IJAZ AHMAD RAO, in the first of a series of two articles, explores the risks and benefits of IPM approach in Pakistan.

The integrated Pest Management

Integrated Pest Management (IPM) is a sustainable approach to managing pests by combining Biological, Cultural, Physical and Chemical tools in a way that minimises economic, health and environment risks. It is a systematic approach to pest management, which combines a wide variety of crop production practices with careful monitoring of pests and their natural enemies.

In the past 25 years, there has been growing concern regarding the environmental impact that the heavy use of chemical inputs in agricultural production might have on the environment. Chemical inputs present a dilemma for both farmers and society because these inputs seem to have positive effects on the quantity and quality of farm products, while at the same time imposing costs on farmers, as well as on society. The use of synthetic pesticides in crop protection programs around the world has resulted in an imbalance of the environment, pest resurgence, resistance of pests to pesticides, and lethal effects on non-target organisms.

The IPM approach is a perfect way of managing agriculture. It involves the use of cultural practices to reduce pest outbreak, natural enemies to reduce pest population. Surveillance and forecasting to monitor pests outbreak results in satisfactory crop growth and high yield. But the main concern at this point is the implementation and management of the IPM approach. Especially with a farming community that can knowledge and implemented.

This means that farmers will have to spend more time observing and interpreting the potential impact of pest populations. The extra work can be offset by the resulting benefits from reduced costs of chemicals inputs, cleaner environment, and decreased resistance problems.

The on-farm adoption of such a complex scheme requires a substantial educational investment by society, and government institutes.

IPM strategies

The first and most crucial step is to identify the pest. The effectiveness of subsequent pest management depends on correct identification. Misidentification of the pest may be harmful and cost time and money. After a pest is identified, appropriate and

injury level (EIL) is the pest population that inflicts crop damage greater than the cost of control measures. Because growers will generally want to act before a population reaches EIL, IPM programmes use the concept of an economic threshold level (ETL or ET), also known as an action threshold. The ETL is closely related to the EIL, and is the point at which suppression tactics should be applied in order to prevent pest populations from increasing to injurious levels.

In practice, many crops have no established EIL's or ETL's, or the EIL's that have been developed may be static over the course of a growing season and do not reflect the changing nature of an agricultural ecosystem. For example, a single cutworm can do more damage to an emerging cotton plant than to a plant that is six weeks old. Clearly,

should also be noted. Record-keeping is simply a systematic approach to learning from experience.

Another thing that should be kept in mind is that a successful IPM program takes time, money, patience, short and long-term planning, flexibility, and commitment. The pest manager must spend time on self-education and on making contacts with extension and research personnel to discuss his or her farming operation. This will aid in developing an integrated plan for the farm. In addition, certain IPM strategies, such as increasing beneficial insect habitat, may take more than a year to show results.

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The first and most crucial step is to identify the pest. The effectiveness of subsequent pest management depends on correct identification. Misidentification of the pest may be harmful and cost time and money. After a pest is identified, appropriate and effective management depends on knowing answers to a number of questions. These may include finding out what the host and non-host crops of this pest are; when injury level (EIL) is the pest population that inflicts crop damage greater than the cost of control measures. Because growers will generally want to act before a population reaches EIL, IPM programmes use the concept of an economic threshold level (ETL or ET), also known as an action threshold. The ETL is closely related to the EIL, and is the point at which suppression tactics should be applied in order to prevent pest populations from increasing to injurious levels.

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technology.

IPM typically takes into consideration many more factors than does conventional pest management. The benefits include reduced costs, reduced on-farm and off-farm environmental impacts and more effective pest management.

Various IPM strategies cannot only help to prevent pest problems from developing, but can also reduce or eliminate the use of chemicals in managing problems that do arise. Results of 18 economic evaluations of IPM on cotton showed a decrease in production costs of seven percent and an average decrease in pesticide use of 15 per cent.

By carefully monitoring pest populations and the crop in the field, the farmer using IPM institutes management measures when specific conditions indicate that they are needed to attain his/her individual goals for the crop. In other words, the farmer determines how serious a problem is and what management options are available before action is taken. This contrasts with routine "calendar" preventive chemical treatments "just in case", or treatments in response to any pest presence regardless of how small the infestation.

Using IPM requires the grower to understand how the crop grows, how different pest populations develop, what the control options are in each specific pest management case, and what the return on investment of these control options is along with the potential impact on the environment and health. To attain the benefits of an IPM programme, more information must be gathered, integrated into a body of

the pest emerges or first appears; where it lays its eggs and in the case of weeds, where the seed source is; where, how, and in what form the pest overwinters and if the cropping system can be altered to make life more difficult for the pest and easier for its natural controls.

Monitoring (field scouting), and economic injury and action levels are used to help answer these and additional questions.

Monitoring is the second step of a good IPM strategy. Monitoring involves systematically checking the fields for pests at regular intervals and at critical times to gather information about the crop, pests, and natural enemies. Sweep nets, sticky traps, and pheromone traps can be used to collect insects for both identification and population density information. Leaf counts are one method for recording plant growth stages. Square-foot or larger grids laid out in a field can provide a basis for comparative weed counts. Records of rainfall and temperature are sometimes used to predict the likelihood of disease infections.

Specific scouting methods have been developed for many crops. The more often a crop is monitored, the more information the grower has about what is happening in the fields. Monitoring activity should be balanced against its costs. Frequency may vary with temperature, crop, growth phase of the crop, and pest populations. If a pest population is approaching economically damaging levels, the grower will want to monitor more often to keep a close eye on population increases or decreases.

The next step in an IPM strategy is determining the Economic injury and action levels. The economic

example, a pest that attacks the fruit or vegetable will have a much lower ETL (that is, it must be controlled at lower levels) than a pest that attacks a non-saleable part of the plant. The exception to this rule is an insect or nematode pest that is also a disease vector. Depending on the severity of the disease, the grower may face a situation where the ETL for a particular pest is zero, i.e., the crop cannot tolerate the presence of a single pest of that particular species because the disease it transmits is so destructive.

Some special considerations

Some special considerations need to be kept in mind. One of these is cosmetic damage and aesthetics. Consumer attitudes toward how produce looks is often a major factor when determining a crop's sale price. Cosmetic damage is an important factor when calculating the EIL, since pest damage however superficial, lowers a crop's market value. Growers selling to a market that is informed about IPM or about organically-grown produce may be able to tolerate higher levels of cosmetic damage to their produce.

Another aspect that should be kept in mind is record keeping. Monitoring goes hand in hand with record-keeping, which forms the collective "memory" of the farm. Records should not only provide information about when and where pest problems have occurred, but should also incorporate information about cultural practices (irrigation, cultivation, fertilization, mowing, etc.) and their effect on pest and beneficial populations. The effect of non-biotic factors, especially weather, on pest and beneficial populations

Tools for Pest Management

There are five major tools for pest management. One of these is Management options. IPM options may be considered proactive or reactive. Proactive options are those that permanently lower the carrying capacity of the farm for the pest. The carrying capacity is made up of factors like food, shelter, natural enemies complex, and weather, which contribute to the reproduction and survival of a species. Cultural controls are generally considered to be proactive strategies.

The second set of options are more reactive. This simply means that the grower reacts to pests with some type of short-term suppressive action. Reactive methods generally include biological controls, mechanical and physical controls, and chemical controls.

Cultural controls

Another tool is cultural controls. Cultural controls are related to growing a crop. They have significant positive and negative effects on pest and disease management. The aim is to choose cultural practices that make the farm environment less favorable for the survival and reproduction of pests. Maintaining and increasing biological diversity of the farm system is of primary importance. Decreased biodiversity tends to result in agroecosystems that are unstable and prone to recurrent pest outbreaks and many other problems. Systems high in biodiversity tend to be more stable. There are many ways to increase biodiversity on a farm.

The sustainable management of farm soils is one way to increase diversity. Healthy soils with a diverse community of organisms support plant health and nutrition better than those deficient in organic matter and low in species diversity. Soils rich in organic matter tend to suppress plant pathogens. In addition, it is estimated that 75 per cent of all insect pests spend part of their life cycle in the soil. Many of their natural enemies are also found in the soil. For example, larvae of one species of blister beetle consume about 43 grasshopper eggs before maturing. Both are found in the soil. (Unfortunately, although blister beetle larvae can help reduce grasshopper populations, the adult beetles can be a serious pest for many vegetable growers.) Overall, a healthy soil with a diversity of beneficial organisms and high organic matter content helps maintain pest populations below their economic thresholds.

Genetic diversity of a particular crop may be increased by planting more than one cultivar. Species diversity of the associated plant and animal community can be increased by allowing trees and other native plants to grow in fence rows or water ways, and integrating livestock into the farm system. Use of the following cropping schemes are additional ways to increase species diversity.

– (To be continued)