Aswamedham.
5. Link game – Answer using clues.
15. Survey

This strategy involves collection of data from the group under study (book, person, materials etc.) It develop the social interaction and communication ability of the learner. It also provide a scope for discovery learning.

Step involved in survey

- Objective of survey
- Selection of area for survey/sampling frame
- Selection of survey method
  - Direct method
  - With help of questionnaire/schedule
- Tabulation and analysis
- Consolidation and Presentation

16. Exhibition

It is a learning strategy by which the learner can get a chance to show the skill developed. It provides the intrinsic motivation and exposure.

Exhibition item can be conducted either individually or as a group task. It can be conducted at school / Regional/State/National Level. Necessary publicity and other arrangement can be provided. Presentation, documentation participation and innovative skills of the learner can be evaluated.

17. Interview

Interview is one of the important learning strategies taking the help of a resource person. Interview is an inner view which provides opinion and information about a topic.

An interview is conducted by the following steps

1. How to introduce a problem?
2. Invite a resource person
3. Decide the questions by learners
4. Decide the time, place etc.
5. How to discuss
6. How many learners to participate
7. Implementation of the interview
8. Conclusion (Facilitator)

**Items required**

1. Interview Schedule
   
   List of question prepared by learners Selection of learners, selected names sequence of question

**18. Field Visit**

Field visit is an inevitable vocational tool to be implemented in vocational Higher Secondary Education. This helps the learners to familiarise with the modern technologies and new situation in a different atmosphere. It provides learning though viewing. It is based on the principle that seeing is better than having. It enables the learning to retain the learned informations longer and to make the subject more interesting. It motivates and give more confidence in his/her particular vocation.

The facilitation should identify suitable center/institution/site. Get prior permission from the authorities before conducting the field visit. Give instructions to the learners for collection data’s/information’s/materials/Specimens. Teacher may assign different duties to learners by working them different groups.

Each learner should take utmost care and interest during the visit. He/She should observe and interact at the center/institution where the field visit is conducted.

After the visit, learner should acquire the ability to apply the ideas/concepts in his future carrier. Each learner should submit a detailed report about the field visit.

**19. Method Demonstration**

Though demonstration we can present an item/product and emphasis its features very effectively In method demonstration the facilitator explains the procedure; tools used and demonstrate the actual operation. The learner observes the procedures and makes notes. After the demonstration he clarifies his doubts and repeats the procedure all by himself. Mean while his way of doing is carefully monitored by the facilitator and suggests corrective
action if any. At the end of this activity the learner gains adequate skill in the procedure and improves self confidence.

Eg:- To understand the method of preparation of Bordeaux mixture

1. Material / Item / Process
2. Demonstration
3. Venue
4. Additional requirements depending upon the nature of the item

**Demonstration Process**

1. Introduction about the item/Material
2. Principles – Working
3. Operation
4. Components
5. Merits of the item

**20. Chart display**

It is also one of the important teaching aid. It can be used in every activities of a learning process.

Chart display is a written or pictorial representation of idea or concept. It is abbreviate brief and clear. It is prepared by study

**Benefits**

1. A learner gets clear idea about the concept
2. The leaner can retain the ideas in his mind for longer periods
3. A complicated idea can be simplified though a chart
CURRICULUM OBJECTIVES

UNIT.1

INTRODUCTION TO PLANT PROTECTION

1. The learner gets awareness about the importance of plant protection in agriculture and the extend of crop loss duet to different organisms like insects, diseases, weeds and non insect pest through brainstorming, group discussion, analysis of supplemented data and making notes.

2. The learner understands the importance of pest outbreak and reasons for pest outbreak through brainstorming, Group Discussion and making notes.

UNIT. 2

INTRODUCTION TO PEST

1. Learner understands the morphological features of non-insect pest like mite, nematode, rodents, slugs and snails, birds and weeds through collection of secondary data, discussion and prepares notes and charts.

UNIT. 3

GENERAL CHARACTERS OF INSECT PEST

1. The learner understands the different groups of insects their and nature of damage through collection, observation, classification and tabulation.

2. The learner identifies the different developmental stages of insects and the phenomenon of metamorphosis through discussion, observation, analysis of diagrams and preparing notes.

3. The learner understands the different destructive stages of different insects, their mouthparts and feeding habits through collection of damaged specimens, observation, identification, tabulation, making notes and charts.

UNIT. 4

INSECT PEST CONTROL

1. The learner understands the different methods of plant protection like physical, chemical, mechanical, biological, legal and cultural methods through different methods of plant protection like physical, chemical, mechanical, biological, legal and cultural methods
2. The learner understands and classifies different insecticides based on mode of entry and mode of action through Classroom discussions, group discussion and prepares notes and charts.

3. The learner understands the basic classification of insecticides through brainstorming, group discussion, presentation and making notes.

4. The learner understands the classification of synthetic organic insecticides, insecticide formulations and label information through survey, presentation and submitting reports and preparing notes.

5. The learner identifies the different commercial formulation of insecticides like WP, SC, SL, SP, EC, DP, and G through observation, discussion, recording and making notes.

6. The learner develops the ability to find out the quantity of insecticide formulation required for field application through calculation.

7. The learner develops the skill for the preparation and field application of insecticide formulations through method demonstration, observation and making notes.

8. The learner develops the skill for the preparation and field application of botanical insecticides (tobacco decoction, neem oil garlic emulsion, and neem kernel suspension) and kerosene soap emulsion, understands their merits and demerits through discussion method demonstration, observation, assignments and making notes.

UNIT 5

BIOLOGICAL CONTROL OF INSECTS

1. The learner understands the concept of biological control through discussion and making notes.

2. The learner understands the importance of biological control through field visit collection identification of available parasites and predators and making diagrams and notes.

3. The learner understands the different Entamo-pathogens and bio-insecticides through general discussion, observe photographs and CD shows and making notes.

4. The learner understands the different biological control agents, their mass multiplication and application methodology through visit to a bio control laboratory and an interview with an expert and making reports.

UNIT-6

ENVIRONMENTAL ASPECTS OF PESTICIDES

1. The learner understands biomagnifications of insecticide, and waiting period through discussion, analysis, interpretation of data and related articles and making notes.
2. The learner understand the concept of ETL and EIL also ETL of major pests of rice through discussion and making charts and notes.

3. The learner understands the importance of IPM and its application in rice ecosystem through discussion.

4. The learner develops and idea about the possible hazards and precautions to be taken while handling plant protection chemicals through brainstorming, class room discussion and making notes.

UNIT-7

INSECT PEST OF MAJOR CROPS OF KERALA

1. The learner develops the skill for identification of the pest of major crops of Kerala, its nature of damage and application of different control measures through field visit, collection, observation, drawing diagrams, projects and making notes.

UNIT-8

NON-INSECT PEST OF MAJOR CROPS

1. The learner develop the skill for identification of non insect pest of major crop, its nature of damage and application of different control measures through observation, drawing diagrams, discussion field visit and making notes.

2. The learner understands various methods of rodent control through group discussion, method demonstration and making notes.

UNIT-9

PEST OF STORED PRODUCTS

1. The learner understands the importance of different storage pests, identifies them, their nature of damage and application of different control measures through brainstorming, observation, collection and making notes.

UNIT-10

INTRODUCTION TO PLANT DISEASES

1. The learner understands the concept of disease, different type of pathogen, its mode of spread through brainstorming, classification, discussion and making notes.

2. The learner understands the importance of different pathogens like bacteria, fungi, virus, Phytoplasma and the disease caused by them through group discussion and making notes.

3. The learner identifies symptoms of plant diseases through discussion, collection, observation, classification and making diagrams notes and herbarium.
4. The learner comprehends the idea of Koch’s postulates through group discussion and making notes.

5. The Learner understands the concept of disease epidemiology and disease forecasting through a game, discussion and making notes.

UNIT-11

PLANT DISEASE CONTROL

1. The learner understands various methods of plant disease control like physical, cultural, biological, legal and chemical methods through brainstorming and classroom discussion.

2. The learner understands the classification of fungicides based on chemical nature through survey, presentation and submitting of notes.

3. The learner understands the methodology for the calculation and preparation of inorganic fungicides like Bordeaux mixture, Bordeaux paste and Cheshunt compound through group discussion, calculation method demonstration and making charts &notes.

4. The learner develop the skill to find out the quantity of commercial fungicides for the preparation of spray solutions and field application through calculation.

5. The learner understands various botanicals and bio-agents used in plant disease management through class Room discussion and Assignments.

6. The learner understands the methodology of soil solarization through discussion and method demonstration

UNIT-12

DISEASES OF MAJOR CROPS OF KERALA

1. The learner develops the skill for identification of diseases of major crops of Kerala; its cause, symptoms and application of different control measures through field visit collection, observation, drawing diagrams, project and making notes.

UNIT-13

WEEDS

1. The learner understand the weed concept, the classification on the basis of life span, habitat and botanical characters through a field visit, collection identification, classification, preparation of herbarium and making notes.

2. The Learner understands the different method of weeds control like mechanical, cultural biological and chemical, their advantages and disadvantage through brainstorming, group discussion and making notes.
3. The learner understands the methodology and effectiveness of biological control of weeds like salvinia, Eichornia, Eupatorium through brainstorming, group discussion and making notes.

4. The learner gets awareness about the terms herbicide weedicide, its classification-based on mode of action, time of application and selectivity through survey, presentation preparation of notes.

5. The learner develops the skill to find out the quantity of commercial herbicides for the preparation and field application through discussion, calculation and making notes.

6. The learner gets awareness about the different methods of weed management in paddy field locally adopted and the scientific aspects of weed management through an interview with a progressive farmer and with a technical person and making reports.

UNIT-14

PLANT PROTECTION EQUIPMENTS

1. The learner understands the different types of plant protection equipments, their parts and working principles through group discussion, observation, comparison, preparation of diagrams and making notes.

2. The learner develops the skill for operating the different plant protection equipments and its repair and maintenance through method demonstration, discussion, making notes and reports.

3. The learner understand the different types of sprayers like high volume, low volume and aerial through experiment and making notes

UNIT-15

COMPATIBILITY OF PLANT PROTECTION CHEMICALS AND FERTILIZERS

1. The learner understands the concept of compatibility of pesticides and fertilizers, their compatible and incompatible combinations through classroom discussion, reviewing compatibility chart and making notes.
PLANNING

To make education activity based, we have to provide learning experiences that would be to develop process skill and components of multiple intelligence. Whether the activities conducted in the class or outside, they are to be completed in a time bound manner.

The teacher has to plan the activities necessary to make learning effective, time require evaluation methods and all other aspects. Teacher must prepare at least three planning documents.

- Year plan
- Unit plan
- Daily plan

Year plan

The year plan will include the total number of units to be transacted through the three term units to be covered during each month and the number of periods required for each unit.

Unit plan

Teacher may prepare unit plan before the actual transaction of the unit in the class room. This plan must make clear the curriculum objectives intended, periods required for transaction of these objectives, instructional strategies to be used and materials required. How the outcomes are to be evaluated may also be spelt out. Unit analysis for each unit given in the source book may be utilized for preparing unit plan.

Daily plan

The daily plan includes curriculum objectives to be transacted during class period, learning activities, learning aids and feedback.

A lesson plan means planning for a lesson

Some models of year plan, unit plan and daily plan are given below.
## YEAR PLAN

### PLANT PROTECTION - II YEAR

<table>
<thead>
<tr>
<th>TERM</th>
<th>UNIT NUMBER</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I TERM</td>
<td>1</td>
<td>Importance of plant protection</td>
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<tr>
<td></td>
<td>2</td>
<td>Introduction to pest</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>General Characters of insect pest</td>
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<td></td>
<td>4</td>
<td>Insect pest control</td>
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<td></td>
<td>5</td>
<td>Biological control of insects</td>
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<tr>
<td></td>
<td>6</td>
<td>Environmental aspects of pesticides</td>
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<tr>
<td></td>
<td>7</td>
<td>Insect pest of major crops of Kerala</td>
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<tr>
<td>II TERM</td>
<td>8</td>
<td>Non insect pest of major crops</td>
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<tr>
<td></td>
<td>9</td>
<td>Pest of stored products</td>
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<tr>
<td></td>
<td>10</td>
<td>Introduction to plant diseases</td>
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<tr>
<td></td>
<td>11</td>
<td>Plant disease control</td>
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<tr>
<td></td>
<td>12</td>
<td>Diseases of major crops of Kerala</td>
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<tr>
<td>III TERM</td>
<td>13</td>
<td>Weeds</td>
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<td></td>
<td>14</td>
<td>Plant protection equipments</td>
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<td></td>
<td>15</td>
<td>Compatibility of plant protection chemicals</td>
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<tr>
<td>Objective</td>
<td>Idea/Concept</td>
<td>Activity</td>
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<td>-----------</td>
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<tr>
<td><strong>Curriculum Objective-1</strong>&lt;br&gt;The learner gets awareness about the importance of plant protection in agriculture and the extent of crop loss due to different organisms like insects, diseases, weeds and non-insect pests through brainstorming, group discussion, analysis of supplemented data and making notes.</td>
<td>Importance of plant protection extend of crop loss due to different organisms like insects, diseases, weeds</td>
<td>Brainstorming, Group discussion</td>
</tr>
<tr>
<td><strong>Curriculum Objective 2.</strong>&lt;br&gt;The learner understands the importance of pest outbreak and reasons for pest outbreak through brainstorming, Group Discussion and making notes.</td>
<td>Pest outbreak Reasons for pest outbreak</td>
<td>Brainstorming, Group discussion</td>
</tr>
</tbody>
</table>
**DAILY PLAN**

**CLASS** : II<sup>ND</sup> YEAR  
**SUBJECT** : Agriculture (Plant Protection)  
**DATE** : .................  
**UNIT** : General Charaters of Insect pest  
**TIME** :  

**CURRICULUM OBJECTIVE :**  
Learner identifies the different developmental stages of insects and the phenomenon of metamorphosis through discussion, observation, analysis of diagrams and preparing notes.  

**Materials** : Diagrams with different types of metamorphosis in insects.

<table>
<thead>
<tr>
<th>Learning Experience/Process</th>
<th>Respons/ Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facilitator leads a discussion</strong></td>
<td></td>
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<tr>
<td>➢ What are the different stages in the life cycle of butterfly?</td>
<td></td>
</tr>
<tr>
<td>➢ Facilitator list responses and elicit the life cycle of butterfly as follows</td>
<td></td>
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<tr>
<td>- Egg ➤ Larva ➤ Adult ➪ Pupa</td>
<td></td>
</tr>
<tr>
<td>➢ Facilitator provides diagrams showing life cycle of insects having incomplete metamorphosis and no metamorphosis.</td>
<td></td>
</tr>
<tr>
<td>➢ Facilitator helps the learners for comparison.</td>
<td></td>
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<tr>
<td><strong>Consolidation</strong></td>
<td></td>
</tr>
<tr>
<td>Metamorphosis - Change is size shape form and appearance of an insect between its birth and maturity</td>
<td></td>
</tr>
<tr>
<td>➢ Types of metamorphosis</td>
<td></td>
</tr>
<tr>
<td>➢ Complete metamorphosis includes all four stages.</td>
<td></td>
</tr>
<tr>
<td>- Egg- Larva- Pupa Adult in its life cycle</td>
<td></td>
</tr>
<tr>
<td>- Eg. Butterflies, Beetles, Flies</td>
<td></td>
</tr>
<tr>
<td>➢ Incomplete metamorphosis includes all stages except the pupal stage.</td>
<td></td>
</tr>
<tr>
<td>- Egg- Nymph- Adult in its life cycle</td>
<td></td>
</tr>
<tr>
<td>- Eg. Bugs</td>
<td></td>
</tr>
<tr>
<td>➢ Insects without metamorphosis - Adults and young ones of these insects are similar.</td>
<td></td>
</tr>
<tr>
<td>- They will not under go any pronounced changes during its development.</td>
<td></td>
</tr>
<tr>
<td>- Egg- Young one - Adult</td>
<td></td>
</tr>
<tr>
<td>- Eg. Silverfish</td>
<td></td>
</tr>
</tbody>
</table>

**Activity:**  
Find out more information on the lifecycle of common insects.
EVALUATION

Evaluation is a systematic process of collecting, analyzing, synthesizing and interpreting evidences of students’ progress and achievements both in cognitive and non-cognitive areas of learning. Evaluation has to play significant role in making the learning process more effective. It provides diverse experiences to the learners, keeping in view the skill to be attained continuously by them.

As the curriculum is based on a particular vocation, the selected stream is the most important part and it should be evaluated accordingly. Technical skills, interest and devotion in the field, communication skills, organizational and presentation skills are to be evaluated. Evaluation of the personal and social qualities also should be done. So the evaluation should be continuous and comprehensive.

Continuous and comprehensive evaluation (CCE)

Our traditional evaluation method measures only the memory and recollection capacity of the learner. To eliminate/overcome this limitation the evaluation should be done on multi-dimensional ways by measuring multiple intellectual capacities of the learner. So it is better to evaluate the learner in a continuous and comprehensive manner. CCE helps the learner to understand his own progress and to develop adequate strategies for further improvement.

Merits

- Assess the all-round development of the learner on a continuous basis through a variety of activities.
- Effective feedback is possible
- Remedial diagnostic teaching is possible
- Process as well as products is assessed.

Components of evaluation

In order to flourish continuous and comprehensive evaluation we make use of the following components of evaluation.
1. Continuous Evaluation (CE)

In the activity based classroom teacher provides variety of experiences through varied tools. Brain storming sessions, group work, discussions, project, seminat, debate field visits, practical works etc., will really flourish joyful learning. By considering the practicability and the nature of the subject, the following tools are advised for continuous evaluation.

A series of learning activities are grouped into five major thrust areas as follows

1) Investigative activities

Activities which create a spirit of enquiry, investigation and a mind for research in the learner belong to this group for example.

- Study project
- Case study
- Field study

2) Interactive activities

Those activities which improve the communication skill, activities of sharing ideas, etc.

For eg:-
- Seminar
- Panel discussion
- Debate
- Group discussion

3) Assigned task

Activities assigned to the learners to enrich/ strengthen the concept and ideas.

For eg:-
- Assignment
- Collections

4) Performance task (Tests)

Activities related to the achievements of the learner.

For eg:-
- Class test (oral/ written/ performance test)
- Quiz
- Open book examination
- Interview
- Group testing
5) Practical based activities

- Preparation of working model
- Album
- Improvisation

From the above five group of activities, the teacher has the freedom to choose any three areas for evaluation purpose. However, the teacher must make sure that the learners should undergo activities related to all the 5 areas during the course of the two years.

1. CE Items

(1) Study Project

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Stages</th>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Planning</td>
<td>Relevance of the study Identification of problem Ability to select</td>
<td>4/3/2/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>appropriate tools, ability to select suitable learning method.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Data Collection</td>
<td>Ability to collect sufficient and relevant data. Ability to classify and</td>
<td>4/3/2/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>arrange data for analysis. Reliability and authenticity of the data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>collected.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Analysis and Inference</td>
<td>Ability to analyse the data Systematic arrangements. Ability to draw</td>
<td>4/3/2/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>inferences based on analysis. Ability to give suggestions based on</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>inference.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Report presentation</td>
<td>Ability to present in logical and sequential order, authenticity of</td>
<td>4/3/2/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>report, time bound completion.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Viva-Voice</td>
<td>Knowledge of content and process. Ability to analyse data. Ability to</td>
<td>4/3/2/1</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Criteria</td>
<td>Score</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>(2) Case study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Identifying the problem</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Approach to the problem</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Time bound Action</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Analysis of the problem</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Problem solving / Reporting</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>(3) Field study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Attitude and readiness towards the task</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Capacity for Observation</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Data collection</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Application of ideas</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Documentation / Recording</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>(4) Assignment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Awareness of the content</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Comprehensivenes of the content</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Systematic and sequential arrangement</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Observation/suggestion/views/judgment/evaluation</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Evaluation</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preparation of note and time bound completion of each stage of work</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>(5) Seminar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Planning and Organization</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Collection and data / content</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Observation / appraisal and clarity</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Content knowledge</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Presentation</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>(6) Debate, Plant discussion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Readiness to participate</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Depth of subject knowledge</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Communication skill</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Ability to justify the stand</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Presentation</td>
<td>4/3/2/1</td>
<td></td>
</tr>
</tbody>
</table>
### (7) Group Discussion

| 1. Readiness to participate | 4/3/2/1 |
| 2. Depth of subject knowledge | 4/3/2/1 |
| 3. Communication skill | 4/3/2/1 |
| 4. Ability to justify in a democratic way | 4/3/2/1 |
| 5. Leadership quality | 4/3/2/1 |

### (8) Interview

| 1. Planning | 4/3/2/1 |
| 2. Preparation of Questions | 4/3/2/1 |
| 3. Communication skill | 4/3/2/1 |
| 4. Participation | 4/3/2/1 |
| 5. Report preparation | 4/3/2/1 |

### 9. Collection

| 1. Collection of materials/Documents | 4/3/2/1 |
| 2. Relevance and comprehensiveness | 4/3/2/1 |
| 3. Presentation | 4/3/2/1 |
| 4. Awareness of the content | 4/3/2/1 |
| 5. Time bound progress of work at each stage | 4/3/2/1 |

### 10. Quiz

| 1. Preparation of questions |
| 2. Relevance of question |
| 3. Presentation |
| 4. Active participation |
| 5. Time management |

### 11. Classtest

| 1. Class test should be oral/ written/ |
| 2. Performance. |
| 3. It is to be evaluated on the basis of specific scoring indicators |

---

**Terminal or Term End Evaluation (TE)**

It is the written form of evaluation aimed at evaluating the facts, concepts and ideas gained by the learner. The test should not be aimed to evaluate the memory alone. Questions are framed in such a way that the learners are able to apply different mental process while answering. The Terminal Evaluation questions give more emphasis on application, analysis and synthesis level.
The maximum scores for TE is 80 and the minimum is 24 (30%). The questions should be formulated taking into consideration the time required to read, think, understands and write answers. These aspects should be considered while fixing the scores also. To avoid blind guessing, multiple choice and application level questions may be mixed. The total number of questions may vary from time to time. All the questions should be based on the curricular objectives. Open ended questions may be included the choice questions if included also should be based on the same curricular objectives.

**Practical Evaluation (PE)**

The goal of vocational Education is to generate skills through continuous practices along with investigation and innovations. Continuous and comprehensive practice transforms the unskilled learner to a skilled one. This is the importance and significance of vocational practical.

PE is done to evaluate the practical skills achieved by the learner in the concerned vocational subject. Total Scores for PE is 150 and minimum is 60 score i.e. 40%. Practical Examination is conducted for a batch of 8 learners having 6 hours duration.

Practical evaluation should be done taking into account the whole practical included in the curriculum since Learning of practical skills is a continuous process through out the period of study.

**Distribution of scores for practical evaluation**

<table>
<thead>
<tr>
<th>Practical Evaluation components</th>
<th>Score</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration</td>
<td>37.5</td>
<td>25</td>
</tr>
<tr>
<td>Viva</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Diagnosis/situation analysis</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Identification</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Calculation</td>
<td>22.5</td>
<td>15</td>
</tr>
<tr>
<td>Record</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>150</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Indicators for vocational practical evaluation

- **Demonstration**
  - Method - write up/procedure 15
  - Technique 15
  - Perfection/neatness 7.5
  Total 37.5

- **Viva**
  Total Score: 15

- **Diagnosis/situation analysis**
  - Identification problem 5
  - Analysis 5
  - Interpretation/inference/remedy 15
  - Reporting 5
  Total 30

- **Identification**
  Total Score: 30
  - Tools/implments/instruments
  - Specimen
  - Breeds/variety

- **Calculation**
  Total Score: 22.5
  - Fertilizer
  - Pesticide
  - Productivity

- **Records**
  Total Score: 15

**Vocational Competency Evaluation (VCE)**

Vocational Competency Evaluation is to evaluate the vocational skill and aptitude developed by the students during the learning process. This is a system to judiciously evaluate the required value addition and consequent capacity building in the concerned vocational curriculum. The vocational education is aimed at developing interest, skills and devotion in specific vocational fields. As other evaluation components like, CE, PE and TE cannot assess the vocational competency and professional skills, acquired by the students an internship evaluation (IE) component has been introduced to meet this requirement.

Internship evaluation should be done based on the following components like regularity and punctuality, value addition and capacity building.
1. Regularity and punctuality

Regularity and punctuality has vital role in vocational education learning continuous process, the regular presence of the Learner is must for attaining maximum efficiency.

2. Value Addition

Value addition is the qualitative measure of the learner’s interest, devotion perseverance and efficiency. Value addition can be evaluated through conducting field visits/ vocational survey. The experiences gained through field visit / vocational survey increases the level of intrinsic motivation and positive attitude towards the vocational field and thereby increase his value as a semi-professional.

3. Capacity Building

It gives a quantitative measure of the student’s skill in graded area exposure. Capacity building can be evaluated through conducting the following activities.

1. OJT / Simulated experiment
2. Performance – camp/exhibition/clinic
3. Performance – Production/Service cum Training centre. (PTC)

These components help the learner to practice the acquired skills in the real situation and thereby increasing self-confidence and promoting self-reliance.

Vocational Competency Evaluation Indicators

<table>
<thead>
<tr>
<th>No</th>
<th>Items</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Regularity and punctuality</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Field visit / vocational project survey (anyone)</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>OJT / Simulated experiment performance - Camp / exhibition / clinic.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performance - PTC (anyone) / Practical skills</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

1. Regularity and punctuality of the learner can be assessed by using attendance and time bound completion of tasks. It is evaluated by using 5 point grading system.
### Rating Scale

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Regularity</td>
<td>Never regular</td>
<td>Often regular</td>
<td>Equally regular</td>
<td>Most of the time regular</td>
<td>Always regular</td>
</tr>
<tr>
<td>2.</td>
<td>Punctuality</td>
<td>Never Punctual</td>
<td>Often Punctual</td>
<td>Usually Punctual</td>
<td>Most of the time punctual</td>
<td>Always punctual</td>
</tr>
</tbody>
</table>

### Item Evaluation indicators Scores Score

<table>
<thead>
<tr>
<th>Value addition</th>
<th>Field visit</th>
<th>Scores</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attitude and readiness towards the task</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Capacity for observation</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Data collection</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Application of ideas</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Documentation/recording</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Or Survey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Planning</td>
<td>4/3/2/1</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2. Data collection</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Consolidation of data and analysis</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Drawing inference</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Reporting</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity Building</td>
<td>OJT/Simulated experiment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Involvement/participation</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Skills in doing work /communication skills</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Time bound action</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Capacity for observation, analysis and innovation</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Documentation, recording and display</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Or Performance in camp/exhibition/clinic</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>1. Ability for planning and organizing</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Mastery of subject</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Ability for communication</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Innovation</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Involvement/social commitment</td>
<td>4/3/2/1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Or Performance in production/service cum training center (PTC)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mastery of vocational skills</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>2. Managerial capacity</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>3. Promoting self confidence</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>4. Innovation approach</td>
<td>4/3/2/1</td>
<td></td>
</tr>
<tr>
<td>5. Promoting self reliance</td>
<td>4/3/2/1</td>
<td></td>
</tr>
</tbody>
</table>

**GRADING**

Continuous Evaluation is essential for activity based learning process. But the skills achieved by the students cannot be completely measured in terms of marking system. Marking system proved unscientific in evaluating the growth and development of individual students both in cognitive and non-cognitive areas. Classification of students in terms of marks were both unjust and indefensible. It also creates mental stress and strain among the students. To overcome this limitation, a popular mode of evaluating students’ performance known as grading system has been evolved. It is quite extensively used all over the world. At the Vocational Higher Secondary stage, it is desirable to use a 9 point scale absolute grading to co-ordinate and record the evaluation. After giving the score, they are changed into percentages and appropriate letter grades are awarded corresponding to each percentage. This system is termed as absolute grading.
The score percentage and corresponding letter grade is given below:

<table>
<thead>
<tr>
<th>Score in percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>A+</td>
</tr>
<tr>
<td>80-89</td>
<td>A</td>
</tr>
<tr>
<td>70-79</td>
<td>B+</td>
</tr>
<tr>
<td>60-69</td>
<td>B</td>
</tr>
<tr>
<td>50-59</td>
<td>C+</td>
</tr>
<tr>
<td>40-49</td>
<td>C</td>
</tr>
<tr>
<td>30-39</td>
<td>D+</td>
</tr>
<tr>
<td>20-29</td>
<td>D</td>
</tr>
<tr>
<td>Below 20</td>
<td>E</td>
</tr>
</tbody>
</table>
## UNIT - 1

**INTRODUCTION TO PLANT PROTECTION**

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Objective-1</td>
<td>Importance of plant protection extend of crop loss due to different organisms like insects, diseases, weeds and non insect pest through brainstorming, group discussion, analysis of supplemented data and making notes.</td>
<td>Brainstorming, Group discussion</td>
<td>Point cards for discussion Chart papers</td>
<td>Notes Charts</td>
<td>Notes Charts</td>
</tr>
<tr>
<td><strong>Curriculum Objective 2.</strong></td>
<td>Pest outbreak Reasons for pest outbreak</td>
<td>Brainstorming, Group discussion</td>
<td>Point cards</td>
<td>Notes</td>
<td>Notes</td>
</tr>
</tbody>
</table>

*Source Book: II Year Agriculture (Plant Protection)*
UNIT 1
INTRODUCTION TO PLANT PROTECTION

Introduction

Ever since man has started agriculture, pest and disease have been attacking crops. References of locust attack; rust and mildews are found in the Bible and other ancient literature like Vedas and Vriksha Ayurveda.

To feed the increasing population man started intensive farming, which lead to an increase in pest and disease incidence. Approximately the loss due to pest is 30-50% of the total production. To stabilize production and to avoid famine various plant protection measures are to be adopted.

Curriculum objective-1.

The learner gets awareness about the importance of plant protection in agriculture and the extend of crop loss due to different organisms like insects, diseases, weeds and non insect pest through brainstorming, group discussion, analysis of supplemented data and making notes.

Syllabus:
Importance of plant protection- economic importance of plant protection – assessment of losses

Learning Experience: 1

Brain Storming

Facilitator introduces the topic by asking questions like

➤ How many of you have cultivation in home?
➤ Do you get good yields regularly? If not why?

Facilitator list out the responses of the student

➤ Facilitator asks whether it is possible to ensure a successful crop without adopting timely plant protection measures even though other scientific cultivation operations done.

Consolidation

❖ The importance of plant protection in agriculture.
❖ Historical incidence like Potato famine, Bengal famine to supplement the importance of plant protection.
Learning Experience: 2

Group Discussion

Materials

Point cards for discussion, Chart papers.

From the list of responses the facilitator helps the learner to identify the different group of pest as insects, non-insect pests, pathogens and weeds.

<table>
<thead>
<tr>
<th>Percentage of loss caused by different groups of pest</th>
<th>Classification of pest based on the extend of damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease 20%</td>
<td>Negligible Pest &lt; 5%</td>
</tr>
<tr>
<td>Weeds 45%</td>
<td>Minor Pest 5-10%</td>
</tr>
<tr>
<td>Insects 30%</td>
<td>Major Pest &gt;10%</td>
</tr>
<tr>
<td>Other factors 5%</td>
<td></td>
</tr>
<tr>
<td>Total 100%</td>
<td></td>
</tr>
</tbody>
</table>

Learners discuss and rank the group of pest according to the extent of damage and the percentage of loss caused by them.

Consolidation

- Percentage of loss caused by different groups of pest
- Classification of pest based on the extent of damage

Products

Notes and charts prepared

Evaluation

1) Classify the following pest based on the extent of damage

Pest A 2% Damage
Pest B 15% Damage
Pest C 7% Damage

Reference:

- “Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.

Source Book: II Year Agriculture (Plant Protection)
Curriculum Objective 2.

The learner understands the importance of pest outbreak and reasons for pest outbreak through brainstorming, Group Discussion and making notes.

Syllabus
Causes of pest and disease outbreak

Learning Experience: 1

Brain Storming

Facilitator introduces the topic

➢ What will happen to the population of mosquito if the natural forces controlling it are eliminated from an area?

➢ What will happen if this balance is disturbed?

Facilitator lists the responses

Consolidation

☒ Natural forces control population of each and every pest

☒ If the natural forces controlling the pest population are upset or disturbed there will be a sudden increase in pest population and consequent damage to crops, which is termed as pest outbreak.

Learning Experience: 2

Group Discussion

Materials:

Point cards

Learners are divided into four groups. Two points are given to each group for discussion to find out the causes of pest out break
After discussion each group present their views and facilitator consolidate each point by supplementing sufficient information.

Eg:-
- BPH attack on paddy in Kuttanadu
- Mite attack on Coconut

### Consolidation

- ![Pest out break](image)
- ![Reasons for pest out break](image)

### Product

Prepared notes.

### Evaluation:

1. A farmer started cultivating bittergourd in his home and experienced severe pest attack. State the reasons for this?

2. Recently in Kuttnad area there was an outbreak of BPH. Can you explain the reasons for this?

### Reference:

- “Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe

Source Book: II Year Agriculture (Plant Protection)
## UNIT- 2

### INTRODUCTION TO PEST

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 1</strong>&lt;br&gt;Learner understands the morphological features of non-insect pest like mite, nematode, rodents, slugs and snails, birds and weeds through collection of secondary data, discussion and prepares notes and charts.</td>
<td>Morphological features of non-insect pest like mite, nematode, rodents, slugs and snails, birds and weeds</td>
<td>Discussion Collection</td>
<td>Secondary data Reference books</td>
<td>Notes and charts.</td>
<td>Notes and charts.</td>
</tr>
</tbody>
</table>
INTRODUCTION TO PEST

Introduction

The pest in general, means enemy. It includes organisms, which are harmful to man. It causes significant damages of economic importance. In this unit, students are familiarized with the different groups of pests like insects, nematodes, rodents, weeds, snails and slugs which attack crop plants, their morphological features nature of damage and control measures.

Curriculum Objective 1

Learner understands the morphological features of non-insect pest like mite, nematode, rodents, slugs and snails, birds and weeds through collection of secondary data, discussion and prepares notes and charts.

Syllabus

Specific characters of different pest like nematodes, rodents and weeds with examples.

Materials:

Points for data collection and discussion, reference books.

Learning Experience:

Discussion

Facilitator leads a discussion on different groups of pests

- The learner identifies insects and non-insect pest as mite, nematode, rodents, slugs and snails, birds and weeds using charts prepared in unit-1.
- Facilitator asks questions about these pests and elicits the following points for data collection.

- Group of pest
- Phylum and class
- Morphological features with diagrams
- Nature of damage
- Control measures
- Examples with crops attacked.

- Learners are divided into six groups and collect information from reference books.
Groups discuss, prepare charts and present the topic

Consolidation

☑ Insects and different groups of non-insect pests
☑ Morphological features of each group

Products

Prepared notes and charts

Evaluation

1) Write one important non-insect pest attacking coconut and how will you control it?
2) Classify the following morphological features belonging to insects and non-insect?
3) Match the following:

<table>
<thead>
<tr>
<th>Six legs</th>
<th>Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight legs</td>
<td>Snails</td>
</tr>
<tr>
<td>Calcareous shell</td>
<td>Insect</td>
</tr>
<tr>
<td>Worm like appearance</td>
<td>Mites</td>
</tr>
<tr>
<td>Vertebral column</td>
<td>Nematodes</td>
</tr>
</tbody>
</table>

Reference

- “Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “The Insects” By Chapman
## UNIT-3

### GENERAL CHARACTERS OF INSECT PEST

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| **Curriculum Objective 1**  
The learner understands the different groups of insects their and nature of damage through collection, observation, classification and tabulation. | External characteristics of insects  
Classification of insects into bugs, beetles, flies, Thrips, moths and butterflies  
Preparation of models | Collection, observation, classification, tabulation  
Preparation of models | Specimens  
Charts  
Format for tabulation | Model of typical insect  
Consolidated table  
Notes | Model of typical insect  
Consolidated table  
Notes |
| **Curriculum Objective 2**  
The learner identifies the different developmental stages of insects and the phenomenon of metamorphosis through discussion, observation, analysis of diagrams and preparing notes. | Different developmental stages of insects  
Phenomenon and types of metamorphosis | Discussion, observation, analysis of diagrams | Diagrams | Notes | Notes |
| **Curriculum Objective 3**  
The learner understands the different destructive stages of different insects, their mouthparts and feeding habits through collection of damaged specimens, observation, identification, tabulation, making notes and charts. | Destructive stages of different insects, their mouthparts and feeding habits | Collection of damaged specimens, observation, identification, tabulation | Damaged specimens, chartpaper and format for tabulation | Notes and prepared charts | Notes and prepared charts |
GENERAL CHARACTERS OF INSECT PEST

Introduction

The science of Entomology deals with the study of insects. The word entomology is derived from two Greek words entoma (Insects) and logos (to study). About 80% of the known species of the animal kingdom consists of insects. Both beneficial and harmful insects are present around us. To study such a large number it is necessary to classify them into distinct groups.

In this unit the learner should get an idea of different stages of insect development, Metamorphosis, Systematic grouping of insects based on their external and internal characteristics, their feeding habits and mouth parts.

It is also essential to get awareness about the destructive or damaging stages of common insect pests.

Curriculum Objective 1

The learner understand the different groups of insects their external characteristics and nature of damage through collection, observation, classification and tabulation.

Syllabus

Classification of insects into groups like bugs, beetles, flies, moths etc. – type of mouth parts – feeding habits.

Learning Experience:

Collection

- Learner collects different groups of insects from their locality and classifies them as bugs, beetles, weevils, moths and butterflies and flies.

- Learners are divided into four groups. Each group is given a particular group of insect to observe the morphological feature and tabulate them on the format provided.
Facilitator consolidates the distinguishing features of different groups of insects using the table.

**Learning Experience: 2**

**Model Preparation**

- Model of a typical insect is made based on the previous Learning Experience:
- The learner prepares the model and presents it.

**Consolidation**

- Insects are organisms with segmented body parts. Insect body is made up of a chitinous exoskeleton.
- They come under Phylum ‘Arthropoda’ and class ‘Insecta’ (Hexapoda ➔ six legs).
- The body can be divided into head, thorax and abdomen.
- Head contains a pair of antennae, eyes and mouthparts.
- The thorax contains three segments. Prothorax, Meso thorax and Meta thorax. The entire three segments have a pair of legs. A pair of wings is present in Meso and meta thoracic segments.
- Abdomen contains tracheal, excretory pores and reproductory appendages.

**PRODUCTS**

Model of typical insects, prepared notes, consolidated table of morphological features of insects.

**Evaluation**

1) Draw a neat-labeled sketch of a typical insect

2) Match the following

<table>
<thead>
<tr>
<th>Order</th>
<th>Insect</th>
<th>Wing characters</th>
</tr>
</thead>
</table>

Source Book: II Year Agriculture (Plant Protection) 69
<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Elytra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diptera</td>
<td>Moths and Butterflies</td>
<td>Membranous wings</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Flies</td>
<td>Scaly wings</td>
</tr>
<tr>
<td>Hemiptera</td>
<td>Beetles</td>
<td>Scaly wings</td>
</tr>
<tr>
<td>Coleopters</td>
<td>Bugs</td>
<td>Halteres</td>
</tr>
</tbody>
</table>

**Curriculum Objective 2:**

Learner identifies the different developmental stages of insects and the phenomenon of metamorphosis through discussion, observation, analysis of diagrams and preparing notes.

**Syllabus**

Important stages of insect development – metamorphosis.

**Learning Experience:**

**Discussion**

**Material**

Diagrams showing different types of metamorphosis and no metamorphosis

Facilitator leads a discussion

- What are the different stages in the life cycle of butterfly?

  Facilitator list responses and elicit the life cycle of butterfly as follows

  | Egg → | Larva ↓ |
  |       |         |
  | ↑     |         |
  | Adult | ← Pupa  |

- Learner observes and analyzes the diagram.
- Facilitator provides diagrams showing life cycle of insects having incomplete metamorphosis and no metamorphosis.
- Learner compares it with the first diagram and discusses the similarities and differences.

**Consolidation**

Source Book: II Year Agriculture (Plant Protection) 70
Metamorphosis - Change is size shape form and appearance of an insect between its birth and maturity

Types of metamorphosis

- Complete metamorphosis includes all four stages. Egg—Larva—Pupa and Adult in its life cycle Eg. Butterflies, Beetles, Flies

- Incomplete metamorphosis includes all stages except the pupal stage. Egg —Nymph—Adult in its life cycle Eg. Bugs

- Insects without metamorphosis -- Adults and young ones of these insects are similar. They will not under go any pronounced changes during its development.
- Egg—Young one – Adult     Eg. Silverfish

Product

Notes.

Evaluation

1) Match the following

<table>
<thead>
<tr>
<th>Type of Insect</th>
<th>Metamorphosis</th>
<th>Develop’l. Stages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterfly</td>
<td>Incomplete metamorphosis</td>
<td>Nymphs</td>
</tr>
<tr>
<td>Bug</td>
<td>without metamorphosis</td>
<td>similar to adults</td>
</tr>
<tr>
<td>Silver fish</td>
<td>complete metamorphosis</td>
<td>Pupa</td>
</tr>
</tbody>
</table>

Reference

- “Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinquk” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “ The Insects” By Chapman
Curriculum Objective 3

The learner understands the different destructive stages of different insects, their mouthparts and feeding habits through collection of damaged specimens, observation, identification, tabulation, making notes and charts.

Syllabus


Learning Experience:

Collection

Materials:

Damaged specimens, Chart papers, formats for tabulation

Learner collects specimens damaged by pests (supplement specimens if necessary), observes and identifies each specimen and tabulates the findings as follows:

<table>
<thead>
<tr>
<th>Specimen and crop</th>
<th>Nature of damage</th>
<th>Type of pest</th>
<th>Stage of attack of pest</th>
<th>Type of food (solid/liquid)</th>
<th>Observed mouthpart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhindi – leaf</td>
<td>Eaten up leaves</td>
<td>Insect</td>
<td>Caterpillar</td>
<td>Solid</td>
<td>Chewing</td>
</tr>
</tbody>
</table>

Consolidation

- Classifies insect as solid feeders and liquid feeders.
- Solid feeders have biting and chewing types of mouthparts-
  - Eg. Beetles, Caterpillars of butterflies and grasshoppers
- Liquid feeders
  - Sucking type of mouthparts
  - Butterfly and moths—adults—have a coiled proboscis.
  - Bugs (Adults and Nymphs)
- Thrips
- Flies
- Destructive stages of insect pest

Source Book: II Year Agriculture (Plant Protection)
Products

Notes and prepared charts

Evaluation

1) Why do flies have spongy type of mouthpart and beetles have chewing type of mouthparts?

2) Lepidopteron insects have chewing types of mouthparts during the larval stage and siphoning type of mouthpart during adult stage. How does this difference help them in survival?

Reference

“Principles and procedures of Plant protection” By S.B.Chattopadhyay

“Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.

“Hand book of Plant protection” By R.L.Sahe

“Insects” By Chapman
## UNIT – 4
### INSECT PEST CONTROL

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 1</strong>&lt;br&gt;The learner understands the different methods of plant protection like physical, chemical, mechanical, biological, legal and cultural methods through brainstorming, discussion and preparing notes</td>
<td>different methods of plant protection like physical, chemical, mechanical, biological, legal and cultural methods</td>
<td>different methods of plant protection like physical, chemical, mechanical, biological, legal and cultural methods</td>
<td>Secondary information</td>
<td>Notes</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective 2</strong>&lt;br&gt;The learner understands and classifies different insecticides based on mode of entry and mode of action through Classroom discussions, group discussion and prepares notes and charts</td>
<td>Classification of insecticides based on mode of entry and mode of action</td>
<td>Brain storming and group discussion</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective-3.</strong>&lt;br&gt;The learner understands the basic classification of insecticides through brainstorming, group discussion, presentation and making notes</td>
<td>Classification of insecticides based on chemical nature</td>
<td>Brain storming and group discussion</td>
<td>Point cards</td>
<td>Notes</td>
<td>Notes</td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection) 74
<table>
<thead>
<tr>
<th>Curriculum Objective-4.</th>
<th>Classification of synthetic organic insecticides, insecticide formulations and label information</th>
<th>Discussion Survey, Tabulation, Preparing notes charts</th>
<th>Survey format, reference books and chart paper</th>
<th>Tabulated chart, note, survey report</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 5</strong></td>
<td>Identification and understanding of different commercial formulation of insecticides like WP, SC, SL, SP, EC, DP, and G through observation, discussion, recording and making notes</td>
<td>Observation Recording</td>
<td>Different formulations of insecticides</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective 6</strong></td>
<td>Calculation of insecticidal formulation</td>
<td>Solving problems</td>
<td>Problems and chart paper</td>
<td>Solved problems and notes</td>
</tr>
</tbody>
</table>
**Curriculum Objective-7**
The learner develops the skill for the preparation and field application of insecticide formulations through method demonstration, observation and making notes.

<table>
<thead>
<tr>
<th>Preparation and field application of insecticide formulations</th>
<th>Method demonstration</th>
<th>Commercial formulation, measuring jar weighing balance, bucket, plant protection equipments protective cloth implements, chart paper</th>
<th>Observation notes prepared chart prepared formulation</th>
<th>Notes</th>
</tr>
</thead>
</table>

**Curriculum Objective-8.**
The learner develops the skill for the preparation and field application of botanical insecticides (tobacco decoction, neem oil garlic emulsion, and neem kernel suspension) and kerosene soap emulsion, understands their merits and demerits through discussion method demonstration, observation, assignments and making notes.

<table>
<thead>
<tr>
<th>Preparation field application merits and demerit’s of botanical insecticides (tobacco decoction, neem oil garlic)</th>
<th>Brainstorming Discussion</th>
<th>Materials required for the preparation of each botanical insecticide</th>
<th>Prepared insecticides notes assignment</th>
<th>Notes</th>
</tr>
</thead>
</table>

Source Book: II Year Agriculture (Plant Protection) 76
INSECT PEST CONTROL

Introduction

Insects appeared on earth very long before descend of man. They depend upon the same sources on which man depend for his food, shelter, clothing and other needs. The fight between man and insect will continue till human race endures on earth. Insect cause injury to plants in many ways and the nature of damage caused by them is mainly depends upon their feeding habits. In this unit the various control measures and management practices employed to keep the pest at bay are described. The details on Classification of insecticides, formulations and botanical insecticides are also included.

A large number of insecticides are used for the control of insect pest. For easier and meaningful study they are classified into different groups. The insecticides are formulated in different ways to increase their quality parameters. The unit also deals with different types of eco friendly botanical insecticides that can substitute chemical insecticides.

Curriculum Objective 1

The learner understands the different methods of plant protection like physical, chemical, mechanical, biological, legal and cultural methods through brainstorming, discussion and preparing notes

Syllabus

Different methods of insect pest control - physical, chemical, mechanical, biological, legal and cultural methods

Materials

Handouts, chart papers, paper cuttings

Learning Experience: 1

Brainstorming

Facilitator initiated discussion

➤ What are the different ways used for pest control?

➤ Which method is familiar to you?

Facilitator list the responses
Learner identifies the different methods as prophylactic and curative,
Learners classify them as cultural, mechanical, physical, legal, biological and chemical methods
Learning Experience: 2:

Group Discussion

Learners are divided into six groups, each group with the name of a plant protection method. Facilitators distribute the review material and point cards with the following details for discussion.

Each group presents their points. Facilitator supplements additional information.

<table>
<thead>
<tr>
<th>METHOD</th>
<th>DETAILS</th>
<th>ADVANTAGE</th>
<th>DISADVANTAGE</th>
<th>SUITABILITY</th>
<th>EXAMPLES</th>
</tr>
</thead>
</table>

Consolidation

Different methods of insect control with suitable examples

Products

Notes and charts.

Evaluation

1) Suppose a form is facing stem borer attack in his rice field. What are the different methods of plant protection, which can be used against the pest?

2) Mention the name of plant protection method used against each of the following the pest

   a. Epilachna Beetle against coffee mealy bug
   b. Bracon against black headed caterpillar in coconut
   c. Phytosanitary certificate
   d. Smearing of groundnut with oil
   e. Covering of bitter gourd fruits with paper bags

Source Book: II Year Agriculture (Plant Protection)
Examples for conducting group discussion as in Curriculum Objective 1 for Cultural and legal methods.

1. Cultural Method

Facilitator initiates a discussion

➢ Do you think digging can be used as a method for controlling pest?

Facilitator lists the responses and learner identifies digging as a cultural control method.

Learners are divided into four groups. Each group is given an example of cultural practice that can be used for pest control

➢ E.g. 1 Alternate planting of rice and cowpea is practiced in a piece of land season after season. Do you think this will help to reduce pest problem substantiate your views?

➢ E.g. 2 Do you think use of a resistant variety will help to reduce pest problem?

Each group presents their views. Facilitator supplements and consolidates

Consolidation

⊙ Cultural method employs the use of various cultural operations for pest control

⊙ Cultural practices for pest control

  o Adjusting the time of sowing or planting.
  o Using resistant variety
  o Crop rotation
  o Flooding
  o Mulching
  o Trap cropping
  o Cover cropping

Reference

- Handbook of plant protection
- Monograph of Crop pests of Kerala
- Textbook of Economic Entomology

Source Book: II Year Agriculture (Plant Protection)
o Digging and ploughing

2. Legal method:

Facilitator narrates Bunchy top as a most important disease of banana. It was introduced from Srilanka to Kerala through contaminated plant parts. How can you prevent such incidents in future?

List the responses. Facilitator consolidates the important of legal methods

Learners are divided into four groups and provided with cards containing the following details

Group I
A lot of 350 anthurium plants imported from Singapore were destroyed by authorities at Thiruvananthapuram airport due to the presence of a species of slug which was not present in India. What is the advantage of destroying the infested anthurium plants?

Group II
Tapioca mosaic is more prevalent in Kerala compared to other states. What can be done to prevent its spread to other states?

Group III
Do you think that it is necessary to create awareness among farmers to prevent the spread of pest?

Group IV
A certificate issued by a competent authority to an agricultural commodity to show its freedom from pest and diseases is essential for its export to a foreign country. A similar certificate is necessary for its import also. Do you think such certificate help in pest control?

Groups present their views and facilitator consolidates

Consolidation

- Quarantine measures
  - Foreign quarantine
  - Domestic quarantine
- Farmers’ awareness programmes
- Phytosanitary certificate

(Other method of plant protection such as Mechanical, Physical, legal, biological
And chemical can be transacted using group discussion as above)
Classroom Activity:

A firm in India would like to export 10000 pepper cuttings to a firm in Singapore. Suppose you are the authority to issue a phytosanitary certificate in India. Students are asked to prepare a phytosanitary certificate of their own.

Curriculum Objective 2

Learner understands and classifies different insecticides based on mode of entry and mode of action through Classroom discussions, group discussion and prepares notes and charts.

Syllabus:

Classification of insecticides based on mode of action and mode of entry

Learning Experience-1

Discussion

Materials

Reference, Books, Chart paper

Facilitator initiates a discussion

➢ How will you take medications for different diseases?

❖ Facilitator lists the responses and consolidates the mode of entry of chemicals as follows

<table>
<thead>
<tr>
<th>Tablets</th>
<th>Ingested</th>
<th>Absorbed from stomach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection</td>
<td>to the system</td>
<td>Systemic</td>
</tr>
<tr>
<td>Creams</td>
<td>Skin</td>
<td>Contact</td>
</tr>
<tr>
<td>Inhalers</td>
<td>To the respiratory system</td>
<td>Fumigants</td>
</tr>
</tbody>
</table>

Consolidation

❖ Stomach poisons
  o Those chemicals which when ingested exert its poisonous effect. Mainly used against insects having biting and chewing type of mouthparts.
  o Eg. Endosulfan, DDT, BHC.

❖ Contact poisons
  o Chemicals when come in contact enter into the insect body through skin and kill them.

Source Book: II Year Agriculture (Plant Protection)
Systemic Poison
- A chemical, which act at a point away from the point of application, is termed as systemic poisons. These chemicals are capable of being translocated through the vascular bundles of plants.
- Eg. Monocrotophos, Phorate, Carbofuran, Rogor

Fumigants
- Chemical enter into the respiratory system of insects through the tracheal system.
- Eg. Methyl Bromide, Aluminium Phosphide, DDVP.

Learning Experience: 2

Group Discussion

Facilitator initiates discussion

- How will you control mosquito larvae?
- How kerosene applied to water kill mosquito larvae?
- What is the action of Cobra venom?
- What is the action of Potassium Cyanide?

Facilitator lists the responses

Learners are divided into 4 groups and each group is given a material describing a practical situation showing the mode of action of pesticides

The groups discuss the material and present their views.

Consolidation

Physical poison:
- Chemical which exert some physical effect and cause death of insects.
  - Eg. Tar oil, Mineral Oil, Silica Gel, Aluminium Powder, Charcoal powder

Protoplasmic poison:
- Chemicals, which cause coagulation of cellular protoplasm of the mid gut epithelium and kills them.
  - Fluorine compound and arsenic compounds.

Nerve poison
- These chemicals inhibit the enzyme acetyl cholinesterase, which cause continuous stimulation and death of insects.
- Organo phosphorus compounds, Carbamates, Nicotines, Pyrethrins

- Respiratory poison
  - Chemicals, which inhibit cellular respiration and death of insects
    - KCN, HCN

Classroom Activity:

Learner prepares a chart showing the classification of insecticides based on mode of entry and mode of action with suitable examples.

Products

Notes, charts

Evaluation

1) The infection of pulse beetle on pulses can be reduced using coconut oil. It prevents the gluing of eggs, and creates asphyxiation. Classify the action of coconut oil based on mode of action?

2) Match the following

<table>
<thead>
<tr>
<th>Mode of action</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Coagulation of cellular protoplasm</td>
</tr>
<tr>
<td>Protoplasmic</td>
<td>impaired nerve stimulation</td>
</tr>
<tr>
<td>Nerve poison</td>
<td>blocks cellular respiration</td>
</tr>
<tr>
<td>Respiratory poison</td>
<td>Kerosene used to kill mosquito larvae</td>
</tr>
</tbody>
</table>

Reference:

- "Principles and procedures of Plant protection" By S.B.Chattopadhyay
- "Keedanasinikal" By Dr.Peethambaran and Dr.Visalakshi.
- "Hand book of Plant protection" By R.L.Sahe

Curriculum Objective-3.
Learner understands the basic classification of insecticides through brainstorming, group discussion, presentation and making notes

**Syllabus:**

Classification of insecticides based on chemical nature

**Learning Experience: 1**

**Brainstorming**

- Facilitator initiates brainstorming.
  - List some of the common pesticides
  - Can you name a few botanical pesticides?
  - Is there any pesticide of animal origin?

Facilitator list responses and consolidates.

**Consolidation**

- There are organic and inorganic pesticides
- Organic pesticides can be of plant or animal origin or they can be synthetic.

Facilitator evolves the following classification of insecticides through discussion

![Insecticides Diagram]

**Learning Experience: 2**

**Group discussion**

Materials: Point cards, materials for discussion.

Source Book: II Year Agriculture (Plant Protection)
Facilitator divides learner into 4 groups
Assign each group the following materials for discussion. Based on point cards.
Groups discuss and prepare charts, present

Details on inorganic insecticides
Details on plant originated insecticides
Nicotinoids
Pyrethroides

Details on
Neris toxin
Hydrocarbon oils
Details on plant originated insecticides
Azadirachtin
Rotenoids

POINT CARD
Name of insecticide
Classification.
Source
Properties
Uses

Consolidation
Details on different types of insecticides

Products
Notes prepared by learners.
Evaluation

1) A farmer has aphid attack in his cowpea crop. Can you suggest an environment friendly pesticide and substantiate your views?

2) Complete the following

<table>
<thead>
<tr>
<th>Group</th>
<th>Source</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic</td>
<td></td>
<td>Mineral Oil</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Plant Origin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inorganic</td>
<td></td>
<td>Sodium Fluoride</td>
</tr>
<tr>
<td>Organic</td>
<td></td>
<td>Nicotine Sulphate</td>
</tr>
</tbody>
</table>

Reference:

- Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe

Curriculum Objective-4.

The learner understands the classification of synthetic organic insecticides, insecticide formulations and label information through survey, presentation and submitting reports and preparing notes.

Syllabus:

Classification of synthetic organic insecticides –

Learning Experience-1

Discussion

Facilitator initiates discussion

- List some of the important pesticides available in the market?
- List some of the important forms of pesticides available in the market?

Consolidation

- Pesticides are chemically different
- There are different formulations of pesticides.
Learning Experience: 2.

Survey

Materials

Survey format, reference books, chart papers

To find out the different types of pesticide formulations, toxicity levels and percentage concentration the learners are divided into four groups. A survey format is evolved through discussion.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Trade name</th>
<th>Generic Name</th>
<th>Type of pesticide</th>
<th>Formulation</th>
<th>Percentage concentration</th>
<th>Toxicity (Colour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ekalux</td>
<td>Quinalphos</td>
<td>Insecticide</td>
<td>EC</td>
<td>25</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Groups classify the insecticides based on chemical nature, formulation, and toxicity level with the help of reference books provided.

Learner tabulate the data in the following formats:

Based on chemical nature

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Chemical Group</th>
<th>Trade Name</th>
<th>Generic Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carbamates</td>
<td>Sevin 50 wp</td>
<td>Carbaryl</td>
</tr>
<tr>
<td></td>
<td>Furudan 3 G</td>
<td>Carbofuran</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Organo phosphorus</td>
<td>Metacid 50 EC</td>
<td>Methyl parathion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rogor 30 EC</td>
<td>Dimethoate</td>
</tr>
</tbody>
</table>

Based on formulation

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of formulation</th>
<th>Name of insecticide</th>
<th>% Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dust</td>
<td>Sevin</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cythion</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>EC</td>
<td>Ekalux</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metacid</td>
<td>50</td>
</tr>
</tbody>
</table>

Based on toxicity

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Toxicity (colour code)</th>
<th>Name of insecticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>Nuvacron</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Yellow</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>--------</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

**Consolidation**

○ Classification of synthetic organic insecticides

**Product**

Tabulated charts, notes, survey reports

**Evaluation**

1. Match the following

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Generic name</th>
<th>Chemical group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevin</td>
<td>Endosulfan</td>
<td>Chlorinated hydrocarbons</td>
</tr>
<tr>
<td>Ekalux</td>
<td>Carbaryl</td>
<td>Organosuphurous acid esters.</td>
</tr>
<tr>
<td>Thiodan</td>
<td>HCH</td>
<td>Carbamates</td>
</tr>
<tr>
<td>BHC</td>
<td>Quinalphos</td>
<td>Organophosphorus</td>
</tr>
</tbody>
</table>

**References**

Keetanasinikal by Dr.A.Visalakshi, Dr.C.K.Peethambaran published by state institute of languages, Kerala, Thiruvananthapuram –3

Package of Practices Recommendation crops published by Kerala Agricultural University

Principles and Procedures of Plant Protection by S.B.Chattopadhyaya Published by Oxford and IBH Publishing Company Private Limited
Curriculum Objective 5

The learner identifies the different commercial formulation of insecticides like WP, SC, SL, SP, EC, DP, and G through observation, discussion, recording and making notes.

Syllabus

Different formulations of insecticides

Learning Experience-1

Observation and Recording

Materials

Different commercial formulation of insecticides

- Facilitator provides different commercial formulation for observation.
- Learner evolve observation format through discussion.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Formulation</th>
<th>Physical state</th>
<th>Texture</th>
<th>Solubility in water</th>
<th>Appearance after mixing with water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WP</td>
<td>Solid</td>
<td>Dust</td>
<td>Soluble</td>
<td>Suspension</td>
</tr>
<tr>
<td>2</td>
<td>EC</td>
<td>Liquid</td>
<td>Oily Fluid</td>
<td>Mixes with water</td>
<td>Emulsion</td>
</tr>
<tr>
<td>3</td>
<td>SL</td>
<td>Liquid</td>
<td></td>
<td>Soluble</td>
<td>Solution</td>
</tr>
<tr>
<td>4</td>
<td>SC\AF</td>
<td>Liquid</td>
<td></td>
<td>Mixes with water</td>
<td>Suspension</td>
</tr>
<tr>
<td>5</td>
<td>SP</td>
<td>Solid</td>
<td>Powder</td>
<td>Soluble</td>
<td>Solution</td>
</tr>
</tbody>
</table>

★ G – Granules - solid – should not be mixed with water, used for direct field application
★ DP-Dusting powder – Fine dust – should not be mixed with water, used for direct field application.

Consolidation

- Different formulations
- Their use
- Merits and demerits.

Products
Notes

Evaluation

1. In a windy situation you want to apply insecticides. The following formulations are available. Rank them according to your preference?

   Dust, Granules, Wettable Powder, Emulsifiable Concentrate.

   2. Suggest the best formulation suitable for the following situations

       a. Water scarcity:
       b. Soil Application:
       c. Pest control in go downs:
       d. water available in plenty :

Reference

- ‘Keetanasinikal’ by Dr.A.Visalakshi, Dr.C.K.Peethambaran published by state institute of languages, kerala, Thiruvananthapuram –3

- Principles and Procedures of Plant Protection by S.B.Chattopadhyaya Published by Oxford and IBH Publishing Company Private Limited

- Hand book of plant protection by R.L.sahe

Curriculum Objective 6

The learner develops the ability to find out the quantity of insecticide formulation required for field application through calculation.

Syllabus

Calculation for the preparation of insecticide solutions - problems

Learning Experience

Discussion & Calculation

Materials

Problems and chart papers.
Facilitator evolves the following formula through discussion with learner

\[
\text{Quantity of commercial formulation} \times \text{Concentration of commercial formulation} = \text{Quantity of spray fluid} \times \text{Concentration of spray fluid}
\]

\[
\frac{\text{Quantity of commercial formulation}}{\text{Concentration of commercial formulation}} = \frac{\text{Quantity of spray fluid} \times \text{Concentration of spray fluid}}{\text{Concentration of commercial formulation}}
\]

Calculate the Quantity of Ekalux 25EC required to spray rice cultivated in an area of 2Ha at a concentration of 0.025%

Volume of spray fluid

For spraying 1 Ha of rice using high volume spray, 500 L of spray fluid is required

For 2Ha of rice = 2x500=1000 L

Concentration of spray fluid = 0.025%

Concentration of commercial formulation = 25%

Quantity of commercial formulation = \(\frac{\text{Quantity of SF} \times \text{Conc of SF}}{\text{Conc of comm. Formulation}}\) = \(\frac{1000 \times 0.025}{25}\) = 1 litre

In the case of granular insecticide, where the rate of application of active ingredient is specified, the quantity is calculated using the formula

\[
\text{Quantity of commercial formulation} = \frac{\text{Rate of Application per Ha} \times \text{Area in Ha} \times 100}{\text{Concentration of Comm. Formulation}}
\]

Calculate the quantity of Thimet 10G required for 1Ha rice when applied at the rate of 1.25 Kg ai per Ha

Source Book: II Year Agriculture (Plant Protection)
Quantity of Thimet 10G = \[
\frac{1.25 \times 1 \times 100}{10} = 12.5 \text{ kg}
\]

Facilitator provides similar problems to the student

**Product**

Notes and solved problems

**Evaluation**

Problems

**Reference**

- "Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peeathambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe

**Curriculum Objective-7.**

The learner develops the skill for the preparation and field application of insecticide formulations through method demonstration, observation and making notes.

**Syllabus**

Preparation and field application of insecticide spray solutions

**Learning Experience**

Method demonstration

**Materials**

Commercial formulations, measuring jar, weighing balance, graduated pipette, bucket, cup, plant protection equipments, protective gears, and chart papers, implements.

- Calculation of the quantity of commercial formulation required
- Facilitator explains and demonstrates the preparation and field application of different commercial formulations.
Learner observes and records the procedure and precautions taken during method demonstration.

Learners are divided into four groups and they repeat the preparation and field application.

**Products**

Observation notes, prepared charts, prepared formulations

**Evaluation**

Prepare 5 litres of Ekalux 25EC at a concentration of 0.025% and demonstrate its application?

**Reference**

- Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “Package of practices recommendations – Crops- 2003 By K.A.U

**Curriculum Objective- 8.**

The learner develops the skill for the preparation and field application of botanical insecticides (tobacco decoction, neem oil garlic emulsion, and neem kernel suspension) and kerosene soap emulsion, understands their merits and demerits through discussion method demonstration, observation, assignments and making notes.

**Syllabus**

Preparation of plant origin insecticides like tobacco decoction, neem oil garlic emulsion, and neem kernel suspension – preparation of kerosene soap emulsion

**Learning Experience**

**Discussion**

Facilitator initiates discussion
Why do we need botanical pesticides? What is its importance?
What is the economic significance of botanical pesticides?

List the responses

Consolidation

Botanical pesticides are those pesticides, which are derived from plants. Such pesticides are cheap and easy to make. They are ecofriendly compared to synthetic chemical insecticide.

Learning Experience: 2

Method demonstration

Materials

Materials for the preparation of botanical insecticide

Facilitator explains and demonstrate the preparation of pesticides using required materials learners observe the method of preparation and prepares notes learners divided into groups and develop the skill to prepared insecticide for field application through repetition.

Learning Experience: 3

Assignment

Topic:
“Different type of locally used botanical insecticide, their merits and demerits”

Products

Prepared insecticide, notes, submitted assignments

Evaluation

1) Write the procedure and demonstrate the skill for the preparation of botanical pesticide and Kerosene soap emulsion

Reference

Source Book: II Year Agriculture (Plant Protection)
Principles and procedures of Plant protection” By S.B.Chattopadhyay

“Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.

“Hand book of Plant protection” By R.L.Sahe

“Package of practices recommendations – Crops- 2003 By K.A.U
## UNIT PLAN
### UNIT 5.
**BIOLOGICAL CONTROL OF INSECTS**

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective-1.</strong></td>
<td>concept of biological control principles of biological control</td>
<td>discussion</td>
<td></td>
<td>Notes</td>
<td>Notes</td>
</tr>
</tbody>
</table>

The learner understands the concept of biological control through discussion and making notes.

| **Curriculum Objective 2** | importance of biological control identification of natural enemies like parasites and predators | field visit collection identification making diagrams and notes | Materials required for insect collection | Notes, diagrams and collected specimens | Notes, diagrams and collected specimens |

The learner understands the importance of biological control through field visit collection identification of available parasites and predators and making diagrams and notes.

| **Curriculum Objective 3** | Entomo pathogens, bioinsecticide | general discussion, photographs, CD shows and making notes. | Photographs CD | Prepared notes | Notes |

The learner understands the different Entamo-pathogens and bioinsecticides through general discussion, observe photographs and CD shows and making notes.

Source Book: II Year Agriculture (Plant Protection) 96
UNIT 5
BIOLOGICAL CONTROL OF INSECTS

Introduction

Nowadays due to ill effects caused by chemical pesticides on eco system and environment biological control of pest has gained a significant attention. The idea of biological control came up in the 16th to 18th centuries. During this period various observations and descriptions of parasites and predators among insects were noted. Various bio agents were introduced and were successfully used for the control of pests. In this unit the learner gets familiarized with various parasites, predators, entamopathogens used as bio agents, their multiplication and field release. The various bio insecticides used are also mentioned.

Curriculum Objective-1.

The learner understands the concept of biological control through discussion and making notes.

Syllabus

Definition of biological control – principles of biological control

Learning Experience

Discussion

✔ Learner recalls previous knowledge on the concept of biological control

✔ Facilitator leads discussion

➢ What is the difference between biological control and natural control?

List the responses and consolidates

Consolidation

☉ Biological control.
When a particular species of insect is controlled by a living organism (Natural enemy), which is introduced, encouraged and disseminated by man. Biological control involves human interference.

- Natural control
  - A natural enemy, under natural conditions, controls insect

- Principles of biological control
  - Collection of a natural enemy from an area where it is available in plenty
  - Multiply the natural enemy under lab conditions.
  - Disseminate the natural enemy when and where it is needed.

Products

Notes

Evaluation
1. In a rice eco system, spider feed on an insect pest. This is not biological control. Do you agree?

Reference

- Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “Package of practices recommendations – Crops- 2003 By K.A.U

Curriculum Objective 2

The learner understands the importance of biological control through field visit collection identification of available parasites and predators and making diagrams and notes

Syllabus

Explain biological control though parasites, predators of major pest of crops like rice, coconut and vegetables.
Materials

Reference books, Photographs if bio control agents, Preserved specimens inspect collecting kit.

Learning Experience: 1

Field visit

Learners visit a near by paddy field, observe and collect various parasites and predators present in the rice eco system. They identify the following natural enemies and make diagrams with the help of reference book

- Spider
- Damsel fly
- Dragon fly
- Lady bird beetle
- Water striders

Consolidation

- If natural enemies are multiplied artificially and used for controlling pest it becomes biological control
- Different natural control agents in rice eco system.

Products

Diagrams and notes

Evaluation

1) All biological control agents are natural; enemies but all natural enemies are not bio control agents substantiate your views

2) The field of paddy is infected with stem borer suggests suitable biological control

★ Repeat the same strategy for identifying and multiplying the biological control agent in coconut and vegetables

Curriculum Objective 3

The learner understands the different Entamo-pathogens and bio-insecticides through general discussion, observe photographs and CD shows and making notes.
**Syllabus**

Entomopathogens – their role in biological control with examples – bio insecticides – definition with examples.

**Learning Experience-1**

**Discussion**

**Materials**

- Photograph, C.D

Facilitator initiates the discussion

- Do you think whether pathogens infect insects?
- Name different group of pathogens?
- Is it possible to use such a microorganism to control that particular insect?

List the responses

**Consolidation**

The various microorganisms, which cause diseases in insects, are called Entomopathogens. Entomopathogens can be used as bio control agents. Formulations containing such Entomopathogens are called Bio insecticides.

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Bacillus thuringiensis</th>
<th>Lepidopteran Larvae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungi</td>
<td>Green Muscardine fungus</td>
<td>Rhinoceros Beetle Grub</td>
</tr>
<tr>
<td></td>
<td>Fusarium pallidoroseum</td>
<td>Cowpea aphids</td>
</tr>
<tr>
<td>Virus</td>
<td>Baculovirus</td>
<td>Rhinoceros adult</td>
</tr>
<tr>
<td></td>
<td>NPV &amp; CPV</td>
<td>Lepidopteron larvae</td>
</tr>
</tbody>
</table>

**Product**

**Notes**

**Evaluation**

1) Suppose cowpea aphids infect a cowpea field. Can you suggest a suitable entomopathogen to control the infection?

2) Thuricide is........................................
Curriculum Objective 4

The learner understands the different biological control agents, their mass multiplication and application methodology through visit to a bio control laboratory and an interview with an expert and making reports.

Syllabus

Familiarisation with rearing/mass multiplication of primary predator, parasite, microbial agent used in bio control

Learning Experience-1

Preparation of Interview Schedule

Facilitator evolves an interview schedule to be used during the visit to the bio-control lab to collect information on the mass multiplication and application methodology of biological control agents.

Interview schedule may have the following questions

1. When was the bio-control Lab started?
2. What are its objectives?
3. Which is the major bio-control agent produced?
4. Which are the major pests controlled by these biological agent?
5. How will you multiply these bio-control agents?
6. How will you distribute these biocontrol agents?
7. How they are applied in the field condition?
8. Do you have any pest monitoring system?
9. Do you conduct any awareness programmer for the farmer?
10. Which are the various sources from which you will get the agents?

Learning Experience-2

Field visit

Facilitator organizes the field visit students collect information through observation discussion and structured interview.

Facilitator consolidates the details collected by the students and asks the students to submit the reports
Materials

Interview schedule

Product

Field Report

Evaluation

1) How will you multiply a biological control agent under lab conditions?
2) You are going to select a natural enemy as bio-control agents. What are the criteria to be considered for selection?

Reference

"Internet"

"Principles and procedures of Plant protection” By S.B.Chattopadhyay

"Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.

"Hand book of Plant protection” By R.L.Sahe

"Package of practices recommendations” – Crops- 2003 By K.A.U
## UNIT PLAN
### UNIT-6. ENVIRONMENTAL ASPECTS OF PESTICIDES

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| **Curriculum Objective 1**  
The learner understands biomagnifications of insecticide, and waiting period through discussion, analysis, interpretation of data and related articles and making notes. | Bio-magnification  
Maximum residual limit  
Waiting period | Discussion  
Analysis of interpretation of data and related articles | Hand out  
Story  
Paper cutting  
IT | Notes | Notes |
| **Curriculum Objective 2**  
The learner understand the concept of ETL and EIL also ETL of major pests of rice through discussion and making charts and notes. | Concept of  
ETL and EIL  
ETL of major pests of rice | Group discussion  
Preparation of charts, notes | Story  
IT | Notes., charts | Notes |
| **Curriculum Objective 3**  
The learner understands the importance of IPM and its application in rice ecosystem through discussion | Concept of IPM  
Application of IPM in rice ecosystem | Discussion  
Preparation of charts, notes | Notes., charts | Notes |
| **Curriculum Objective 4**  
The learner develops and idea about the possible hazards and precautions to be taken while handling plant protection chemicals through brainstorming, class room discussion and making notes | Hazards of pesticides  
Precautions to be taken while handling pesticides | Brainstorming  
Discussion  
Notes | Notes | Notes |

Source Book: II Year Agriculture (Plant Protection)
INTRODUCTION

Invention of DDT and its extensive possibilities in agriculture was a milestone in plant protection. It equipped the farmers for effective pest control. Years of indiscriminate use of pesticides ended up with many problems like environmental pollution, pest resurgence, bio magnification, health hazards and destruction of natural enemy complex. At this juncture man started to think about other methods of pest control and judicious use of pesticides.

To control pest effectively and to reduce their use of chemical pesticides, awareness among the students is necessary about the ill effects of pesticides. This chapter deals with information on bio magnification, maximum residual limit, Economic Threshold Level (ETL), Economic Injury Level (EIL), waiting period, Integrated Pest Management (IPM), handling of plant protection chemicals and precautions to be taken while handling plant protection chemicals.

Curriculum Objective 1

The learner understands biomagnifications of insecticide, Maximum residual limit and waiting period through discussion, analysis, interpretation of data and related articles and making notes.

Syllabus

Bio magnification and its hazards - Maximum residual limit and waiting period

Learning Experience

Discussion

Materials Required

Story of clear lake, paper cuttings, IT

- Learner recalls previous information ion bio magnification.
- Facilitator initiates a discussion.
- Narrates the story of Clear Lake: a historical incident to prove the drastic effects of accumulation of pesticide residues in living organisms.
Long ago DDT was used for pest control in the forests of American continent. The residues of this chemical washed down to the clear Lake through rainwater. The phytoplankton and zooplanktons became contaminated with the chemicals. Concentration of the chemical further increased in the body of fishes, which ate the zooplankton. Birds, which consumed the fishes of clear lake, were killed in large numbers. On examination, it was found that the pesticide residue concentration increased 10,000 times when it reached the bird’s body through the food chain.

“The silent spring” - written by Rachel Curson an American journalist to create awareness among people about the ill effects of indiscriminate use of pesticides. In this book the author narrates here painful experience when the spring was silent due to the mass killing of birds

Facilitator ask questions

- What was the reason for the mass death of the birds near clear lake in America?
- Can you relate this incident to the application of pesticide in plants?
- How does the pesticide residue reach the birds?
- Which factor was responsible for the death of the birds?

Facilitator lists the responses

Consolidation

- Bio magnification is the phenomenon which pesticide residue gets accumulated with each tier in the food chain. This phenomenon caused the magnification of the small residue of the pesticide which resulted in the death of the bird.
- Residual toxicity is the amount of pesticide residue remaining for a ling period in plant parts after its application

Facilitator explains that most of the agricultural produces contain traces of pesticides.

Facilitator asks questions like

- Do you think that we can fix limit to the pesticide present foodstuff for our safety?

Facilitator lists the responses

Source Book: II Year Agriculture (Plant Protection)
Maximum Residual limit is the maximum quantity of a pesticide residue permitted in a foodstuff

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Crop</th>
<th>MRL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furudan</td>
<td>Cereals</td>
<td>0.2 p.p.m (milligram in 1Kg)</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>Vegetable</td>
<td>5 milligram/kg</td>
</tr>
</tbody>
</table>

Facilitator asks questions

- A farmer-applied pesticide on amaranthus, vegetable etc. Will you eat these leaves or vegetable on the very next day? If not why?

Facilitator consolidates the following points

- The waiting period is the time gap between the application of a pesticide and harvest of a produce to reduce its toxicity to a safe level.

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Waiting Period</th>
<th>Vegetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malathion</td>
<td>3 days</td>
<td>Brinjal</td>
</tr>
<tr>
<td></td>
<td>4 days</td>
<td>Bitterguard</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>5 days</td>
<td>Brinyal</td>
</tr>
<tr>
<td></td>
<td>11 days</td>
<td>Bitterguard</td>
</tr>
</tbody>
</table>

Products

Prepared notes

Evaluation

1. On a research it was found that the residue level of DDT on grasses is 0.000001 ppm, .001 in cows and 1 ppm in humans. What is the reason for such a result?
2. What happened in Kasaragode after the application of Endosulfan in cashew plantation why?
3. MRL is…………………………………………………………………………
4. Waiting period is different for Tomato and Bitter gourd. Why?

Reference

- Internet

“Principles and procedures of Plant protection” By S.B.Chattopadhyay

Source Book: II Year Agriculture (Plant Protection)
Curriculum Objective 2

The student understand the concept of ETL and EIL also ETL of major pests of rice through discussion and making charts and notes.

Syllabus

Economic Injury Level – Economic Threshold level – concept of thresholds

Learning Experience

Discussion

Material

Story

Facilitator narrates the story of Anil and Sunil.

- Anil had a mild fever and cold. He rushed to the hospital and spent lot of money for treatment. Was it necessary?

- Sunil was suffering from fever and head ache for the past one-week. After the aggravation of the symptom he went to a hospital. Doctor said that if he had started treatment earlier he would not have been critical. Now his treatment is going to be expensive. According to you what he would have done to avoid this situation?

Facilitator leads the discussion

Consolidation

ETL is the level of pest population at which suitable control measures have to be taken to prevent the pest population from reaching EIL.
EIL-level of pest population at which the damage caused by the pest is no longer economically tolerated.

The students with the help of reference materials tabulate ETL of important pests of paddy.

<table>
<thead>
<tr>
<th>Pest</th>
<th>ETL Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem borer</td>
<td>One egg mass/m²</td>
</tr>
<tr>
<td></td>
<td>One adult/m²</td>
</tr>
<tr>
<td>BPH</td>
<td>5-10 insects/hill</td>
</tr>
<tr>
<td>Gall fly</td>
<td>1 silver shoot or gall/m²</td>
</tr>
<tr>
<td>Leaf folder</td>
<td>Two freshly damaged leaves/hill</td>
</tr>
</tbody>
</table>

(More details available in “Package of Practices - Recommendations Crops-2003” by Kerala Agricultural University.)

**Products**

Notes, Charts of ETL of different pest of paddy.

**Evaluation**

1) How do the knowledge of ETL and EIL help a farmer in pest control?

2) Do you think that pesticide application according to ETL will help to reduce pollution?

**Reference**

- Principles and procedures of Plant protection” By S.B.Chattopadhyay
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “Package of practices recommendations – Crops- 2003 By K.A.U

**Curriculum Objective 3**

The learner understands the importance of IPM and its application in rice ecosystem through discussion.
Syllabus

Integrated Pest Management (IPM)

Learning Experience

Discussion

⭗ Learner recalls the previous knowledge on the control measures against the major pests of paddy.

⭗ Facilitator initiates discussion

➢ What is the control measures adopted against rice stem borer?

⭗ Lists out responses

➢ Can we combine some of these methods to make the control more effective?

Consolidation

○ IPM is the use of various control measures like physical, chemical, biological, legal, cultural, mechanical and modern plant protection methods in an integrated and compatible manner so as to reduce the pest population below economic injury level without much disturbance to the ecosystem.

⭗ Learners identify the various methods of controlling rice stem borer under IPM approach.

○ Cultural Methods
  ▪ Destruction of stubbles of previous crop
  ▪ Use of resistant varieties like IR-20, Kanchana.
  ▪ Destruction of collateral hosts

○ Mechanical methods
  ▪ Collection and destruction of egg masses
  ▪ Light traps

○ Legal methods
  ▪ Restriction on the transport of infested planting materials.

○ Biological methods
  ▪ Trichogramma
  ▪ Xanthopimpla

○ Chemical
Insecticides like Carbaryl, Quinalphos

Modern plant protection methods
  Pheromone Traps

Activity

Learners make the following diagram

Facilitator consolidates

IPM in rice as
  Eco friendly
  Cheaper and more effective
  Reduces pollution
  Chances of pest
  Preserves natural enemy

Products

Notes and charts.
Evaluation

1) How will you apply IPM measures against rhinoceros beetle in coconut?

2) Suppose a farmer is using chemicals indiscriminately to control pest. What will you suggest as a suitable alternative?

Reference

Keedanasinikal by Dr.A.Visalakshi, Dr.C.K.Peethambaran published by state institute of languages, kerala, Thiruvananthapuram –3

Principles and Procedures of Plant Protection by S.B.Chattopadhyaya Published by Oxford and IBH Publishing Company Private Limited

Hand book of plant protection by R.L.sahe, Kalyani publishers , New Delhi

Curriculum Objective 4

The learner develops and idea about the possible hazards and precautions to be taken while handling plant protection chemicals through brainstorming, class room discussion and making notes

Syllabus

Hazards of plant protection chemicals – precautions to be taken while handling plant protection chemicals.

Learning Experience

Brainstorming.

Facilitator initiates discussion

What are the possible hazards due to careless handling of pesticides?

What are the precautions to be taken while handling pesticides?

Learners list out various points from their life experiences.

Facilitator supplements and consolidates.

Consolidation

Hazards due to careless handling of pesticides

Source Book: II Year Agriculture (Plant Protection)
Precautions to be taken while handling pesticides

Products

Prepared notes

Evaluation:

1) Mr. Gopalan is a farm labourer regularly engaged in the application of pesticides. What are the precautions that he should take to avoid health hazards?

Reference:

Keedanasinikal by Dr. A. Visalakshi, Dr. C. K. Peethambaran published by state institute of languages, Kerala, Thiruvananthapuram –3

Principles and Procedures of Plant Protection by S. B. Chattopadhyaya Published by Oxford and IBH Publishing Company Private Limited

Hand book of plant protection by R. L. sahe, Kalyani publishers, New Delhi

Residual toxicity of insecticides

Many of the chemical pesticides leave their residue in plant parts after its application. This is mainly due to their ability to resist degradation for a reasonable period of time. This tenacity of pesticide is somewhat essential in effective pest control. The chemical is said to have residual toxicity if the chemical remain on the plant part for a longer period of time after completing its function. The quantity of residue left on the plant part depends on the

1. Nature of chemical
2. Crop and its variety
3. Climatic conditions
4. The dosage of application
5. Method of application
6. Treatment of the produce
7. Soil conditions such as pH and texture etc.

Residual toxicity will lead to environmental pollution and bio-magnification. Toxic residues left on food and fodder cause serious health hazards in man and other higher animals.

**Maximum Residue Limit (MRL)**

The Maximum residue limit is a value estimated for pesticides in food. *It is the maximum permissible quantity of a pesticide in foodstuff.* It is based on the assumption that good agricultural practice has been employed for the use of pesticides in farming. It is also assumed that the product has been used in an appropriate manner and suitable waiting periods have been permitted.

Since residues of pesticides and drugs may be broken down in tissue into various metabolites, MRLs are expressed either in terms of the amount of the parent compound remaining, or a metabolite that is representative of the residue of toxicological concern in the food. It is usually expressed in mg/kg of the produce. Estimates are usually made on the total intake of the residue based on the MRLs and food intake data of these commodities for which MRLs have been established.

**Waiting period**

It is the period of time given for a pesticide, to degrade and reduce its level of toxicity to a safer level, after its application. OR

It is the time gap to be observed between the application of a pesticide and harvesting of the produce for consumption.

Waiting period depend on the Chemical, Crop treated, dose and method of application.

<table>
<thead>
<tr>
<th>Name of chemical</th>
<th>Waiting Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbaryl</td>
<td>21-30 days</td>
</tr>
<tr>
<td>Malathion</td>
<td>3-5 days</td>
</tr>
<tr>
<td><strong>DDVP (Nuvan 100EC)</strong></td>
<td><strong>24 Hours</strong></td>
</tr>
<tr>
<td>Aldrin</td>
<td>2 Years</td>
</tr>
<tr>
<td>Phosphamidon (Dimecron)</td>
<td>8-10 days</td>
</tr>
<tr>
<td>Methyl Parathion (Metacid)</td>
<td>7-10 days</td>
</tr>
<tr>
<td>Phorate</td>
<td>3 weeks to 3 months</td>
</tr>
<tr>
<td>Quinalphos (Ekalux)</td>
<td>1 week</td>
</tr>
<tr>
<td>Monocrotophos (Nuvacron)</td>
<td>3-5 weeks</td>
</tr>
</tbody>
</table>

**Waiting period of some chemicals in vegetables (Days)**

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Carbaryl</th>
<th>Fenitrothion</th>
<th>Quinalphos</th>
<th>Malathion</th>
<th>Fenthion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhindi</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>11</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Brinjal</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection)
Labels and labeling of insecticides

According to the Insecticide act 1968, Insecticide rules 1971 and its amendments in 1977, no person is permitted to stock, exhibit for sale or distributes any insecticide unless it is packed and labeled in accordance with the provisions of the act.

Label means any printed, written or graphic matter on the immediate package or any such material accompanying the insecticide.

Manner of labelling

The label should contain informations like
- Name of manufacturer,
- Name of insecticide (both generic name and trade name),
- Registration Number
- Kind and name of active ingredient and its percentage content,
- Net content/Volume
- Batch No.
- Expiry date
- Antidote statement etc

Label (Graphic)

Should occupy not less than 1/16th of the total area of the face of the label
It is a square set at 45 degrees divided into two equal triangles. The upper triangle shows symbol and signal word and the lower triangle shows the colour specified for the toxicity of the insecticide.
### Classification of insecticides based on toxicity

<table>
<thead>
<tr>
<th>No</th>
<th>Classification of insecticide</th>
<th>Oral LD50 (mg/kg of body weight of test animal)</th>
<th>Dermal LD50 ((mg/kg of body weight of test animal)</th>
<th>Colour band on label</th>
<th>Symbol/signal word</th>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extremely toxic</td>
<td>1-50</td>
<td>1-200</td>
<td>Bright Red</td>
<td>Skull and cross bones POISON in red</td>
<td>1,2</td>
</tr>
<tr>
<td>2</td>
<td>Highly Toxic</td>
<td>51-500</td>
<td>201-2000</td>
<td>Bright Yellow</td>
<td>POISON in red</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Moderately Toxic</td>
<td>501-5000</td>
<td>20001-20000</td>
<td>Bright blue</td>
<td>DANGER</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Slightly toxic</td>
<td>&gt;5000</td>
<td>&gt;20000</td>
<td>Bright green</td>
<td>CAUTION</td>
<td></td>
</tr>
</tbody>
</table>

Warnings should appear in an appropriate place outside the triangle.

1. **KEEP OUT OF THE REACH OF CHILDREN**
2. **IF SWALLOWED, OR IF SYMPTOMS OF POISONING OCCUR CALL PHYSICIAN IMMEDIATELY.**
<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective-1</strong></td>
<td>Identification of the pest Its nature of damage Control measures</td>
<td>Field visit Collection Observation Discussion Drawing diagrams Notes Project</td>
<td>Specimens Photographs Symptoms of damage IT Chart papers Reference books Field diary</td>
<td>Collections Notes Charts Diagrams Project report</td>
<td>Collections Project report</td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection)
UNIT 7
INSECT PEST OF MAJOR CROPS OF KERALA

Introduction

A large number of major and minor pests are infesting our crop plants. Every year we are loosing major part of our agricultural products due to pest attacks. For increasing yield and to attain self-sufficiency in agriculture production, it is necessary to control these pests.

For successful pest control through scientific understanding of pest its destructive stage and suitable control measures are necessary. This unit aims at creating such scientific understanding among learners in identification, nature of damage and control of pest of major crops grown in Kerala.

Curriculum Objective-1

The learner develops the skill for identification of the pest of major crops of Kerala, its nature of damage and application of different control measures through field visit, collection, observation, drawing diagrams, projects and making notes.

Syllabus

Major insect pest of important crops of Kerala – pest of rice, coconut, areacanut, pepper, cardamom, rubber, ginger, mango, cashew, banana, vegetables, ornamental plants – nature of damage – stage of the pest causing damage and management.

Learning Experience-1

Discussion

Materials

Preserved specimens, symptoms of damage, IT, diagrams, reference books, field diary, chart papers, plant protection equipments and chemicals.

- Learner recalls previous knowledge on classification of pest, mouthparts, metamorphosis and different methods of pest control
- Facilitator provides preserved specimens of pest, symptoms and damage.
- Learner observes the morphological features, distinguishing characters of nature of damage prepares drawing and make notes.
- Learner familiarizes the various control measures that can be used against the pest.

Source Book: II Year Agriculture (Plant Protection)
Facilitator discusses and consolidates.

Consolidation

- Familiarisation with the insect pest
- Its symptoms
- Destructive stage
- Nature of damage
- Management

Learning Experience: 2

Field Visit

- Learners are divided into 4 groups
- Groups collect, observe, identify and preserve the pest and symptoms of damage
- Groups practice the different methods of control
- Groups share their finding and discuss
- Facilitator supplements and consolidates.

Consolidation

- Collection of the insect pest
- Preservation of the insect pest
- Familiarisation with field symptoms
- Application of control methods

Learning Experience: 3

Project

“Study of Crop pest of Rice and Amaranthus”
(Any combination of a major crop and a minor crop can be given)

- Learners are divided into groups of 3
- One Major and one minor crop are assigned to each group.

- Objectives:
  - Identify various crop pests of rice and amaranthus
  - Their nature of damage
  - Presence of natural enemy complex
  - Locally adopted control measures
  - Suggested control measures
  - Possibility of IPM measures.
Groups present project report with chart, diagrams and specimens.

Facilitator supplements and consolidates.

Learners prepare and submit project reports.

*Suggested list of major and minor crops*

<table>
<thead>
<tr>
<th>Major crops</th>
<th>Minor crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>Rubber</td>
</tr>
<tr>
<td>Coconut</td>
<td>Cashew</td>
</tr>
<tr>
<td>Pepper</td>
<td>Areca nut</td>
</tr>
<tr>
<td>Banana</td>
<td>Cardamom</td>
</tr>
<tr>
<td>Mango</td>
<td>Ginger</td>
</tr>
<tr>
<td>Cucurbits</td>
<td>Tapioca</td>
</tr>
<tr>
<td>Cow pea</td>
<td>Sweet potato</td>
</tr>
<tr>
<td>Bhindi</td>
<td>Chillies</td>
</tr>
<tr>
<td>Brinjal</td>
<td>Amaranthus</td>
</tr>
<tr>
<td></td>
<td>Rose</td>
</tr>
<tr>
<td></td>
<td>Orchids and anthurium</td>
</tr>
</tbody>
</table>

**Products:**

Notes, Collection, Prepared charts, Drawings, Project Report.

**Evaluation**

1) A farmer is cultivating paddy crop and he saw some plants with brown coloured dried up central shoot. Identify the pest and suggest suitable control measures?

2) Complete the following
<table>
<thead>
<tr>
<th>Crop</th>
<th>Pest</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------</td>
<td>--------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Stem borer</td>
<td>White ear head</td>
<td></td>
</tr>
<tr>
<td>Coconut</td>
<td>Triangular shaped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cuts on leaves</td>
<td></td>
</tr>
<tr>
<td>Cucurbits</td>
<td>Fruit fly</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>holes on pseudo stem</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>Pollu beetle</td>
<td>Pollu berries on the</td>
<td></td>
</tr>
<tr>
<td>spike</td>
<td>spike</td>
<td></td>
</tr>
</tbody>
</table>

Reference

- Monograph on the Crop pest of Kerala by M.R.Nair
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “Package of practices recommendations – Crops- 2003 By K.A.U
- Handbook of Agriculture By ICAR
## UNIT PLAN

#### UNIT-8.

### NON-INSECT PEST OF MAJOR CROPS

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 1</strong></td>
<td></td>
<td>Identification of non insect pest</td>
<td>Field visit</td>
<td>Photographs</td>
<td>Collections Notes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nature of damage</td>
<td>Collection Observation Discussion</td>
<td>Symptoms of damage IT Chart papers Reference books</td>
<td>Notes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application of control measures</td>
<td>Drawing diagrams Notes</td>
<td>Traps, baiting materials, Rodenticides, fumigants, spade</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective 2</strong></td>
<td>Various methods of rodent control</td>
<td>Group discussion Method demonstration</td>
<td>Traps, baiting materials, Rodenticides, fumigants, spade</td>
<td>Notes</td>
<td>Notes</td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection) 121
UNIT 8
NON-INSECT PEST OF MAJOR CROPS

Introduction
Considerable losses to the food grains due to the attack of pest takes place every year. Besides the insect pest there are large number of non-insect pest attacking crop plants. This includes rats, mites, nematodes, snails and slugs and nematodes. In certain cases these pests seriously infect crop plants causing severe losses.

It is very important to study the different non-insect pest attacking crop plants, their nature of damage and the measures adopted to control them. This chapter deals with these aspects.

Curriculum Objective 1

The learner develops the skill for identification of non insect pest of major crop, its nature of damage and application of different control measures through observation, drawing diagrams, discussion field visit and making notes.

Syllabus

Non-insect pest of paddy, coconut, tapioca, banana and vegetables – rodents, nematodes, mites and birds – nature of damage and their control.

Learning Experience: 1.

Discussion

Materials

Preserved specimens, symptoms of damage, IT, diagrams, reference books, field diary, chart papers, plant protection equipments and chemicals.

- Learner recalls previous knowledge on classification of pest and different methods of pest control
- Facilitator provides preserved specimens of pest, symptoms and damage.
- Learner observes the morphological features, distinguishing characters of nature of damage prepares drawing and make notes.
- Learner familiarizes the various control measures that can be used against the pest.
- Facilitator leads the discussion and consolidates.

Consolidation

- Familiarisation with the non-insect pest
- Its symptoms.
Learning Experience: 2

Field Visit

- Learners are divided into 4 groups
- Learner collects, observes, identifies and preserves the pest and symptoms of damage
- Learner practices the different methods of control.
- Groups shares their finding and discuss
- Facilitator supplements and consolidates.

Consolidation

- Collection of the non-insect pest
- Preservation of the non-insect pest
- Familiarisation with field symptoms
- Application of control methods

Products:

Notes, Collection, Prepared charts, Drawings.

Evaluation

1. Immature nuts show triangular yellowish patches below the perianth region. Identify the pest and suggest suitable control measures?

2. Banana plant is showing general yellowing, weakness and damage like galls, lesions on roots. Identify the non-insect pest and suggest suitable control measures

Reference

- Monograph on the Crop pest of Kerala by M.R.Nair
- "Keedanasinikal" By Dr.Peethambaran and Dr.Visalakshi.
- "Hand book of Plant protection" By R.L.Sahe
- "Package of practices recommendations – Crops- 2003 By K.A.U
- Handbook of Agriculture By ICAR
RODENT CONTROL

Introduction

Rats cause considerable damage to agricultural crops and other human possessions in addition to acting as carriers of several human and animal diseases like bubonic plague and Weils syndrome are caused by rats. It is highly essential to control these pests and the learner should understand the importance and methods of rat control.

Curriculum Objective-2

The learner understands various methods of rodent control through group discussion, method demonstration and making notes.

Syllabus

Familiarisation with rat traps, demonstration of rodent control using rodenticide such as Zinc phosphide, warfarin and aluminium phosphide.

Learning Experience-1

Group discussion

Materials

Traps, baiting materials, rodenticide, spade.

- Learner recalls the previous information on rodent control and rodenticide.
- Facilitator initiates discussion

- What is the importance of rodent control?
- What are the various methods adopted in your area / home for controlling rodents?

- Facilitator lists the responses
- Learners are divided into 4 groups and the group discussion is conducted on locally adopted rodent control methods. After discussion, learners present their findings.

Consolidation

- Method of rodent control using zinc phosphide, Aluminium phosphide and warfarin.
- Locating live burrows
- Prebaiting and bait shyness
Rat traps

Product

Notes

Learning Experience: 2

Method demonstration

- The facilitator on the following aspects conducts Field demonstration.
  - Locating live burrows
  - Preparation of poison baits
  - Setting up of traps
  - Learners repeat the skills and prepare notes

Consolidation

Skill for

- Locating live burrows
- Preparation of poison baits
- Setting up of traps

Product

Prepared notes

Evaluation

1. Can you suggest the necessary precautions while using Aluminium phosphide for rodent control
2. Rodents create more problems than insects. Do you agree?
3. Suggest a few rodent control methods that can be safely used in home?

References:

- "Principles and procedures of Plant protection" By S.B.Chattopadhyay
- "Package of practices recommendations – Crops- 2003 By K.A.U
### UNIT PLAN
### UNIT-9.

**PEST OF STORED PRODUCTS**

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| Curriculum Objective -1 | The importance of different storage pests, identifies them, their nature of damage and application of different control measures through brainstorming, observation, collection and making notes. | Brainstorming Observation Collection Discussion Notes | Specimens Photographs Symptoms of damage IT | Notes Collections | }
UNIT 9
PEST OF STORED PRODUCTS

Introduction

Considerable losses of food grains due to the attack of pest takes place every year. Quite a large part of agriculture produce is lost in the field due to pest infestation. Over and above this a huge amount of produce in storage go downs are infested by different pest. As a result losses both in quality and quantity of food grains occur. When the availability of food grain is comparatively less and population is much higher, such losses make much impact leading to famine. The organisms responsible for losses in stored products are insect, mites, rodents etc. Under prevailing conditions the food grains have to be stored for a fairly long period. It is very important to take measures to reduce these losses. As such we should understand different storage pest and suitable methods to be adopted to control them.

Curriculum Objective -1

The learner understands the importance of different storage pests, identifies them, their nature of damage and application of different control measures through brain storming, observation, collection and making notes.

Syllabus

Important storage pest – cereals, pulses and spices – nature of damage and their control.

Learning Experience: 1

Brainstorming

Materials:

- Preserved specimens, symptoms of damages, IT, photographs.

- Name the important storage pests in your home?

- What is the usual control measure adopted?

- Facilitator list responses

- Facilitator provides preserved specimens.

- Learner observes and makes drawings.

- Facilitator leads a discussion on the various storage pests of crops, control measures.

- Facilitator supplements and consolidates.
Consolidation

- Familiarisation with the storage pest
- Its symptoms.
- Destructive stage
- Nature of damage
- Management

Products:
Collected specimens, notes.

Evaluation

1. A cowpea seed stored for the next season was completely spoiled by some pest by making them hollow. Identify the pest and suggest suitable precautionary measures to prevent such a pest attack in future?
2. Suppose you are the manager of FCI go down. Suggest the precautionary measures to be taken to keep the food grains free of pest attack?

Reference:

- Monograph on the Crop pest of Kerala by M.R.Nair
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
- “Package of practices recommendations – Crops- 2003 By K.A.U
- Handbook of Agriculture By ICAR
## UNIT PLAN
### UNIT-10.

### INTRODUCTION TO PLANT DISEASES

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective -1</strong>&lt;br&gt;The learner understands the concept of disease, different type of pathogen, its mode of spread through brainstorming, classification, discussion and making notes.</td>
<td>Concept of plant pathology&lt;br&gt;Concept of disease&lt;br&gt;Type of pathogen&lt;br&gt;Mode of spread</td>
<td>Brainstorming Discussion&lt;br&gt;Notes</td>
<td>Photographs Charts</td>
<td>Prepared charts&lt;br&gt;Notes</td>
<td>Prepared charts&lt;br&gt;Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective-2.</strong>&lt;br&gt;The learner understands the importance of different pathogens like bacteria, fungi, virus, Phytoplasma and the disease caused by them through group discussion and making notes.</td>
<td>Different pathogens like bacteria, fungi, virus, Phytoplasma&lt;br&gt;Disease caused by them</td>
<td>Group discussion&lt;br&gt;Making notes&lt;br&gt;Discussion</td>
<td>Point cards&lt;br&gt;Reference books&lt;br&gt;review material</td>
<td>Notes</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective-3.</strong>&lt;br&gt;The learner identifies symptoms of plant diseases through discussion, collection, observation, classification and making diagrams notes and herbarium.</td>
<td>Symptoms of plant diseases&lt;br&gt;Classification</td>
<td>Group discussion, Collection Observation&lt;br&gt;Diagrams&lt;br&gt;Herbarium Notes</td>
<td>Specimens&lt;br&gt;Photographs&lt;br&gt;Point cards</td>
<td>Herbarium&lt;br&gt;Notes&lt;br&gt;Diagrams</td>
<td>Herbarium</td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection) 129
<table>
<thead>
<tr>
<th><strong>Curriculum Objective 4.</strong></th>
<th>Koch’s postulates</th>
<th>Group discussion Notes</th>
<th>Notes</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner comprehends the idea of Koch’s postulates through group discussion and making notes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Curriculum Objective 5</strong></th>
<th>Disease epidemiology Disease forecasting</th>
<th>Game Discussion Notes</th>
<th>Materials for the Game</th>
<th>Notes</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Learner understands the concept of disease epidemiology and disease forecasting through a game, discussion and making notes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNIT 10
INTRODUCTION TO PLANT DISEASES

Introduction

In the history of mankind plant diseases have been connected with a number of important events. The classic example is the late blight of potato, which caused the notorious Irish Famine. This incident paved the pathway for the scientific understanding of plant diseases and which helped in the development of plant pathology. The Irish Famine in 1845 and the Bengal famine in 1943 due to brown leaf spot of rice took a heavy toll on human lives. This unit covers the causes, mode of spread, general symptom, losses due to diseases, disease epidemiology and disease forecasting.

Curriculum Objective -1

The learner understands the concept of disease, different type of pathogen, its mode of spread through brainstorming, classification, discussion and making notes.

Syllabus
Define plant pathology- disease causing organisms- classification of disease based on casual organism and mode of spread.

Learning Experience: 1.

Brainstorming

Materials:

Photographs, charts.

Facilitator ask open ended questions:

➢ When do you feel that you are sick?
➢ Name a few human diseases?
➢ Name the different disease causing microorganisms?
➢ Is there any cause other than microorganism, which cause disease?

Facilitator list the responses
Learner identifies the different disease causing organisms as Pathogens

Consolidation

Source Book: II Year Agriculture (Plant Protection) 131
Disease – Any deviation from the normal physiological functioning in a plant.
Pathogen – Any organism, which cause disease.
Plant Pathology – Study of plant diseases.

Disease is caused by Biotic (living) factors and Abiotic (Non living) factors.

**BIOTIC FACTORS**

- Bacteria
- Fungi
- Virus
- Phytoplasma
- Algae

**ABIOTIC FACTORS**

- Physiological disturbances
- Nutrient deficiency
- Environmental pollution
- Lack of moisture
- Stress

Products

Charts, notes

Evaluation

1. List a few instances where Abiotic factors lead to disease?

2. Classify the following into insects, non-insects, and disease causing organisms.
   - Bacteria, mites, rice stem borer, fungus, nematodes, rhinoceros beetle, BPH, Virus, Rodents

Learning Experience: 2

Brainstorming

- Facilitator initiates brainstorming.
  - What is the possible mode of spread of the disease?

- Facilitator list the responses

Consolidation
Spread through air  Air borne  Rice blast
Spread through water  Water borne  sheath blight of paddy
BLB
Spread through soil  Soil borne  Soft rot of ginger,
Quick wilt of pepper
Spread through seed  Seed borne  loose smut of wheat, blast
and Blight of paddy

Products
Notes.

Evaluation

1. Match the following

1. Seed borne  
   Sheath blight
2. Water borne  
   Damping off
3. Soil borne  
   Blast of rice
4. Air borne  
   Grain smut of sorghum

Curriculum Objective-2.
The learner understands the importance of different pathogens like bacteria, fungi, virus, Phytoplasma and the disease caused by them through group discussion and making notes.

Syllabus

Pathogens

Learning Experience

Group discussion

Materials

Point cards, review materials, reference books,

ünk The learner recalls the previous knowledge on pathogens like bacteria, fungi, virus, Phytoplasma.
The learners are divided into four groups and provided with materials for review based on point cards.

### Point card
- **Type of pathogen**
- **Morphological features**
- **Reproduction**
- **Example for disease**

#### Consolidation

- **Disease caused by Bacteria**
  - Bacterial disease
  - BLB of rice
- **Disease caused by fungi**
  - Fungal disease
  - Bud rot of coconut
- **Disease caused by virus**
  - Viral disease
  - Bunchy top of Banana
- **Disease caused by Phytoplasma**
  - Phytoplasmal disease
  - Root wilt of coconut

#### Products

- Notes

#### Evaluation

1. Classify the following diseases based on the causal organism?

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of Pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blast</td>
<td>Bacterial disease</td>
</tr>
<tr>
<td>Bunchy top</td>
<td>Fungal disease</td>
</tr>
<tr>
<td>Quick wilt</td>
<td>Viral disease</td>
</tr>
<tr>
<td>Root wilt</td>
<td>Phytoplasmal disease</td>
</tr>
<tr>
<td>BLB of rice</td>
<td>Wilt of brinjal</td>
</tr>
<tr>
<td>Kokkan</td>
<td>Root wilt</td>
</tr>
<tr>
<td>Katte disease</td>
<td>Little leaf</td>
</tr>
</tbody>
</table>

#### Curriculum Objective-3.

The learner identifies symptoms of plant diseases through discussion, collection, observation, classification and making diagrams notes and herbarium.

#### Syllabus

Source Book: II Year Agriculture (Plant Protection)
Explain different types of symptoms like leaf spot, blight, blast, anthracnose, wilt, dieback, rot, canker, galls, mildew, leaf curl and mosaic.

**Learning Experience: 1**

**Discussion**

- Learners recall the previous knowledge on symptoms of plant diseases.
- Facilitator initiates discussion
  - Name few symptoms of plant diseases that you have seen?
- Facilitator lists the responses and supplements

**Learning Experience: 2**

**Collection**

- Learner collects various symptoms of plant diseases
- Classifies them based on appearance as like leaf spot, blight, blast, anthracnose, wilt, dieback, rot, canker, galls, mildew, leaf curl and mosaic.
- Facilitator supplements with photographs
- Learners make diagrams and notes

**Learning Experience: 2**

**Group discussion**

- Learners are divided into four groups
- Each group is given a set of symptoms, specimens, photographs and point cards
- Groups conduct discussion; make chart and note, present.
- Groups make herbariums
- Facilitator supplements

**Point card**

- Name of symptom
- Host
- Size, shape, colour, appearance
- Extend of damage
- Possible casual organism

Source Book: II Year Agriculture (Plant Protection)
Consolidation

- Symptoms of plant diseases

Product

Chart, notes, herbarium of symptoms

Evaluation

1) A bhindi plant is showing black coloured angular spots on it slower surface. Identify the symptom, casual organism and disease?

2) A papaya plant is showing alternate dark green and light green patches on leaves. Identify the symptom, casual organism and disease?

Reference

“Principles of plant pathology” by Nine and Thapliar

“Hand book of Plant protection” By R.L.Sahe

Curriculum Objective 4.

Student comprehends the idea of Koch’s postulates through group discussion and making notes.

Syllabus

Koch’s postulates

Learning Experience

Group discussion

Materials:

Reference materials

- Facilitator leads a discussion

- What is the casual organism of anthrax disease in cattle?
- How do we confirm that this organism is responsible for the disease?
- How we can prove that this organism is causing the disease?

- List the responses
Divide the students into 4 groups

Each group discusses and find out scientific methods to prove that a particular organism is causing a particular disease.

The groups discuss and present their findings.

Consolidation

Koch’s postulates.

Product

Notes

Evaluation

1. What is the relevance of Koch’s postulates?

2. The leaf blight in paddy is to be caused by *Xanthomonas campestris pv.oryzae* (bacteria). How will you establish that this organism cause leaf blight in paddy through Koch’s postulates

Reference

- “Principles of plant pathology” by Nine and Thapliar
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe

Curriculum Objective 5

The learner understands the concept of disease epidemiology and disease forecasting through a game, discussion and making notes.

Learning Experience: 1

Materials

Coloured thermo-cool rings each one cut into three equal parts. Each part bears labels like-
- Virulent pathogen, favourable climate, and susceptible host on the opposite side
Red and Green rings having 3 equal parts and have same colour

Part of Blue ring (only two parts) indicating any two factors

Part yellow ring (only one part--) indicating any one factor - yellow coloured

Display board (thermo Cole)

Pins to fix the part of rings Bucket

Game

- Rings with labels are placed in a bucket
- 4 students are invited.
- Each of them is assigned a particular colour like red, green, blue and yellow.
- The participants are asked to make a complete ring with the colour assigned within a minute.
- Take one piece at a time
  - After one minute the facilitator asks questions like
    - Why the blue and yellow rings are not complete?
    - What should be done to make it complete?
If we assume the ring as disease and the parts as causing factors, can you imagine how a disease is formed?
Do you think that the formation of the disease can be predicted?
Facilitator lists the responses

Consolidation

- Epidemiology
- Disease triangle
- Factors influencing the formation of the disease
- Forecasting of diseases with suitable examples.

Products

Notes

Evaluation

1) Can you explain how plant disease forecasting help the farmers for the effective control of plant diseases?
2) Mention the role of different climatic factors in causing a disease?

Reference

- "Principles of plant pathology" by Nine and Thapliar
- "Keedanasinikal" By Dr.Peethambaran and Dr.Visalakshi.
- "Hand book of Plant protection" By R.L.Sahe
Disease Epidemiology

Appearance of a disease in a large number of individuals over large areas in relatively short time is called an epidemic. In plants the epidemic is also known as epiphytotic.

Epidemiology deals with outbreaks and spread of the disease in a plant population. Plant disease is the outcome of the interaction between the plant, the pathogen and the environment. In this disease triangle the environment favorably or unfavorably influences both the plant and the pathogen. When the favorable interactions between these three components of incidence of a disease continue for long, epidemics occur. These three factors form the most important components of a disease. These three components should be there for a long period of time for the development of a disease. Thus time becomes a fourth component of an epidemic. Often human activities interfere with epidemics through management practices and the epidemics may be encouraged or halted.

The study of epidemics helps to

- Understand the various factors involved in the development of an epidemic
- To understand the interaction of these factors in the development of the disease
- To predict a forthcoming infection to take timely control measures and to reduce losses.

Essential condition for the development of an epidemic

1. Host related factors

   1.1 Level of genetic resistance of the plant
   1.2 Genetic uniformity of the population
   1.3 Abundance and distribution of susceptible host
   1.4 Presence of Collateral hosts

2. Pathogen related factors

   2.1 Presence of a virulent pathogen
   2.2 High birth rate and low death rate of the pathogen
   2.3 Easy and rapid dispersal of the pathogen
   2.4 Adaptability of the pathogen

3. Environment related factors

   Meteoropathology deals with the study of relationship between the weather and epiphytotics.

   3.1 Temperature
   3.2 Moisture
3.3 Cultural practices that modify temperature and moisture
3.4 Presence of antagonistic micro flora

4. Time related factors

4.1 Season of the year suitable for disease development
4.2 Time of planting
4.3 Duration of favourable conditions to develop the disease

5. Human activities

5.1 Selection of field for cultivation
5.2 Selection of planting materials
5.3 Choosing the time of planting
5.4 Transportation of planting materials
5.5 Control measures taken to protect or manage the disease
## UNIT PLAN
### UNIT-11.
### PLANT DISEASE CONTROL

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| **Curriculum Objective 1**  
The learner understands various methods of plant disease control like physical, cultural, biological, legal and chemical methods through brainstorming and classroom discussion | Various methods of plant disease control like physical, cultural, biological, legal and chemical | Brainstorming Discussion | Notes | Notes |

| **Curriculum Objective-2**  
The learner understands the classification of fungicides based on chemical nature through survey, presentation and submitting of notes. | Classification of fungicides based on chemical nature | Survey, presentation and Notes | Survey format | Survey report | Survey report |

| **Curriculum Objective-3**  
The learner understands the methodology for the calculation and preparation of inorganic fungicides like Bordeaux mixture, Bordeaux paste and Cheshunt compound through group discussion, calculation method demonstration and making charts & notes | Calculation and preparation of inorganic fungicides like Bordeaux mixture, Bordeaux paste and Cheshunt compound | Discussion Group discussion Calculation Method demonstration | Point card Hand out Chart paper Chemicals | Chart note Prepared fungicides | Notes Charts |
<table>
<thead>
<tr>
<th><strong>Curriculum Objective - 4</strong></th>
<th>Calculation of commercial fungicides for field application</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner develop the skill to find out the quantity of commercial fungicides for the preparation of spray solutions and field application through calculation</td>
<td>Preparation of fungicides</td>
</tr>
<tr>
<td></td>
<td>Calculation of commercial fungicides</td>
</tr>
<tr>
<td></td>
<td>Discussion and calculation</td>
</tr>
<tr>
<td></td>
<td>Problems</td>
</tr>
<tr>
<td></td>
<td>Solved problems Notes</td>
</tr>
<tr>
<td></td>
<td>Problems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Curriculum Objective –5</strong></th>
<th>Various botanicals and bio-agents used in plant disease management</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner understands various botanicals and bio-agents used in plant disease management through class Room discussion and Assignments</td>
<td>Discussion Assignment</td>
</tr>
<tr>
<td></td>
<td>Photographs Paper cutting Reference books</td>
</tr>
<tr>
<td></td>
<td>Assignment Notes</td>
</tr>
<tr>
<td></td>
<td>Assignment Notes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Curriculum Objective 6</strong></th>
<th>Methodology of soil solarization</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner understands the methodology of soil solarization through discussion and method demonstration</td>
<td>Discussion Method demonstration</td>
</tr>
<tr>
<td></td>
<td>Materials for soil solarization</td>
</tr>
<tr>
<td></td>
<td>Notes</td>
</tr>
<tr>
<td></td>
<td>Notes</td>
</tr>
</tbody>
</table>
UNIT 11
PLANT DISEASE CONTROL

Introduction

Since plant diseases are a great threat to the cultivation of crops, disease should be controlled. In the control of plant disease, the main aim is to prevent or reduces the severity of the disease, so as to minimise the economic losses. To achieve a satisfactory control a combination of different control measures have to be adopted. This chapter comprises the different methods of plant disease control including IDM.

Curriculum Objective 1

The learner understands various methods of plant disease control like physical, cultural, biological, legal and chemical methods through brainstorming and classroom discussion.

Syllabus

Methods of plant disease control - physical, cultural, biological, legal and chemical methods

Learning Experience-1

Brain storming and classroom discussion

Materials

Reference Books, Hand outs.

_symbols_ Learner recalls previous knowledge on various pest control methods.
_symbols_ Divide learner into five groups. Each group is given the name of different plant protection methods.
_symbols_ Discuss plant protection methods and present findings
_symbols_ List the responses.

Consolidation

_symbols_ Prophylactic method;
  - All the methods applied to prevent disease occurrence
  - Eg: Prophylactic spraying of Bordeaux mixture before monsoon to prevent incidence of quick disease in pepper

_symbols_ Curative methods
  - All the methods applied to cure a diseased plant
- Eg: Application of tridemorph for the control of sigatoka disease in pepper.

- Physical method
  - Eg: Hot water treatment of seeds against udbatta disease of rice.

- Cultural method
  - Eg: Roguing of infected plants and plant parts, use of resistant varieties.

- Biological methods.
  - Eg: Trichoderma against quick wilt of pepper

- Legal Method:
  - Eg: Use of quarantine laws to control plant disease

- Chemical Method – Use of different types of chemicals-fungicides-to control pathogens
  - Eg: Use of Bordeaux mixture to control beed rot of coconut

- IDM- Integrated Disease Management confined use of all the different methods of plant disease control.

### Products

### Notes

### Evaluation

1) Suppose a coconut plan in your homestead is infested with Bud Rot suggest an integrated management program for the control of the disease

2) Match the following

<table>
<thead>
<tr>
<th>Measures adopted</th>
<th>Type of control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use of trichoderma</td>
<td>Cultural method</td>
</tr>
<tr>
<td>2 Bordeaux Mixture</td>
<td>Biological methods</td>
</tr>
<tr>
<td>3 Hot water treatment of seeds</td>
<td>Chemical method</td>
</tr>
<tr>
<td>4 rouging of infected plants</td>
<td>Physical Method</td>
</tr>
</tbody>
</table>

3) Prevention is better than cure. Substantiate?

### Reference

“Principles of plant pathology” by Nine and Thapliar

### Curriculum Objective-2
The learner understands the classification of fungicides based on chemical nature through survey, presentation and submitting of notes.

**Syllabus**

Define fungicide - Classify fungicide based on chemical nature.

**Learning Experience-1**

**Survey**

**Materials**

Survey format

Learner recalls previous information on classification of insecticides and uses the survey report made in Unit IV. (Conduct a field survey to collect various information on fungicides if it has not been covered in unit IV)

Facilitator leads a discussion. Learner classifies fungicides in the following format, which is evolved by them.

Facilitator should provide additional information on fungicides which has not been collected by the students for classification

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Name of fungicide</th>
<th>Organic or inorganic</th>
<th>Group</th>
<th>Formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Consolidation**

Fungicides are classified into two groups

Organic fungicides  Inorganic fungicides

<table>
<thead>
<tr>
<th>Group</th>
<th>Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic fungicides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphur based fungicides</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Carbamates and others | Ziram  
|                       | Zineb  
|                       | Mancozeb  
| Organo phosphorous compounds | -Ediphenphos (Hinosan)  
| Chlorinated Nitrobenzene | Dinocap  
|                         | Captan  
| Systemic Fungicides | Carbendazim  
|                        | Hexaconazole  
|                        | Propiconazole  
| **Antibiotics** | **Antifungal Antibiotics**  
|                        | Aureofunginsol  
|                        | Griseofulvin  
|                        | Validancycin  
| **Antibacterial antibiotics** | Streptocycline  
|                        | Agrimycin  
|                        | Plantomycin  
| **Inorganic fungicides** | Sulphur fungicides  
|                        | Sulphur dust  
|                        | Wettable Sulphur  
|                        | Lime Sulphur  
| **Mercuric fungicides** | Mercuric chloride  
| Copper fungicides | CuSo4 Preparations  
|                        | Bordeaux mixture  
|                        | Bordeaux Paste  
|                        | Cheshunt compound  
|                        | Burgundy mixture  
|                        | Cuprous Oxide preparations  
|                        | Copper oxy Chloride preparations  
|                        | Blitox  
|                        | Blue copper  

Source Book: II Year Agriculture (Plant Protection)
Evaluation

1. Classify the following fungicides into organic and inorganic and antibiotic

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lime Sulphur, sol</td>
<td>Hinosan</td>
<td>aureofungin</td>
</tr>
<tr>
<td>Bordeaux mixture</td>
<td>Validamycin</td>
<td>Zineb</td>
</tr>
</tbody>
</table>

Reference

- “Principles of plant pathology” by Nine and Thapliar
- “Package of practices recommendations crops 2003” by KAU.
- “Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe

Curriculum Objective-3

The learner understands the methodology for the calculation and preparation of inorganic fungicides like Bordeaux mixture, Bordeaux paste and Cheshunt compound through group discussion, calculation method demonstration and making charts &notes

Syllabus

Calculation, preparation and field application of Bordeaux mixture, Bordeaux paste, Cheshunt compound

Learning Experience: 1

Classroom discussion

Materials

Point cards, Materials for discussion

Facilitator leads discussion.
Learner recall previous knowledge on inorganic fungicides like Bordeaux mixture, Bordeaux paste and Cheshunt compound.

Facilitator asks questions

- What is the active ingredient in these preparations?
- What are the ingredients?

Consolidation

- Bordeaux mixture, Bordeaux paste and Cheshunt compound contain Copper which act as fungicide.
- CuSO4 and Quick lime are the ingredients of Bordeaux mixture, Bordeaux paste
- In Cheshunt compound instead of Quick lime, Ammonium carbonate is used

Learning Experience: 2

Group discussion

Materials

Materials for discussion, chart papers, Point card

- Divide the learner into groups. Give each group the procedure for preparation of a particular inorganic fungicide
- Each Group discusses the procedure based on the point cards and present their finding

<table>
<thead>
<tr>
<th>Name of Inorganic fungicide</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of mixing ingredients</td>
<td>Preparation of fungicides</td>
</tr>
<tr>
<td>Testing of fungicides</td>
<td>Keeping quality</td>
</tr>
<tr>
<td>Precautions</td>
<td></td>
</tr>
</tbody>
</table>

Consolidation

- Procedure for the preparation of inorganic fungicides

Learning Experience: 2

Methods demonstration
Materials

Materials for preparing fungicides & charts

- Learner recalls previous knowledge of mixing ratio of different ingredients for the preparation of fungicides

- Calculation of the quantity of CuSO4 and Lime required for the preparation of 1 litre of Bordeaux mixture. Facilitator explains the calculation as follows

  - Bordeaux mixture contains 1% CuSO4
  - 100 ml of Bordeaux mixture should contain g of CuSO4 to form 1%
  - 1000 ml of contains 10g CuSO4
  - Equal quantity of lime is added to neutralize free copper
  - 1 litre of Bordeaux mixture requires 10g of CuSO4 & 10 g of lime in 1 L of water
  - CuSO4 solution should be added to lime solution to have a basic medium at the time mixing the two.
  - Learner prepare the following chart

<table>
<thead>
<tr>
<th>Quantity of Bordeaux mixture</th>
<th>Quantity of CuSO4</th>
<th>Qty of lime</th>
<th>Qty of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 L</td>
<td>10g</td>
<td>10g</td>
<td>1 L</td>
</tr>
<tr>
<td>5 L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 L</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Facilitator demonstrates the preparation and application of fungicide
- Learners observe and record the procedure of preparation
- Divide learner into 4 groups
- Repeat the preparation & application by themselves.

Consolidation

- Procedure and skill for the preparation of Bordeaux Mixture

Products

- Charts, Notes, Prepared fungicides
Evaluation

1) How will you prepare 20 l of Bordeaux mixture to be applied in grapes to control Downy mildew?

2) Match the following

<table>
<thead>
<tr>
<th>Name of fungicide</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bordeaux mixture</td>
<td>Soil Drenching</td>
</tr>
<tr>
<td>2 Cheshunt compound</td>
<td>Wound Dressing</td>
</tr>
<tr>
<td>3 Bordeaux Paste</td>
<td>Foliar application</td>
</tr>
</tbody>
</table>

(Use same strategies for the transaction of preparation of Bordeaux paste and Cheshunt compound)

Reference

“Package of practices recommendations crops 2003” by KAU.
“Keedanasinikal” By Dr. Peethambaran and Dr. Visalakshi.
“Hand book of Plant protection” By R.L. Sahe

Curriculum Objective 4

The learner develops the skill to find out the quantity of commercial fungicides for the preparation of spray solutions and field application through calculation

Syllabus

Calculation and preparation of fungicidal formulations

Learning Experience

Discussion and calculation

Materials

Problems

- Learner recollects previous knowledge on the calculation of insecticides
- Facilitator explains that for fungicidal
For Calculations the active ingredient concentration of all commercial fungicides is taken as 100%.

<table>
<thead>
<tr>
<th>Commercial formulation</th>
<th>Vol. of Spray fluid</th>
<th>Recommended Conc. of spray fluid in %</th>
</tr>
</thead>
</table>

1. Calculate the quantity of Bavistin 50 WP required to prepare 10 L of 0.3% spray solution.

\[
Q = 10 \text{ L} \times \frac{0.3}{100} = 0.3 \times 1000 = 30 \text{ g}
\]

2. Calculate the quantity of Hinosan 50 EC required to prepare 500 L of 0.1% concentrated spray solution.

\[
Q = 500 \text{ L} \times 0.1\% = 50000 \times \frac{0.1}{100} = 500 \text{ ml}
\]

Products

Solved Problems & Notes

Evaluation

A farmer would like to spray coconut palms infected with Bud Rot with Blitox 50WP at a concentration of 0.3%. He needs 100 L of spray solution. Calculation the quantity of fungicide required

Reference

“Package of practices recommendations crops 2003” by KAU.

“Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.

“Hand book of Plant protection” By R.L.Sahe

Curriculum Objective –5
The learner understands various botanicals and bio-agents used in plant disease management through class Room discussion and Assignments

**Syllabus**

Biological agents and botanicals in plant disease management – examples and uses.

**Learning Experience: 1**

**Class Room Discussion**

**Materials**

Photographs, Pupa cuttings, reference Books

- Learner recalls previous information on tropesticides

- Facilitator asks
  - What is a mycorrhiza?
  - What is the importance of Trichoderma?
  - Why is it used for controlling soil borne pathogens

- List the responses

**Consolidation**

- Microorganisms, which are used to control pathogens, are called antagonistic macro organisms. They effect the control by competition, production of antibiotics, and production of enzymes

**Learning experience 2**

**Assignment**

“Use of Bio-agents and botanicals in plant disease control”

- Learner prepares an assignment

- Facilitator provide sufficient reference material for students to prepare assignment

**Products**

Notes and Assignments
Evaluation

1. A farmer would like to know about trichoderma and apply it to soil to control soil borne pathogens. Give proper advice to this farmer?

Curriculum Objective 6

The learner understands the methodology of soil solarization through discussion and method demonstration

Syllabus

Soil solarization

Learning Experience: 1

Class Room discussion

- Facilitator initiates discussion by asking questions
  - Is it possible to destroy pathogens using high temperature?
  - How can we use solar energy to create high temp and sill soil borne pests?

- List the responses

- Facilitator supplements further information on soil Solarization

Learning Experience: 2

Method Demonstration

Materials

100-150 gauge transparent polythene sheets, spade and rose can

- Facilitator explains and demonstrates the methodology of soil solarization
- Learner observes and records the procedure, precautions taken during method demonstration
Divide learners into four groups and they repeat the procedure

Consolidation

- Procedure and skill for soil solarization

Products

Notes

Evaluation

1. A farmer wants to raise a crop of Amaranthus. The problem of damping off is severe in that area. Help the farmer to make a pathogen free nursery bed using the technique of soil solarization

Reference

Package of Practices Recommendations crops published by Directorate of Extension, KAU
CD show
SOIL SOLARIZATION

Soil solarization is a method of hydrothermal disinfection. This is done by covering the moist soil with transparent polythene sheet and expose to direct sunlight during the hottest period of the year.

Method of solarization

1. Nursery Bed

   The nursery bed for raising the seedlings is to be leveled and the pebbles are removed from the surface. Incorporate sufficient quantity of organic manure and sprinkle water at the rate of 5L/m². Cover the area with 100-150 gauge transparent polythene sheets. Seal the ends of the sheet with soil to keep it in position and to maintain temperature and moisture inside. Adequate care is to be taken to see that the polythene sheet is in close contact with soil to avoid air pockets. Keep the sheets in this position for 20-30 days. Protect it from stray animals and birds. After the period of solarization remove the sheets and the bed is now ready for sowing or transplanting.

2. Potting mixture

   Potting mixture is prepared as per the recommended practice. Spread the potting mixture on a level surface to a height of 15-20 cm. Sprinkle water using rose can and cover the soil with polythene sheet of 100-150 gauge thickness. Solarize for 20-30 days. This method is very effective for the preparation of disease free pepper cuttings.

Hints for solarization

1. Solarization should be done on in open field without any shade.
2. Transparent polythene sheet of 100-150 gauge thickness should be used as it is cheap and is more effective in conduction of heat.
3. Summer months are more suitable for solarization.
4. Soil should be moist during solarization. This increases the sensitivity of resting structures of pathogens in soil and weed seeds.
5. Solarization may be extended to more than a month to effect disinfection to deeper layers of soil.
6. Excess seepage of water into the solarizing bed should be avoided. But summer showers won’t affect the process.
7. Potting mixture should never be heaped for solarization. It should be spread to a height of 15-20cm and moistened before solarization.
8. Soil should have good tilth and should be in good contact with the polythene sheet.

Benefits of solarization

1. It controls fungal pathogens like Pythium, Phytophthora, Rhizoctonia, Fusarium etc.
2. Solarization controls plant parasitic nematodes like root knot nematode.
3. Solarization controls weeds like Cynadon, Cyperus etc.
4. Improves plant growth expressed as increased plant height, number of leaves, better root formation etc.
## UNIT PLAN

### UNIT-12.

### DISEASES OF MAJOR CROPS OF KERALA

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 1</strong></td>
<td>Identification of disease; its cause, symptoms and application of different control measures through field visit collection, observation, drawing diagrams, project and making notes</td>
<td>Discussion Field visit Collection Drawing diagrams Project Making notes</td>
<td>Preserved symptoms Photographs Internet Field diary Reference books Chart</td>
<td>Notes Project report Collection Charts</td>
<td>Project report</td>
</tr>
</tbody>
</table>
UNIT 12
DISEASES OF MAJOR CROPS OF KERALA

Introduction

In Kerala our crop plants are severely affected by many diseases; which causes a major loss of about 20% reduction in Yield. To reduce the disease incidence and to increase the yield, control of diseases is very essential. This chapter aims to make the learners aware of the different diseases affecting crops, their symptoms, and proper control methods to be adopted in the major crops growth in Kerala.

Curriculum Objective 1

The learner develops the skill for identification of diseases of major crops of Kerala; its cause, symptoms and application of different control measures through field visit collection, observation, drawing diagrams, project and making notes.

Syllabus

Major diseases of important crops – rice, coconut, arecanut, rubber, cashew, banana, mango, pepper, cardamom, ginger, vegetables, tubers and ornamental plants.

Learning Experience: 1

Discussion

Materials
Preserved symptoms of diseases, diagrams, photographs

➢ Learner recalls previous knowledge on classification of pathogens, various causes of plant diseases, different types of symptoms and different methods of disease control

➢ Facilitator provides preserved specimens of disease symptoms in crops.

➢ Learner observes the distinguishing characters of various symptoms. Learner prepare drawings and notes

Learning Experience: 2

Field visit

Materials

Field diary, Chart papers, and Disease collection kit.
Divide learners into four groups. Learner collect observe, identify and preserve the disease symptoms from the field. Each group share their funding.

Facilitator consolidates the findings of the students’ by supplementing additional information.

**Learning Experience: 3**

**Project**

**Materials**

Reference books, Field diary

Divide the learners into groups of 3.

Assign each group a major crop and a main or crop for project work.

- **Objective**
  - To identify various diseases affecting rice and their extend of damage
  - Suggest suitable control measures against the diseases
  - Collection, observation and making diagrams of various disease symptoms
  - Carry out identification.
  - Suggest suitable control measures after analyzing field situation

- Each group present project reports with charts, diagrams and specimens.
- Facilitator consolidates presentation by supplementary information
- Learner submits project reports

**Consolidation**

- Diseases of crop plants
- Symptoms
- Control measures
- Application of control methods.

**Products**

Notes, Collection, Prepared charts, Drawings, project report

**Evaluation**

1) A farmer is growing rice crop, on leaves he noticed eye shaped sports with gray center brown margin and drying of leaves. What may be possible cause can you help him to solve the problem
2) Fill up the missing
<table>
<thead>
<tr>
<th>Crop</th>
<th>Disease</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhindi</td>
<td>Yellowing of veins</td>
<td></td>
</tr>
<tr>
<td>Tapioca</td>
<td>Distorted leaves with alternate yellow &amp; green patches</td>
<td></td>
</tr>
<tr>
<td>Bunchy top</td>
<td>Root wilt</td>
<td>Ribbing &amp; flaccidity of leaflets</td>
</tr>
<tr>
<td>Rubber</td>
<td>Pink Disease</td>
<td>Cottony growth on the lower leaf surface</td>
</tr>
<tr>
<td>Cucurbits</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reference**

- "Principles of plant pathology” by Nine and Thapliar
- “Package of practices recommendations crops 2003” by KAU.
- "Keedanasinikal” By Dr.Peethambaran and Dr.Visalakshi.
- “Hand book of Plant protection” By R.L.Sahe
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<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 1</strong></td>
<td>Weed concept, the classification on the basis of life span, habitat and botanical characters</td>
<td>Field visit, collection identification, classification, preparation of herbarium and making notes</td>
<td>Chart paper Gum</td>
<td>Notes Herbarium</td>
<td>Notes Herbarium</td>
</tr>
<tr>
<td>The learner understand the weed concept, the classification on the basis of life span, habitat and botanical characters through a field visit, collection identification, classification, preparation of herbarium and making notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Curriculum Objective 2</strong></td>
<td>Weed Control like mechanical, cultural biological and chemical</td>
<td>Brainstorming Group discussion</td>
<td>Handouts Reference books</td>
<td>Notes</td>
<td>Notes</td>
</tr>
<tr>
<td>The Learner understands the different method of weeds control like mechanical, cultural biological and chemical, their advantages and disadvantage through brainstorming, group discussion and making notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Curriculum Objective 3</strong></td>
<td>Biological control of weeds like salvinia, Eichornia, Eupatorium</td>
<td>Brainstorming Group discussion</td>
<td>Handouts Reference books Charts</td>
<td>Notes Charts</td>
<td>Notes</td>
</tr>
<tr>
<td>The learner understands the methodology and effectiveness of biological control of weeds like salvinia, Eichornia, Eupatorium through brain storming, Group discussion and making notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection)
<table>
<thead>
<tr>
<th>Curriculum Objective 4</th>
<th>Herbicide classification-based on mode of action, time of application and selectivity</th>
<th>Survey</th>
<th>Survey format</th>
<th>Survey report notes</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Survey format Reference materials Containers of herbicides</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Curriculum Objective 5</th>
<th>Calculation of the quantity of commercial herbicides for the preparation and field application</th>
<th>Calculation Method demonstration</th>
<th>Charts Herbicides Water Sprayers Measuring cylinder Bucket</th>
<th>Notes Prepared Herbicides Solved problems</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Curriculum Objective 6</th>
<th>Weed management in paddy field</th>
<th>Interview</th>
<th>Interview schedule Photographs Specimen Pictures</th>
<th>Interview report Notes</th>
<th>Interview report Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNIT 13
WEEDS

Introduction

Weeds have been a problem ever since man started cultivating crops. They successfully compete with cultivated crops by thriving adverse conditions and are known as silent killers of crop plants. They create difficulties in agricultural operations, increase labour cost, and create health hazards and difficulties in aquatic systems.

About 45% of total crop losses in India are reported due to weeds. This indicates the importance of weeds and weed management in crop production. For the study of weeds a to suggest suitable control methods, grouping of weds is essential based on characterizes like life cycle, habitat and botanical characters. Our aim to control weeds should have a long range effect. For that preventive and other control methods should go hand in hand.

The former can make use of a combination of different control methods to manage weeds efficiently and economically.

Curriculum Objective 1

The learner understands the weed concept, the classification on the basis of life span, habitat and botanical characters through a field visit, collection identification, classification, preparation of herbarium and making notes.

Syllabus

Define weed – Classification of weed based on life span habitat and number of cotyledons

The facilitator leads the discussion by asking the learners about the different types of weeds they have studied in the previous year.

Learning Experience:

Field visit

Materials

Chart paper, Gum

The facilitator takes the students for a field visit
The learners collect the different types of weeds found in the premises.
Then the learners are divided into 4 groups
Learners identity the weeds and classify them as wet land and dry land and Narrow leaved and broad leaved.
Consolidation

- Consolidates the weed concept the classification of weeds based on life span, habitat and number of cotyledons. Facilitator gives an idea of herbarium preparation and asks them to prepare the same and submits

Product

- Notes, herbarium

Evaluation

1. Classify the following weeds into dicots and monocots
   Eupatorium, lantana, cynadon & cypress

2. Classify the following weeds into dry land and wetland?
   Eupatorium, salvinia, bida, marsclia, emilia, tridax, Eichornia, ludwigia

Reference:

- Principles of weed science – by Rao.V.S, Published by oxford I B H, New Delhi

Curriculum Objective 2

- The Learner understands the different methods of weeds control like mechanical, cultural biological and chemical, their advantages and disadvantages through brainstorming, group discussion and makes notes

Syllabus

Methods of weed control – cultural, mechanical, biological and chemical

Learning Experience: 1

Brainstorming

- Facilitator initiates discussion
  - Digging comes under which method of control
  - How does flooding the field control weeds
  - Can we use chemicals to control weeds?
  - Can we use hand weeding as a control measure?
Facilitator lists the response and supplements

**Consolidation**

Concept of

- Cultural control
- Mechanical control
- Biological control
- Chemical control

**Learning Experience: 2**

**Group Discussion**

**Materials**

Point card, handouts

- Facilitator divided learner into four groups.
- Each group is given the details of a particular method or discussion based on point cards.

<table>
<thead>
<tr>
<th>Point card</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Method</td>
</tr>
<tr>
<td>2. Operational definition</td>
</tr>
<tr>
<td>3. How the method is used, examples-</td>
</tr>
<tr>
<td>4. Advantages and disadvantages</td>
</tr>
</tbody>
</table>

- Groups present their findings.
- Facilitator consolidate the different methods of controlling weeds

**Consolidation**

Details of different method of control with examples.

- Cultural control
- Mechanical control
- Biological control
- Chemical control

**Product**

Notes
Evaluation

1) Broad-leaved weeds are predominating in a wetland situation. Which is the
method of control you suggest and why?
2) A household is heavily infested with grass. Which method do you suggest to
control the weeds?

Reference:

Principles of weed science – by Rao.V.S, Published by oxford I B H, New Delhi

Curriculum Objective 3

The learner understands the methodology and effectiveness of biological control
of weeds like salvinia, Eichornia, Eupatorium through brain storming, Group discussion
and making notes

Learning Experience

Classroom Discussion

Materials

Handouts, chart

Facilitator recalls the previous knowledge about Biological control
Initiate discussion

What do you know about biological control?
What are the qualities of good bio agents?

List the responses
Divide the learners in to 4 or 5 group.
With the help of handouts given below the students discuss about biological
control, qualities of a good bio-agent and examples.

Hand out:

Examples
Each group present their findings and facilitator consolidates by supplementing additional information. Students prepare notes.

Product:

Prepared Notes, charts

Evaluation

Suppose a canal in your panchayat is heavily infested with salvinia. As an agricultural assistant what measures will you suggest for its control?

Reference

Principles of weed science – by Rao.V.S, Published by oxford I B H, New Delhi

Curriculum Objective 4
The learner gets awareness about the terms herbicide weedicide, its classification—based on mode of action, time of application and selectivity through survey, presentation preparation of notes

**Syllabus**

Define herbicide – classify herbicide based on mode of action, time of application and selectivity with suitable examples

**Learning Experience**

Survey

**Materials**

Survey format, reference materials, collected empty packets, containers of herbicide

- Learner recalls the previous information on classification of herbicides and uses the survey report made in Unit IV.
- (A field survey may be conducted to collect information, if it is not collected in unit IV.)
- Facilitator leads a discussion and helps the learner to classify herbicides

- Based on mode of action
- Based on mode of selectivity
- Based on time of application

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Name of herbicide (Common name)</th>
<th>Formulation</th>
<th>Trade name</th>
<th>Contact translocated</th>
<th>Selective Non-selective</th>
<th>Preplant/pre emergent post emergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,4 DSodium salt</td>
<td>WSP</td>
<td>Fernovore 80% WSP</td>
<td>Translocated</td>
<td>Selective</td>
<td>Post emergent</td>
</tr>
</tbody>
</table>

**Consolidation**

- Mode of action
  - Contact: Do not move into the plant, kills the plant tissues touched by the herbicide
    - Eg: paraquat, propanil
  - Translocated: translocates through the vascular system, and kills the whole plant. Eg: Dalapon, 2,4-Disease
- Based on Selectivity:
Selective:- Kills the plants of only certain species 2,4-D control only broad leaved weeds.
  - Dalapon:- Control only grass inceds.
Non selective:- Kills all plants.
  - Eg: weed oils, glyphosate

Based on time of Application

Preplant:- Applied to soil before the crop is planted
  - Eg: Vapan
Pre Emergent: Applied before the crop or weeds have emerged.
  - Eg: Diuron, Atrazine, Oxy-flurfan, Thiobencarb
Post emergent:- Applied after the emergence of weeds
  - Eg; Glyphosate, Paraquat

Product

Survey Report, Notes

Evaluation

Suppose a paddy field is heavily infested with weeds like, monochoria, hudwigia, Cyprus which herbicide will you recommend to control it?

Reference

Principles of weed science – by Rao.V.S, Published by oxford I B H, New Delhi

Curriculum Objective 5

The Learner develops the skill to find out the quantity of commercial herbicides for the preparation and field application through discussion, calculation and making notes.

Syllabus
Calculation, preparation and field application for weed management.

Learning Experience

Discussion and calculation

Materials

Chart paper
Learner recollects the previous knowledge for the calculation of herbicides

\[ \text{Quantity of herbicide required} = \frac{\text{Rate of application in kg ai/ha} \times \text{Area in ha}}{\text{Strength of commercial product}} \times 100 \]

\[ Q = \frac{RA}{C} \times 100 \]

1) Calculate the quantity of Fernoxone 80% WSP required to control broad leaved weeds in 2 ha of rice field at a recommended rate of 1 kg ai/ha

\[ Q = \frac{RA}{C} \times 100 \]

R = 1 kg ai/ha

A in Ha = 2 Ha

C = 80 %

\[ Q = \frac{1 \times 2}{80} \times 100 = 2.5 \text{ kg} \]

Product

Prepared Notes

Evaluation: - suppose your school is having an area of 1 acre, which is infested with weeds. The PTA of school would like to construct a playground. Suggest the quantity of Gramaxone 20% EC required to clear the area @ 0.8 kg ai/ha

Learning Experience-2

Method demonstration

Material

Herbicide, Water, Sprayer, measuring cylinder, bucket, wooden stirrer

- The facilitator explains and demonstrates the procedure of preparation of the herbicidal solution.
- Learners observe and prepare notes on the procedure and preparation.
- The learners are divided into 4 groups and each group repeats the preparation and application of the herbicide

Product

Notes, prepared herbicidal solution

Source Book: II Year Agriculture (Plant Protection)
Reference

Principles of weed science – by Rao.V.S, Published by oxford I B H, New Delhi

Curriculum Objective 6

The learner get awareness about the different methods of weed management in paddy field locally adopted and the scientific aspects of weed management through an interview with a progressive farmer and with a technical person and making reports.

Syllabus

Explain weed management in rice fields

Learning Experience –1

Interview

The facilitator initiates discussion.

➤ How can you manage the weeds in a paddy field?
➤ Where can we get such information?

Facilitator lists out the responses.

An interview schedule is evolved through discussion with the learners.

<table>
<thead>
<tr>
<th>Points for making interview schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name and address of farmer</td>
</tr>
<tr>
<td>2. Area</td>
</tr>
<tr>
<td>3. Season</td>
</tr>
<tr>
<td>4. Common weeds seen</td>
</tr>
<tr>
<td>5. Yield affected by weeds</td>
</tr>
<tr>
<td>6. Weed control methods adopted (Puddling, hand weeding, flooding, Chemical, Burning)</td>
</tr>
<tr>
<td>7. Whether herbicides used?</td>
</tr>
<tr>
<td>8. If yes name the herbicide?</td>
</tr>
<tr>
<td>9. Time and rate of herbicide application</td>
</tr>
<tr>
<td>10. Effectiveness of the herbicides</td>
</tr>
<tr>
<td>11. Environmental hazards due to herbicide application.</td>
</tr>
</tbody>
</table>

Learner conducts the interview.

Findings are presented. The facilitator consolidates.

Consolidation

Common weeds in rice fields:
  o Grasses: Varinellu, Kavada
  o Sedges: Cyperus spp., Fimbristyles
  o Broad leaved weeds: Monochoria, Ludwigea
  o Ferns: Salvinia
Algae: Spyrogyra

Control methods:
- Keep the rice fields free of weeds up to 45 days by hand weeding or chemical control.
- Herbicide used in the following field conditions
  - Dry seeded rice
  - Wet seeded rice
  - Transplanted rice

Control of salvinia in rice fields
Precautions while using herbicides.

Product
Report, notes

Evaluation

1. From the following list select the weeds found in paddy fields:
   Lantana, Monochoria, Salvinia, Cyperus, Tridax, Spirogyra, Eupatorium, Scoparia
   Azolla, Emilia,
2. Suppose your neighbor ask you a favour to control Salvinia infestation in his rice field. How will you help him?

Reference:

Principles of weed science – by Rao. V. S., Published by Oxford I B H, New Delhi
## UNIT PLAN

### UNIT-14.

### PLANT PROTECTION EQUIPMENTS

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum Objective 1</strong>&lt;br&gt;The learner understands the different types of plant protection equipments, their parts and working principles through group discussion, observation, comparison, preparation of diagrams and making notes.</td>
<td>Types of plant protection equipments, their parts and working principles</td>
<td>Group discussion, observation, comparison, preparation of diagrams and making notes.</td>
<td>Handouts Models Equipments</td>
<td>Notes Diagrams</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective –2</strong>&lt;br&gt;The learner develops the skill for operating the different plant protection equipments and its repair and maintenance through method demonstration, discussion, making notes and reports.</td>
<td>Developing the skill for operating the different plant protection equipments and its repair and maintenance</td>
<td>Discussion Method demonstration</td>
<td>Plant protection equipments Charts Buckets</td>
<td>Notes Maintenance report of plant protection equipment</td>
<td>Notes</td>
</tr>
<tr>
<td><strong>Curriculum Objective –3</strong>&lt;br&gt;The learner understand the different types of sprayers like high volume, low volume and aerial through experiment and making notes</td>
<td>High volume, low volume and aerial spraying</td>
<td>Discussion Experiment</td>
<td>Multimedia Materials for the experiment</td>
<td>Notes</td>
<td>Notes</td>
</tr>
</tbody>
</table>

Source Book: II Year Agriculture (Plant Protection)
UNIT 14
PLANT PROTECTION EQUIPMENTS

Introduction:

Plant protection chemicals are formulated in different ways such as dust, Wetable powder, Emulsifiable concentrate, granules etc. Various types of equipment are needed for the application of formulations. The plant protection equipment differs depending upon the nature of crop also. Eg. There are differences in the type of sprayers suitable for spraying, field crops and tree crops. This unit covers the different types of plant protection equipments, parts, uses and their repair and maintenance and the method of application of pesticide.

Curriculum Objective 1

The learner understands the different types of plant protection equipments, their parts and working principles through group discussion, observation, comparison, preparation of diagrams and making notes.

Syllabus

Different types of plant protection equipments – and their uses –mention the important parts of a sprayer and a duster.

Learning Experience: 1

Discussion

Materials:

Handouts, models, Charts.

Facilitator initiates discussion

- Have you ever seen spaying operation?
- Have you noticed any difference in the sprayers?
- Have you noticed any difference in the sprayers in relation to type of crop?

Facilitator lists the responses and consolidates:

- Plant protection equipment are those used for applying plant protection chemicals.
- There are different plant protection equipments to suit different situations
- Depending on the use, type of crop the parts and principle of operation differ.
- Facilitator provides different plant protection equipments
- Learners observe, compare and make diagrams and notes
Learning Experience: 2.

Group discussion

Materials

Hand outs, Diagrams, Models

- Divide learners into four groups
- Assign each group with the details of operation of a plant protection equipment for group discussion based on the point card.

| 1. Name of the equipment |
| 2. Use                  |
| 3. Different parts      |
| 4. Working principle    |
| 5. Type of sprayer      |

Consolidation

- Use,
- Parts
- Working principle
- Type of sprayers.

Products:

Notes and diagrams

Evaluation

1. Compare the use of Knapsack and Rocker sprayer?
2. A farmer would like to spray Bordeaux mixture to his rubber plantations. Suggest suitable plant protection equipments and substantiate?

Reference

- “Hand book of Plant protection” By R.L.Sahe
- “Principles and procedures of Plant protection” By S.B.Chattopadhyay

Curriculum Objective –2
The learner develops the skill for operating the different plant protection equipments and its repair and maintenance through method demonstration, discussion, making notes and reports.

**Syllabus**

Operation of different plant protection equipments- spraying and dusting on different crops – repair and maintenance of plant protection equipments

**Learning Experience:-1**

**Discussion**

**Materials:**
Plant protection equipments, plant protection chemicals, water, bucket, and charts.

- Learner recollects the knowledge on plant protection equipments, their parts and principles of operation.
- Facilitator provides plant protection equipments for observation
- Learners observe them and make diagrams

**Learning Experience-2**

**Method Demonstration**

- Facilitator explains and demonstrates the method of operation of plant protection equipment.
- Learner observes and makes notes on the method of operation.
- Divide the learner into four groups.
- Each group repeat the equipment operation.
- Facilitator explains and demonstrates the repair and maintenance of the Sprayer/Duster with exploded view of the parts.
- Learner repairs a damaged Sprayer/Duster and reports are prepared

**Product**
Notes, Report on the repair of damaged sprayer

**Evaluation**
1. A knapsack sprayer on operation delivers only coarse droplets. Find out the reason for this problem and how can we repair it?

**Reference**

- “Hand book of Plant protection” By R.L. Sahe
- “Principles and procedures of Plant protection” By S.B. Chattopadhyay

**Curriculum Objective –3**
The learner understand the different types of sprayers like high volume, low volume and aerial through experiment and making notes

**Syllabus**

Explain high volume, low volume and aerial spraying

**Learning Experience-1**

**Experiment 1**

Materials: Hand sprayer, Rocker sprayer, coloured liquid, water and white chart paper, Measuring Jar.

- One litre of water is filled in two types of sprayer - Hand sprayer and Rocker sprayer. Water is sprayed continuously for one minute into a bucket. The quantity of water collected in the bucket is measured using measuring jar.

- Learner observes the difference in quantity of water collected and notes down

**Consolidation**

- Learner understand that the spray volume required for different types of sprayers are different

**Learning Experience: 2**

**Experiment 2**

- Coloured liquid is sprayed for a fraction of a second from a distance on a white surface using the above-mentioned sprayers. Learners observe the difference in droplet size and prepare notes.

**Consolidation**

- The volume of spray fluid required by different type of plant protection equipment to cover unit area is different. This difference is due to the variation in droplet size and pressure. On the basis of this the sprayers are classified as high volume, low volume and ultra low volume sprayers. Each type is used for a specific purpose.

- Aerial spraying uses low volume sprayers for applying plant protection chemicals on cashew and rubber plantations.
- For spraying tall trees, rocker sprayer is used.
- Their uses, advantages and disadvantages of other sprayers also.
**Product**
Notes, diagrams

**Evaluation**

1) A cashew plantation is infected with tea mosquito and the authorities recommended aerial spraying. Do you agree with this decision?

2) Match the following

<table>
<thead>
<tr>
<th>Mango tree</th>
<th>Hand sprayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>Rocker sprayer</td>
</tr>
<tr>
<td>Potted plant</td>
<td>Aerial Spraying</td>
</tr>
<tr>
<td>Rubber plantation</td>
<td>Knapsack sprayer</td>
</tr>
</tbody>
</table>

**Reference**

Principles and procedures of Plant protection S.B.Chattopadhyay
CLASSIFICATION OF SPRAYERS

Depending on the volume of spray fluid required for spraying 1 ha of area Sprayers are classified into high volume sprayers, low volume sprayer and ultra low volume sprayers. This classification is also based on the Sprayer used, particle size in the spray and the number of droplets per square centimetre area. Nowadays, controlled droplet applicators (CDA) are also used for generating very minute particle size in sprays. These type of sprayers are used for fogging machines and smoke generators.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Type of Sprayer</th>
<th>Volume of Spray fluid /Ha.</th>
<th>Particle size (Microns)</th>
<th>No. of particle/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Volume Sprayers</td>
<td>500-100 lit.</td>
<td>300-500</td>
<td>10-20</td>
</tr>
<tr>
<td>2</td>
<td>Low Volume Sprayers</td>
<td>50-200 lit</td>
<td>100-300</td>
<td>30-50</td>
</tr>
<tr>
<td>3</td>
<td>Ultra Low Volume Sprayers</td>
<td>&lt; 5 lit.</td>
<td>60-100</td>
<td>50-70</td>
</tr>
<tr>
<td>4</td>
<td>Controlled Droplet Application (CDA) Sprayers</td>
<td>Formulation like aerosols are use as such</td>
<td>Fogging machine-1-15</td>
<td>70-350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Type of Sprayer</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Volume Sprayers</td>
<td>Knapsack, Rocker, Hand Sprayers</td>
</tr>
<tr>
<td>2</td>
<td>Low Volume Sprayers</td>
<td>Power Sprayers</td>
</tr>
<tr>
<td>3</td>
<td>Ultra Low Volume Sprayers</td>
<td>ULV Sprayers</td>
</tr>
<tr>
<td>4</td>
<td>Controlled Droplet Application (CDA) Sprayers</td>
<td>Fogging machines, Smoke generators</td>
</tr>
</tbody>
</table>
## UNIT PLAN
### UNIT-15.
#### COMPATIBILITY OF PLANT PROTECTION CHEMICALS AND FERTILIZERS

<table>
<thead>
<tr>
<th>Curriculum Objective</th>
<th>Ideas / Concept</th>
<th>Activity</th>
<th>Materials</th>
<th>Product</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| **Curriculum Objective 1**  
The learner understands the concept of compatibility of pesticides and fertilizers, their compatible and incompatible combinations through classroom discussion, reviewing compatibility chart and making notes. | Concept of compatibility of pesticides and fertilizers, their compatible and incompatible combinations | Discussion, reviewing compatibility chart and making notes. | Compatibility char | Notes | Notes |
Unit-15
COMPATIBILITY OF PLANT PROTECTION CHEMICALS AND FERTILIZERS

Introduction

In the plant protection schedule, very often it becomes necessary to combine the application of different agrochemicals such as fungicides, insecticides, herbicides and fertilizers. In doing so, we can save the cost of labour and time too. In this unit, the students are made aware of compatibility chart and combination of different agrochemicals.

Curriculum Objective 1

The learner understands the concept of compatibility of pesticides and fertilizers, their compatible and incompatible combinations through class room discussion, reviewing compatibility chart and making notes.

Syllabus
Compatibility of plant protection chemicals and fertilizers

Materials
Compatibility chart

Learning Experience:
Classroom discussion

❖ The facilitator initiates discussion by describing a situation

❖ “A farmer is cultivating paddy in an area of 2 ha. The crop is infested with rice stem borer and blast disease. The labourers engaged in plant protection operations will be available for 2 days. The amount to be spent on plant protection operations is also limited. In these circumstances, what steps should the farmer take to control both the pest and disease in time?”

❖ Facilitator lists the responses by providing additional information.

Consolidation

❖ Pesticides can be combined and sprayed.
❖ All combinations of pesticides are not possible.
❖ Points to be considered while mixing plant protection chemicals and fertilizers
❖ Advantages of combined spraying
❖ Only compatible plant protection chemicals can be mixed and sprayed
❖ Compatibility – it is the ability where different plant protection chemicals and fertilizers when mixed together will not react with each other and not lose their individual properties.
Bordeaux mixture is compatible with Quinalphos, Urea and 2,4-D. and incompatible with Carbaryl and Malathion

Compatibility chart

Product

Prepared notes

Evaluation

1. For the control of fungal pollu and scale infestation in pepper, one farmer sprayed Bordeaux mixture and Dimethoate which led to the drying up of vines. Another farmer sprayed Dimethoate and Copperoxy chloride and found effective. Analyse both the situations and express your views.

2. Find out the fungicide, fertilizer and herbicide that can be safely combined with the following insecticides using the compatibility chart.
   a. Quinalphos
   b. Carbaryl
   c. Dichlorvos
   d. Dimethoate

Reference:

“Package of practices recommendations – Crops- 2003 By K.A.U

“Principles and procedures of Plant protection” By S.B.Chattopadhyay

Source Book: II Year Agriculture (Plant Protection)