UNIT 19 FUTURE PROSPECTS OF IPM

You got to be careful if you don't know where you're going, because you might not get there. The future ain't what it used to be.

Yogi Berra

Structure

19.1 INTRODUCTION

"The farmer works the soil, the agriculturist works the farmer"

Eugene F. Ware

Since the expression "integrated pest management" was explicitly presented in the late 1960s, the concept has been under close scrutiny. It is now generally agreed that adoption of IPM, although lagging in most crops and in most parts of the world, is not an option; it is an imperative if agricultural production is to keep up with the demands of a growing human population. As the physicist Niels Bohr said, "It is difficult to make predictions, particularly about the future!" The goal of IPM should be to achieve the desired level of interference with ecosystem processes needed to regulate pest impacts with minimum undesired impacts on other ecosystem.

In 21st century's agriculture, IPM will assume an even greater role in light of mounting concern about pesticide residues, products of biotechnology, preservation of biodiversity, food/nutritional security and global agricultural trade issues. The nation has to face 21st century, likely to be a very challenging period, through excellence in competence and performance of plant protection functionaries. **IPM is the way of future pest management**. Therefore, the pace of generation of human resources through training of plant protection extension functionaries as well as training of farmers needs to be given greater thrust.

Within the mantle of Sustainable Development is the idea of Integrated Crop Management (ICM). It is a new agricultural paradigm sweeping developing nations involving managing the crop profitably but with respect to the environment, in a way which suits the local soil and climate and safeguards a farm's natural assets in the long term. Biological and technical advances must be used responsibly.

Objectives

After studying this unit you will be able to:

- describe holistic approach in IPM,
- appreciate the role of communication technology in IPM,
- explain possible changes in IPM tactics,
- appreciate the need for Plant Health Clinics (PHCs), their role and features and
- discuss future strategies in IPM.

19.2 IPM: SOME QUESTIONS

IPM is a socially acceptable approach for regulating pest species because it is comprehensive and flexible, enabling farmers, urban dwellers, school systems, and municipalities to develop more sustainable, environmentally sound and economically viable systems.

i) In light of these criteria, several resounding questions surface. Is IPM to the point of meeting the expectations of reduced pesticide inputs promised in the late 1960s and early 1970s? Probably not.
ii) Has IPM succeeded despite nearly three decades of support from the government? From a sociological vantage point, perhaps not.
iii) Have we approached a time when pest management decisions will be made in the best interests of society versus the most expedient and profitable vantage point of the producers? Possibly.

Now let us find in this unit what should be our future strategies and directions of possible changes so that we can confidentially declare that IPM has succeeded.

19.3 HOLISTIC APPROACH IN IPM

IPM in 'true sense' can be implemented to a greater extent if a universal definition of IPM is accepted. Though progress in adoption of IPM has been made but more is anticipated in the future if some changes are made in applying the control tactics.

There are several ecofriendly methods of pest control such as mechanical methods, cultural methods, behavioural methods, biological methods and host plant resistance etc. We know that such methods are not sufficient alone but can be very effective when combined with other methods. For example, natural enemies alone or resistance variety alone may not be able to suppress pest population to a desired level but when these are combined together they prove very effective. Much work has not been done on the integration of such methods. The need of the hour is therefore to integrate effective and compatible pest control methods.

Insect pests can be effectively controlled through integration of resistant cultivars, natural enemies and selective pesticides. Crops have rich fauna of natural enemies of pests, which should be utilized for the suppression of pests in a proper manner. Efforts should be made to protect the natural enemies from harmful effects of broad-spectrum pesticides. If selective pesticides are not available then selectivity can also be achieved through proper formulations or methods of pesticide application. **Granular formulations of systemic pesticides do not harm natural enemies** much as they don't come in direct contact with natural enemies, for example carbofuran and phorate granules are less harmful to predators and parasitoids in rice ecosystem. **Pesticides should be used as last resort when other methods fail to contol pest population and not as first option**. During unfavourable weather, the natural enemies are absent during some period on some crops. In such situations pesticides can be used. Later on when natural enemies become active, then pesticides should be avoided. For example in case of wheat, aphids are active from December to March. From December to mid

February, their predators such as coccinellids and syrphids are inactive. In their absence aphids attain very high population. With warming up of weather, coccinellids and syrphids become active and feed voraciously on aphids. During severe winter aphids population can be kept under control by pesticides and later on pesticides should be avoided to take maximum advantage of natural enemies.

19.4 MODELS, INFORMATION TECHNOLOGY AND COMMUNICATION TECHNOLOGY IN IPM

The future of IPM will be an exciting and challenging era with tremendous changes in technology. The technological era with internet capabilities provides tremendous opportunities to access information quickly, but it also presents challenges in reaching masses appropriately.

Models are representations of a system. You have already studied about use of models and remote sensing in pest management in Unit 8. Farmers and the general public already have access via the internet to a wide range of informed and uninformed opinion, information and data relating to pest management issues. Scientists and vested interest groups will be able to receive a personalized update of information on matters relating to food and environmental safety (e.g. on pesticide residues, GMOs) could potentially lead to a better informed and aware general public.

Technological development will bring revolution in following IPM tactics.

Pest Monitoring and Decision Making

Technological developments have changed the approaches to arthropod pest monitoring and decision making starting in the 1980s.

Other important developments are based on the rapidly expanding computer and global communication technologies since the early 1980s. Increases in computer power, and reduction in size and weight, should contribute to greater use of computers for field diagnosis and real-time decision making. Data retrieval and recording, running models, and using expert systems in the field will increase through the use of powerful portable computers and data loggers. The use of computers to evaluate data will be the only possible way to achieve integration of pest management. Expected future changes include the following:

i) **Pest identification:** Access to expert system pest identification will become routine, including picture catalogs of the pests. It is conceivable that computers will, through digital imaging technology, be able to rapidly identify pest organisms. Identification of pests will be expedited by genetic profiles and the use of genetic markers for identification will become more of a standard practice, particularly for cryptic organisms such as pathogens and nematodes.

ii) **Forecasting:** Improvements in the ability to run models that forecast events will be an important area for disease and insect pest management.

iii) **Improved thresholds and monitoring:** Development of user-friendly expert systems operating on handheld field computers will greatly improve the ability to use economic thresholds where such decision-making parameters are useful. Another computer application is the use of degree day models to predict pest incidence and possible abundance.

iv) **Data storage and retrieval for recommendations:** The ability to quickly and easily access large databases from the field, such as field historical records, pest biology, control recommendations, and pesticide label information, will greatly enhance the ability of PCAs (Pest Control Advisors) to make IPM decisions on the spot.

v) **Computer digital imaging technology:** Such advancements will be developed to permit real-time crop and pest (especially weed) identification by machine. This will in turn permit programming of robotic equipment to control sprayer and other mechanical field equipment thus decreasing pesticide use and risk to human operators.

Precision Farming The use of computers for precision farming through a global positioning system (GPS) and a geographic information system (GIS) will result in site-specific application of control tactics in real time. Precision farming packages are rapidly being developed and implemented. This approach allows farmers to optimize economic returns and minimize environmental impacts by maintaining better control of input costs. Present precision agricultural systems provide decision support for insect management.

Precision farming is a farm management technology that uses within field spatial variability to guide application of management actions.

GIS or geographic information system is computer based system used for collection, storage and analysis of spatial data.

SAQ 1

How models and information technology can shape the future of IPM?

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19.5 DIRECTIONS OF POSSIBLE CHANGES

You have studied about various pest management tactics in Blocks 3 & 4. Most of the changes will occur in development and improvement of existing tactics in the future.

Pesticides

The use of pesticides will continue, but safety of use and the nature and mode of action (particularly of insecticides) will change in the future. Development of novel synthetic pesticides will be at a slower pace than in the second half of the twentieth century. Of all the pesticides, herbicides for weed management will continue to be used in the largest amounts and on the greatest area.

Pesticide-delivery technology is changing. Nozzles and spray technologies will be improved to reduce the risk of drift and nontarget effects.

Managing Resistance, Resurgence and Replacement (3R's of pest management)

In the past, single tactics were considered expendable because of the seemingly ready availability of new tactics to replace those lost to pest resistance. The multi tactic IPM approach will become the norm for managing the three R's of pest management.

Biological Control

There will be further developments for biocontrol of pathogens and nematodes, and perhaps more modestly, for weeds.

Behavioral Control

The use of semiochemicals, especially sex pheromones, to manage arthropod pest will increase in the future. Application of modern chemical tools to quickly identify semiochemicals, including pheromones and novel way of delivering them in the context of IPM system will open new avenues for the management of arthropod pests.

Cultural Tactics

Two areas of crop culture have been changing pest management since the mid 1970s. Both irrigation management and no-till or reduced tillage systems may further impact pest management.

Physical and Mechanical Control

Computer imaging technology, coupled with global positioning systems, will be developed permitting equipment to more accurately follow the crop row and to adjust position automatically.

Host-plant Resistance/Plant Breeding and Biotechnology

The next 20 years will see a substantial increase in the use of genetically engineered plants. Genetic engineering offers great possibilities relative to host-plant resistance to pests. The genetic engineering of crop plants by moving genes for desired characteristics into crop cultivars without transferring linked undesirable traits represents a significant advance over classical breeding for the development of new crop cultivars. This technology has the potential to revolutionize disease, insect, and nematode management completely. Biotechnology has made an impact on agricultural production systems and will make even greater contributions in the future. Transgenic plants with resistance to insects and diseases are becoming widely available. The greatest challenges to biotechnology include: further understanding of cost: benefit relationship, consumer acceptance, resistance management and compatibility of these technologies with comprehensive IPM programmes.

SAQ 2

What possible changes are predicted in IPM tactics?

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19.6 LEGISLATIVE MEASURES FOR SUSTAINABLE IPM–PEST RISK ANALYSIS (PRA)

You have already learnt about pest risk analysis under legislative measures (legal control) in Unit 16 of Block 4. Here you will be explained further details of pest risk analysis in IPM.

Pest Risk Analysis is carried out to assess the damage potential of exotic or foreign pests if they get introduced into new countries. Following considerations should be included in PRA:

- Likelihood of becoming a pest
- Pathways of spread
- Amount and type of damage
- Ease and cost of control
- Effect and cost to the environment

PRA follows strict protocols for each pest category, and are developed by the appropriate government agencies in cooperation with the parties that are likely to be imparted. If the assessment of risk is high for an organism that is not present, it should be excluded. These organisms are targeted by inspectors at international ports or on produce prior to international shipment.

For example hessian fly, *Mayetiola destructor* is a serious pest of wheat in several countries but it is not found in India. If due to quarantine negligence such pests gain entry into India then they may wreak havoc here. This may be assessed through simulation models. The foreign pests that are under quarantine cannot be brought deliberately into new countries to test them for their damage potential. Therefore such studies can be carried out through simulation models. Soybean rust model, SOYRUST, which when run with continental USA weather data, predicted potential areas for soybean rust epidemics. When disease estimates produced by model were

further linked to soybean crop model, the potential losses attributable to rust epidemics were determined. Such studies should be carried out against other pests. Procedure for such an analysis is depicted in Fig. 19.1.

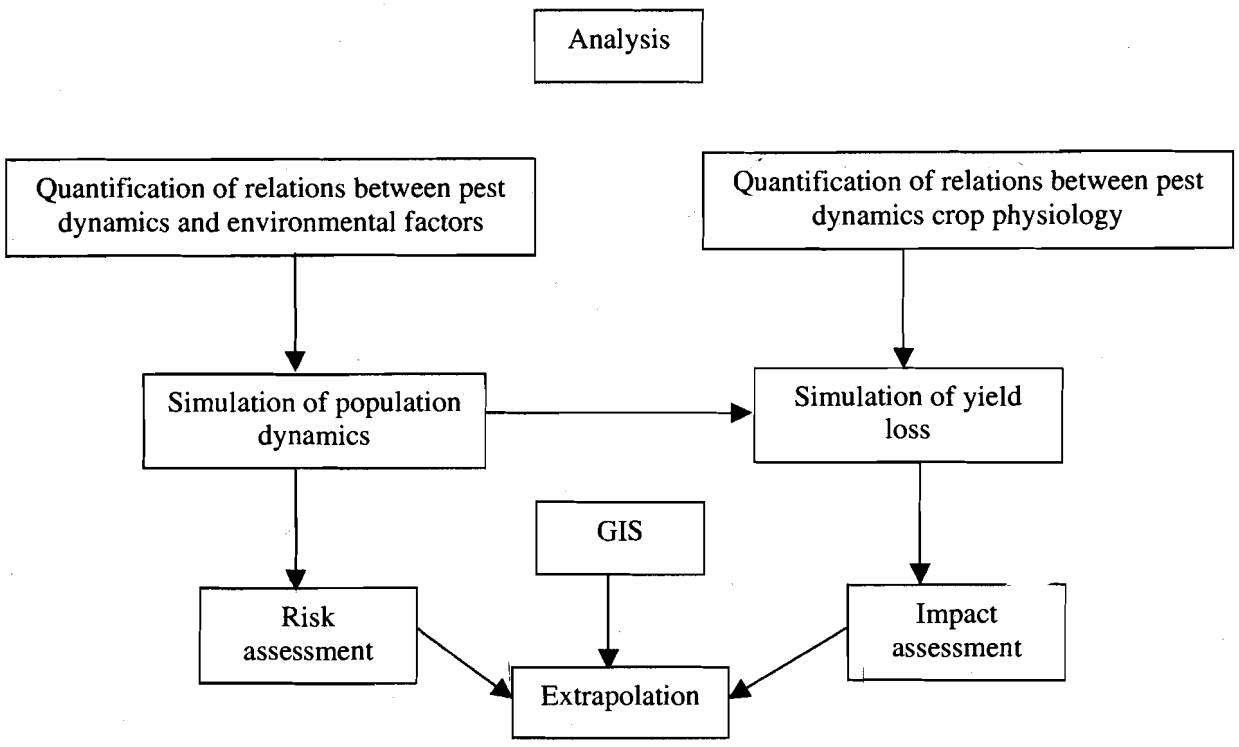

Fig. 19.1: Schematic diagram showing suggested steps in using models for pest risk analysis

SAQ 3

What steps are suggested in using models for PRA?

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19.7 PLANT HEALTH CLINICS

Under the changing agricultural scenario and WTO regime, the cost-quality relationship in farming is becoming increasingly important. The modern agriculture is therefore, becoming more and more complex where farmers need a very strong farm advisory service to provide them the needed technology. In view of this, the services related to insect pest, weed, disease, nematode and soil health management etc. assume greater importance. In this direction, proposed **Plant Health Clinics (PHCs) in the country are aimed to provide low-cost plant protection services (Advisory and Operational) to the farmers for harvesting their crops, preferably free from pesticide residues, need based utilization of resources and assist government in exploring the employment avenues for rural youth**. The prime mission of the PHC is to explore new frontiers of knowledge generated at the Research Institutes or elsewhere and utilize it harmoniously for the profitable productivity which is effective, safe, sustainable and socially equitable among the growers and others concerned leading to the improved quality of human life.

19.7.1 The Concept

The basic concept of the clinic is to provide information package (pest diagnosis and treatment procedures) more effectively and promptly to the growers at the door-step in near future through Plant Health Clinic Practitioners and to those visiting clinics. The clinic, will function like hospitals where visitor's material will be examined and cultured, if necessary, by the concerned experts (Consultants) who will be assisted by technical and administrative staff. Under Operational Services, certain treatment facilities like seed and planting material teatment, fumigation, pesticidal dip, hot water treatment etc. will be facilitated to the visitors on nominal charges basis.

There is an urgent need for establishing the PHCs in the country for providing the facilities in the area of insect pest, nematode, disease, weed, nutrition and water management etc. Recommendations for pesticides should be based on the trade names and not on technical ones which is a prevailing practice. Besides, Pesticide Dealers be placed preferably adjacent to clinic or in the compound itself where visitors can purchase items and get cash memos.

Small, marginal and commercial farmers, export houses, industries, individuals with related pest problems, or product quality testing, and NGOs involved in the agricultural trade are main users of PHCs.

19.7.2 Thrust Areas/Mandate

- To develop infra structural facilities at the State level (Central Plant Clinic), drawing expertise mainly from entomology, pathology, nematology, weed science, soil and water testing, soil and water management etc.
- To facilitate advisory services free of cost among the marginal and sub-marginal farmers and on cost basis to the progressive farmers/commercial growers/non-agriculturists including traders. It may include field operations as well as post harvest treatment protocols including quarantine facilities for plants and animals like bioagents as a requirement under FAO protocols on import and release of biological control agents.
- To develop/facilitate the details of implementable consultancy negotiations between technology developer (scientists or concerned staff) and the technology user/buyer.
- To launch postal help line in crop protection available to farming communities through Internet.
- To conduct emergency team visits consisting of plant protection experts at the farmers' fields/institutions/agency in case of pest outbreaks and assist concerned government/institution/agency in determining the losses caused by the pests.
- To develop crop based museum depicting all kind of important pest problems occurred due to non availability of balanced nutrients or injuries inflicted by insects, mites, rodents, birds, vertebrates, diseases, nematodes etc. To develop Integrated Crop Protection Packages for important ones including newly released cultivars by the Institute, preferably at farmer fields. The study will include even post harvest handling and marketing of the produce.
- To develop training material and protocol for the Plant Health Clinic practitioners in order to generate employment avenues for them and easy flow of technology to the grassroot at the fastest rate and update the popular literature from time to time for practitioners as well as farmers. Besides, cataloguing the pesticides in field use, their status, sources of availability and compatibility with other chemicals/ nutrients/biopesticides, safety precautions in handling and storage, various trade names and recommended dosages, level of mammalian toxicity and effects on natural enemies and non-target organisms in order to facilitate such information packages alongwith other options of pest management to the practitioners.

- To develop National and International linkages, exchange programmes, database and pest diagnostic kits/ programmes availing latest information technology facilities.
- To assist disaster management programmes in case of natural calamities.

SAQ 4

i) Why the need to develop PHCs was felt?

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ii) What functions are carried out by PHCs?

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19.8 IDENTIFICATION OF FUTURE STRATEGIES

From being just a concept in the early 1960s, IPM has become a political and social force for the beginning of the new millennium. The philosophy and practices of IPM will continue to change and develop. It will remain dynamic simply because of its diverse nature and the range of individuals, disciplines and organizations involved in its study, development and implementation. IPM will continue as a valuable means of addressing pest management problems for many years, therefore, IPM in the future will emphasize biological and ecological knowledge in managing pests. Beyond that, specific areas are described here that will cause impact on research and implementation of IPM in the future.

Though extension functionaries and farmers have accepted IPM as a farmer friendly approach as it leads to generation of employment and income savings on input and that it is environment friendly resulting in protection of agro-ecosystem, however, it is to go a long way to reap full benefits. Unless farmers become experts through FFS and manage the ecosystem rather than attempting to control it, unless communities own IPM, sustainability will not be achieved.

India faces a challenging and gigantic task of training vast number of extension functionaries engaged in plant protection throughout the country. The country faces the problem of numbers with consequential bearing on institutional training support. There are more than one hundred thousand extension personnel in India who need to be adequately trained who in turn have to train more than 150 million farming families. The total task of expanding the usage of the IPM approach is gigantic, herculean but achievable. What is needed is tremendous zeal, enthusiasm, energy, a down to earth field approach at all levels, and a strong will to achieve the desired objectives in the best interest of one and all, besides adequate material and financial support. Along with research efforts, developmental efforts are to be continued with major thrust on:

i) HRD in IPM through training of trainers and farmers.
ii) Large scale demonstrations of field tested IPM practices.
iii) Participatory approach among state extension functionaries, scientists of SAUs, agricultural research institutions, NGOs, Farmer groups, etc.
iv) Farmer to farmer training programs by the trained farmers to train their fellow farmers-community approach.

In the recent years we have witnessed changes in the pest scenario in crops grown in our country. The world agriculture is at the threshold of witnessing yet another revolution, the bio-revolution. GM (Genetically Modified) crops are being grown in many countries. Indian farmers may also cultivate transgenic/GM crops in future. Further in post WTO (World Trade Organisation) era, with liberalization and globalization of agriculture, the pest situation in the country is likely to change at a faster pace than what has been experienced so far.

Some of the strategies, discussed below, if implemented correctly in future will help to promote IPM.

i) Training for Women

Worldwide, women's participation in agricultural production is considerable and in many regions, rural women are responsible for the majority of pest management activities, often devoting more time to pest control than men.

In developing countries, there is a growing realisation that approaches such as IPM should entail careful attention to the knowledge, needs and perceptions of women farmers. Given the gender division of labour and differences in access to land, labour, finance and education, the technological needs of women farmers are often distinct from those of men, needing low external input, time saving technologies adapted to small-scale, non-uniform subsistence crop production. The basic principles of IPM are well suited to such needs, but few mechanisms exist at the national and international levels to incorporate gender issues into the research and development of IPM technologies.

As women farmers are often unlikely to gain access to IPM technologies through existing extension systems, it is becoming obvious that such systems must be modified or new channels for agricultural information established. There is also a growing realisation that better information on the role of rural women and the incorporation of gender issues into research agendas could lead to improvements in pest management, especially in small plots.

ii) Involvement of Voluntary/Non-Governmental Organizations (NGOs)

Training by voluntary or non-governmental organizations has been found effective in imparting knowledge and skills to the farmers. Greater involvement of these organizations is required in imparting training to the farmers. Active participation of greater number of NGOs would help considerably, in popularizing the eco-friendly IPM practices among farmers.

iii) University Education on IPM

The State Agriculture Universities (SAUs) and Agricultural Colleges have a very important role to play. It is necessary to ensure that future agriculture graduates coming out of the colleges are fully equipped to help the farmers in IPM approach. There is a lot of scope in the service sector, setting up of bio-control labs to make available bio-control agents pesticide/bio-pesticide application services and maintenance of plant protection equipment. To cope with rapid strides in plant protection IPM technology, the curriculum, the course contents need to be revised and updated. The present concept and approach of IPM to pest management has to be fully incorporated in the university curriculum.

iv) Food Safety

The Food Quality Protection Act (FQPA), the amended Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), requires the EPA to review all federally registered pesticides in the next 10 years and to use a more comprehensive health standard when allowing re-registration. The ultimate impact is unknown, but FQPA

A convergence of technical, environmental and social forces is moving agriculture towards more non-pesticide pest management alternatives like biological control, host plants resistance and cultural management.

will most likely result in stricter regulations concerning pesticide residues in food, particularly with respect to organochlorines, organophosphates, and carbamates. Some of the most toxic pesticides have already been "de-registered" with respect to some of their former uses. These regulations may provide incentive for more widespread adoption of IPM. FQPA will force farmers and IPM consultants to examine differing pesticide toxicities, re-educate themselves and clientele on use of pesticides, processing and distribution systems from a food safety prospective.

v) New Options

Pest control methods are evolving and diversifying in response to public awareness of environmental and health impacts of synthetic chemical pesticides and resulting legislation. The strong growth of the organic foods market—20% annual expansion for the past several years—may also be a factor in the accelerated development of organic pest management methods.

Agricultural pests are developing resistance to many synthetic agrochemicals, and new synthetic chemicals are being registered at a slower rate than in the past. This situation has helped open the market for a new generation of microbial pesticides.

Research is proceeding on natural endophytes [fungi or bacteria that have a symbiotic (mutually beneficial) relationship with their host plant] and their effects on plant pests. This research might yield products that could be used to inoculate plants against certain pests.

vi) More Weed IPM

Weeds are the major deterrent to the development of more sustainable agricultural systems, particularly in agronomic crops. Problems associated with soil erosion and water quality are generally the result of weed control measures like tillage, herbicides, cultivation, planting date and pattern, etc. In the future, research will focus not on symptoms, such as soil erosion, but on basic problems such as how to *sustainably* manage soils. Weeds, as an important facet of sustainable soil management, will consequently receive more emphasis in IPM or Integrated Crop Management (ICM) programmes.

vii) On-farm Resources

As farm management strategies become increasingly fine-tuned to preserve a profitable bottom line, the conservation, utilization, and development of on-farm resources will take on added importance. In the context of IPM, this will mean greater emphasis on soil management as well as on conserving beneficial organisms, retaining and developing beneficial habitats, and perhaps developing on-farm insectaries for rearing beneficial insects.

viii) Area wide approaches

Area wide approaches to IPM have been in vogue for nearly 30 years. Earlier, only area wide applications of insecticides was prevalent, but attempts have been made recently to utilize ecologically-based techniques such as mating disruption to control oriental fruit moth, sanitation and aeration to control insects in stored grain system. The concept of area-wide approach in suppressing pest through community effort and coordinated by organizations is a welcome step.

ix) IPM On-line

There is an increasing body of information about production, marketing, and record keeping available to growers via the Internet. The Internet is also a good source of information about IPM, beneficial insects, products, and pest control options for individual crops. IPM specialists are generating high-quality websites as a modern

educational delivery tool, and many Extension Service leaflets are now being made available in electronic format only. This trend will only accelerate as more and more agriculturists familiarize themselves with the Internet for a thorough listing of IPM resources available on the Internet.

x) IPM Certification and Marketing

Certification of crops raised according to IPM or some other ecology-based standards may give growers a marketing advantage as public concerns about health and environmental safety have increased. For example, since 1995, Wegmans has sold IPM-labeled fresh-market sweet corn in its Corning, Geneva, Ithaca, Syracuse, and Rochester, New York stores. Wegmans has also added IPM-labeled corn, beets, and beans to its shelves of canned vegetables. One goal of the programme, in addition to being a marketing vehicle, is to educate consumers about agriculture and the food system. Another goal is to keep all growers moving along the "IPM Continuum."

By using labels and other active marketing strategies (newspapers, brochures etc.), awareness and acceptance of IPM by consumers is enhanced because it will have positive consequences for human health. Similarly, IPM certification can help farmers build consumer demand for products grown with these methods and can allow-growers the opportunity to obtain a economic return for investing in IPM methodologies.

These "ecolabels," as they're known, are becoming more popular, with over a dozen brands now in existence. They may provide for a more certain market and perhaps a price premium to help growers offset any costs associated with implementing sustainable farming practices. There is concern from some quarters that IPM labeling will cause consumers to raise more questions about pesticide use and the safety of conventional produce. Some advocates of organic farming worry about consumer confusion over the relationship of the ecolabel to the "Certified Organic" label.

xi) Social Issues

Social issues will continue to be important to the future of IPM. Society's concern for the structure of agriculture, the safety of food supply and preservation of endangered wildlife will direct major changes in the future of IPM. IPM must be viewed as a sound investment for preserving or protecting natural resources. Traditionally, IPM represented a reaction to crises often created by traditional pest control approaches. This thought process must change if IPM is to move forward into public awareness and acceptance. IPM's future will depend upon how communication flows between the scientific community, public and decision makers.

SAQ 5

i) Describe the role of village women in IPM.

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ii) Write about the role of NGOs in promoting IPM.

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19. 9 SUSTAINABLE AGRICULTURE AND IPM

Sustainable agriculture is a system of agriculture that is ecologically, economically, and socially viable, in short as well as in long term. Rather than standing for a specific set of farming practices, sustainable agriculture represents the goal of developing a food production system that:

- yields plentiful, high-quality food and other agricultural products,
- does not deplete or damage natural resources (such as soil, water, wildlife, fossil fuels, or the germplasm base),
- promotes the health of the environment,
- supports a broad base and diversity of farms and the health of rural communities,
- depends on energy from the sun and on natural biological processes for fertility and pest management and
- can last indefinitely.

IPM and sustainable agriculture share the goal of developing agricultural systems that are ecologically and economically sound. IPM may be considered a key component of a sustainable agriculture system.

A premise common to IPM and sustainable agriculture is that a healthy agroecosytem depends on healthy soils and managed diversity. One of the reasons modern agriculture has evolved into a system of large monocultures is to decrease the range of variables to be managed. However a system with few species, much like a table with too few legs, is unstable.

19. 10 IPM FORUM–A GROUP PROMOTING SUSTAINABLE AGRICULTURE IN DEVELOPING COUNTRIES

The IPM Forum is an affiliation of interested individuals and organisations with the aim of promoting the wider implementation of IPM in developing countries, as a means of reducing losses due to pests and diseases, while preserving environmental health and human well-being.

The specific objectives of the IPM Forum include:

i) bringing together the key organisations and interest groups which influence IPM implementation to improve communication and cooperation between them and thus support the regional, national and international structures necessary to overcome implementation obstacles;
ii) providing a forum for the exchange of information and also preparing promotional material to achieve improved communication of IPM-related information;
iii) facilitating the creation of structures which will enhance global integration of agricultural resource use;
iv) strengthening the capability of developing countries and agencies to implement IPM;
v) promoting the efficient use of limited resources, and
vi) awareness and interest in the IPM concept.

The aim of the IPM Forum is to help poor farmers in developing countries by strengthening the capacity of Non-Governmental Organisations (NGOs) to promote and implement appropriate integrated pest management (IPM) approaches and techniques, as a component of sustainable agricultural development at the farm level.

In order to do this, it provides a forum in which different IPM interests can interact and can help NGOs to develop support initiatives in selected target countries, which will:

- increase NGOs' awareness and interest in IPM for sustainable agricultural development;
- increase NGOs' capacity to promote and implement IPM;
- enhance and sustain collaboration, mutual support and information exchange on IPM between NGOs themselves, and between NGOs and other IPM institutions operating in the target countries;
- improve NGOs' access to overseas IPM resources and support (e.g. training, information, research and technical backstopping), and strengthen NGOs' contribution to the agendas of the institutions providing these resources;
- establish a sustainable institutional framework through which NGOs can continue to improve their IPM capacity, raise awareness, network, access external resources and influence policy etc. after the completion of IPM Forum support;

IPM Forum is a member of the **IPM Information Partnership**, which is an evolving partnership of international and regional non-profit organisations with a specific interest in the use of IPM in sustainable development, with the aim of presenting a common integrated approach to publishing information on the Internet.

SAQ 6

What are the specific objectives of IPM Forum?

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19.11 SUMMARY

- IPM is the way of future pest management. Therefore, the pace of generation of human resources through training of plant protection extension functionaries as well as training of farmers need to be given greater thrust.
- Insect pests can be effectively controlled through integration of resistant cultivars, natural enemies and selective pests.
- Emphasis may be given to systems approach for quarantine security against exotic pests for safeguarding the agricultural trade.
- Pest management programmes should be based on farmer/ public participation.
- There is a need to establish and popularize plant health clinics for rapid and efficient solutions to pest problems.
- Pest modeling and remote sensing and advancement in information technology will change the approach towards pest management.
- Involvement of women, voluntary organisations and NGOs in IPM would really bring revolution in society.
- Use of new control methods, emphasis on weed IPM and IPM certification will be emphasised.
- IPM and sustainable agriculture share the goal of developing ecologically and economically sound agricultural system.

19.12 TERMINAL QUESTIONS

1. What do you understand by 'holistic approach' in IPM?

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2. What is the basic concept of Plant Health Clinics?

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3. Discuss the future strategies in IPM.

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4. What are the similarities between IPM and sustainable agriculture?

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19.13 ANSWERS

Self-assessment Questions

1. Refer Sec. 19.4
2. Refer Sec. 19.5
3. See Fig 19.1
4. i) and (ii) Refer Sec. 19.7
5. i) and (ii) Refer Sec. 19.8
6. Refer Sec. 19.10

Terminal Questions

1. Refer Sec. 19.3
2. Refer Sec. 19.7
3. Refer Sec. 19.8
4. Refer Sec. 19.9

GLOSSARY

Agro-ecosystem analysis (AESA): It is an approach, which can be gainfully employed by group of farmers for decision making in IPM. The basic components of AESA are:- a) plant health at different stages, b) compensation abilities of the plant, c) pest and defender population, d) soil condition, irrigation status etc., e) weather conditions, f) past experience of the farmer in the situation, g) other investment opportunities.

Are-wide IPM: IPM tactics implemented across large geographic regions to suppress pest populations at the regional rather than field scale; requires co-operation among multiple agencies.

Geographic information systems (GIS): Computer-based system used for the collection, storage, and analysis of spatial data, including the ability to generate maps.

Global positioning system (GPS): A system that uses triangulation to multiple satellites to allow a user to determine their geographic location with great accuracy.

Pest control advisor (PCA): A person who makes agricultural pest control recommendations, or any person who holds her/himself out as an authority or general advisor on any agricultural use, or solicits services or sales.

Pest control operator (PCO): A person or firm that is officially licensed to apply pesticides, or use any method or device for hire, to control pests or prevent, destroy, repel, mitigate, or correct any pest infestation or disorder.

Pesticide dealer: Any distributor or retailer that: sells pesticides for agricultural use, methods and devices for the control of agricultural pests, or soliciting pesticide sales.

Precision farming (site-specific farming): A farm management technology that uses within-field spatial variability to guide application of management actions. Utilizes GPS and GIS systems to allow application as per site-specific requirements.

FURTHER READING

1. Concepts in Integrated Pest Management. Robert F. Norris, E.P. Caswell-Chen and Marcos Kogan (2003). Pearson Education, Inc., New Jersey.

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4. Biological Pest Suppression. Gautam, R.D. (1994). Westvill Publishing House, New Delhi.

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AND THE FINAL WORD

An additional 1 billion people will be added to the planet earth in the next 10 years or so. To feed these extra mouths, at least 2000 million tons of additional food grains will be needed. As we progress towards intensification of agriculture for achieving the additional production, the natural resources for achieving the production goals are shrinking. At the same time, the pressure of biotic stresses (pests, diseases and weeds) will be multiplied, causing enhanced losses. It has been amply demonstrated that IPM approach can greatly reduce the losses which are inflicted to our harvests. The expanding success in IPM achieved in some countries demonstrates that IPM is a strategy, which can be applied for enhanced, sustained, and equitable agricultural production. However, this calls for appropriate institutional and financial resource and a conducive policy environment.

The future of IPM will likely seek a balance between the economics of production and environment stewardship. Future IPM programmes will extend well beyond agriculture into the agriculture: urban interface. It is perspective asking consultants to integrate planning and implementation over a longer time frame, on both micro and macro scales, and more from an ecological perspective. The greatest challenge that IPM consultants face is the sustainable management of agricultural production system in conjunction with preservation of natural resources. Policy makers interested in effective crop protection have to balance the social benefits and costs of pesticide use, and to do this, better knowledge about pest losses is required. Options for improving pest management include the development of pesticides that are more benign than current products. IPM promises to be the most pragmatic approach. Governments not only need to support IPM but also regulate hazardous pesticide use. Genetically engineered crops offer great promise but need to be monitored. Developing countries will have to invest in their own technological capacities or enter into sharing arrangements with corporations. Finally, ways to encourage corporate responsibility will have to be addressed.

Standard abbreviations

A) Units and general abbreviations

a.i.	active ingredient
^0C	degrees Celsius
cm	centimeter
cv.	cultivar
e.c.	emulsifiable concentrate
g	gram
h	hour
ha	hectare
h.v.	high volume
i.r.	infra-red
kg	kilogram
km	kilometre
£	pound sterling
l	litre
LC_{50}	median lethal concentration
LD_{50}	median lethal dose
l.v.	low volume
m	metre
mg	milligram
min	minute
ml	millilitre
mm	millimetre
pH	hydrogen ion concentration
post-em	post-emergence
ppm	parts per million
pre-em	pre-emergence
RH	relative humidity
s	second
sp.	species
spp.	species (plural)
ssp.	subspecies
sspp.	subspecies (plural)
$	dollar
u.l.v.	ultra-low volume
u.v.	ultra-violet
var.	variety
vol.	volume
w.p.	wettable powder
w/w	weight for weight

B) Miscellaneous abbreviations

BPH	Brown Planthopper of rice
BC	Biological control
BSI	British Standards Institute
Cda	Controlled droplet application
GV	Granulosis virus
IPM	Integrated pest management
EAG	Electroantennagram
OC	Organochlorine compounds
OP	Organophosphorous compounds
NPV	Nuclear Polyhedrosis virus
PM	Pest management
SIRM	Sterile insect release method

C) Organizations

ADAS	Agricultural Development and Advisory Service (formerly NAAS), MAFF, UK
ARC	Agricultural Research Council, UK
AVRS	Asian Vegetable Research Station, Taiwan
BM (NH)	British Museum (Natural History), London, UK
CAB	Commonwealth Agricultural Bureaux, Slough, UK
CIATG	Centre for International Tropical Agriculture, Cali, Colombia
CIBC	Commonwealth Institute of Biological Control (headquarters), West Indies
CIE	Commonwealth Institute of Entomology, London, UK
CIP	International Potato Centre, Lima, Peru
CIH	Commonwealth Institute of Helminthology, St Albans, UK
CMI	Commonwealth Mycological Institute, Kew, UK
COPR	Centre for Overseas Pest Research, London, UK
CSIRO	Commonwealth Scientific and Industrial Research Organization, Canberra, Australia
EAAFRO	East African Agricultural and Forestry Research Organization, Nairobi, Kenya
EPA	Environmental Protection Agency, Washington, USA
EPPO	European Plant Protection Organization, Paris, France
FAO	Food and Agricultural Organization of the United Nations, Rome, Italy
GCRI	Glasshouse Crops Research Institute, UK

IAC	International Agricultural Centre, Wageningen, Netherlands
ICRISAT	International Crops Research Institute for the Semi-arid Tropics, Hyderabad, India
IITA	International Institute of Tropical Agriculture, Ibadan, Nigeria
IRRI	International Rice Research Institute, Manila, Philippines
ICIPE	International Centre for Insect Physiology and Ecology, Nairobi, Kenya
MAFF	Ministry of Agriculture, Fisheries and Food, UK
MARDI	Malaysian Agricultural Research and Development Institute, Selangor, Malaysia
NAAS	National Agricultural Advisory Service (now ADAS), UK
NAPPO	North American Plant Protection Organisation, USA
NVRS	National Vegetable Research Station, Wellesbourne, UK
ODM	Ministry of Overseas Development, UK
PBI	Plant Breeding Institute, Cambridge, UK
PESTDOC	Derwent Pooled Pesticidal Literature Documentation
TPRI	Tropical Products Research Institute, London, UK
US AID	United States Aid for International Development, USA
USDA	United States Department of Agriculture, USA
WHO	World Health Organization, Geneva, Switzerland
WICSCBS	West Indies Central Sugarcane Breeding Station, Barbados, West Indies
WRO	Weed Research Organization, Oxford, UK