Plant protection

Cultural

Cultural Control:

"Cultural control is the deliberate manipulation of environment to make it less favorable for pests by disrupting their reproductive cycles, eliminating their food, or making it more favorable for their natural enemies"
Cultural control is an important component of Integrated Pest Management (IPM). It is one of the oldest and most effective methods of pest suppression. Cultural control methods are widely used in pest management systems. These methods comprise of regular gardening operations, the purpose is to destroy pests or to prevent them from causing injury to gardens. Examples Include cultivated techniques, adjustment of planting dates, choice of cultivars (resistant varieties), general crop hygiene, manipulation of harvesting procedures, crop rotation, crop covers, etc. Below are descriptions of some of these methods to help you choose ways to help deter pests in your garden.

Variety Selection:

Choose resistant plant varieties.
Planting Dates:

Crop Rotation:

Crop rotation can be very important in fighting disease and pests. Rotate crops year to year. Do not plant the same things in the same place year after year

Trapping Crops:

Some pests prefer certain plants to others. By planting sacrificial plants, you can keep away pests from the plants you want.

Row Covers:

A floating row cover is a physical barrier used to protect crops, particularly annual vegetables. Floating row covers should be used when the damage is being done by the insect larvae. It prevents the adult flying insect from landing and depositing eggs on the plants. The floating row cover should be placed over the entire crop at transplanting or seeding time and it must cover the plants

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Chemical

Pesticide application has become more complex over the past several years. The number of different kinds of pesticides available for use has increased. Effects on wildlife and the environment are now known to be important considerations. Highly toxic pesticides require special equipment and safety measures. Pesticide applicators, therefore, need to know more about safety and proper use than ever before. New applicators must know to protect the environment from pesticide contamination, the proper handling of pesticides, and protection from personal injury.

Types of Pesticides

A pesticide is any chemical which is used by man to control pests. The pests may be insects, plant diseases, fungi, weeds, nematodes, snails, slugs, etc. Therefore, insecticides, fungicides, herbicides, etc., are all types of pesticides. Some pesticides must only contact (touch) the pest to be deadly. Others must be swallowed to be effective. The way that each pesticide attacks a pest suggests the best way to apply it; to reach and expose all the pests. For example, a pesticide may be more effective and less costly as a bait, rather than as a surface spray.

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Insecticides

Insecticides are chemicals used to control insects. Often the word "insecticide" is confused with the word "pesticide." It is, however, just one of many types of pesticides. An insecticide may kill the insect by touching it or it may have to be swallowed to be effective. Some insecticides kill both by touch and by swallowing. Insecticides called **Systemics** may be absorbed, injected, or fed into the plant or animal to be protected. When the insect feeds on this plant or animal, it ingests the systemic chemical and is killed.

Broad Spectrum. Insecticides vary in the numbers of different kinds of insects they kill. Some insecticides kill only a few kinds of insects. Sometimes you can choose these insecticides when you wish to kill only one insect pest and not other beneficial insects in the area. Many insecticides are general purpose or wide range killers. These "broad spectrum" pesticides are used when several different kinds of insects are a problem. One chemical can kill them all. No broad spectrum insecticide kills all insects; each varies as to the kinds of insects it controls.

Narrow Spectrum. While many insecticides are broad spectrum, killing a wide variety of animals by attacking a system common to all, such as the nervous system, a new group of insecticides are much more selective. The chitin inhibitors only affect animals with chitin in their exoskeleton (i.e. insects). Growth regulators are even more specific. They affect certain groups of species that have a particular hormone. Finally, pheromones are the most restrictive because they react with only one species or one sex of a single species.

Chitin synthesis inhibitors interfere with the development and molting of immature insects causing their death. Chitin is the primary structural chemical in an insects body wall. An immature insect treated with a chitin inhibitor dies the next time it attempts to molt.

Insect growth regulators or IGRs mimic the action of an insect's naturally occurring juvenile hormone. They interfere with certain normal processes and prevent immature insects from completing development into normal reproductive adults. The effects of IGRs on insects include abnormal molting, twisted wings, loss of mating behavior, and sometimes death to embryos in eggs. IGRs attack a growth process found only in insects, thus there is a great margin of safety for humans and other vertebrates. However, one disadvantage is that growth regulators act slowly, since they do not kill the insect until it molts into an adult.

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Pheromones

Pheromones are naturally produced chemicals used by animals to communicate to each other. There are three basic types of pheromones. Aggregation pheromones attract many individuals together, for example, a site where food may be plentiful. Sex pheromones are used by one sex of a species to attract a mate. Trail pheromones are deposited by walking insects, such as ants, so that others can follow. Synthetic pheromones produced in laboratories mimic these natural chemicals. They are used to attract pest insects into traps, disrupt mating, and monitor populations of insects. Because they do not kill insects, they are often not considered to be pesticides.

Short Term vs. Residual. Insecticides also vary in how long they last as a killing agent. Some break down almost immediately into nontoxic by -products. These "short term" chemicals are very good in situations where the insects do not return or where long-term exposure could injure non-target plants or animals. For example, short-term insecticides are often used in homes and dwellings where people and domestic animals might be exposed. Other insecticides remain active killers for a fairly long period of time. These "residual" pesticides are very useful when the insects are a constant problem and where they will not be an environmental and/or health hazard. For example, residuals are often used for fly control in livestock buildings or for termite control in wooden used for fly control in livestock buildings or for termite control in wooden structures.

Miticides and Acaricides

Miticides (or Acaricides) are chemicals used to control mites (tiny Insecticides spider-like animals) and ticks. The chemicals usually must contact the mites or ticks to be effective. These animals are so numerous and small, that great care must be used to completely cover the area on which the mites live. Miticides are very similar in action to insecticides and often the same pesticide kills both insects and mites. The terms "broad spectrum," "short term," and "residual" are also used

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Fungicides

Fungicides are chemicals used to control the fungi which cause molds, rots, and plant diseases. All fungicides work by coming in contact with the fungus, because fungi do not "swallow" in the normal sense. Therefore, most fungicides are applied over a large surface area to try to directly hit every fungus. Some fungicides may be systemic in that the plant to be protected may be fed or injected with the chemical. The chemical then moves throughout the plant, killing the fungi. to describe miticides.

Protectant vs. Eradicant. There are two basic approaches in the use of fungicides. One is designed to prevent the plant from getting the disease. These fungicides are used as "protectants" and are similar in purpose to polio and smallpox vaccinations for humans. They are applied before the disease gets a start. This type of fungicide is very useful when a particular disease or group of diseases are likely to attack a plant or crop, year after year. Protectants, for example, have often been used as a routine precaution on fruit and vegetable crops.

Most protectant fungicides are fungistatic. This means they prevent or inhibit fungal growth. Once the fungistatic action ceases, the controlled fungus may grow again or produce spores. Thus, a protectant fungicide may have to be applied at regular intervals to continue the protection from infection.

The other type of fungicide kills the disease after it appears on (or in) the plant. These fungicides, called "eradicants," are like penicillin or other antibiotics which cure diseases in humans after the sickness appears. Eradicants are less common than protectants because once the fungus is established in a plant, it is often difficult to destroy. Eradicants are often used when protectants aren't available, aren't applied in time, or are too expensive. Eradicants are also applied when the disease appears unexpectedly on a plant or in an area. For example, a common use is on fruit and vegetables when the protectant spray wasn't applied on time to prevent infection. Eradicants are also used by orchardists in combatting diseases of fruit trees, such as apple scab.

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Herbicides

Herbicides are chemicals used to control unwanted plants. These chemicals are a bit different from other pesticides because they are used to kill or slow the growth of some plants, rather than to protect them. Some herbicides kill every plant they contact, while others kill only certain plants.

Nonselective herbicides are toxic to all plants. These are often used when no plants are wanted in an area. For example, nonselective herbicides could be used for clearing under guardrails or for total control of weeds in industrial areas.
Selective herbicides kill some plants with little or no injury to other plants. Usually selective types will kill either broadleaved plants or grassy

plants. Usually selective types will kill either broadleaved plants or grassy plants. These are useful for lawns, golf courses or in areas with desirable trees. Some very selective herbicides may kill only certain plants in a group; for example, crabgrass killers on lawns.

Preplanting vs. Preemergence vs. Postemergence. The timing of an herbicide application is important. Care must be used to get the job done effectively without injuring desirable plants. The directions on the label tell you when to apply the herbicide for best results. **Preplanting** treatments are made before the crop is planted. These chemicals may be used in seed beds or incorporated into the soil before planting.

Any treatment made before the crop and weed appears is called **preemergence**. The application may be made before both the crop and weeds appear, or after the crop appears but before the weeds appear. The label or directions will state "preemergence to the crop," "preemergence to the weeds," or "preemergence to both crop and weeds."

When the herbicide treatment is made after the crop or weeds appear, it is called **postemergence**. Postemergence applications must be very selective. They must control the weeds but leave the crop unharmed. Often, the chemical will be applied postemergent to the crop but preemergent to the weeds.

Growth Regulators and Harvest Aids

A plant growth regulator (or plant regulator) increases, decreases or changes normal growth or reproduction in a plant. Fertilizers and other nutrients are not included. Some growth regulators are used to move up or move back the normal harvest date for the crop. Others are used to obtain better quality and/or yield of the crop. Electric power utilities could use growth regulators to slow the growth of a tree threatening power lines, thus saving the tree from being cut.
Defoliants and desiccants are pesticide materials generally referred to as harvest aids. A defoliant causes the leaves of a plant to drop off early, but does not kill the plant. A desiccant draws moisture from a plant, killing the plant foliage.

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Rodenticides

Rodenticides are chemicals used to control rats, mice, bats and other rodents. Chemicals which control other mammals, birds, and fish are also grouped in this category by regulatory agencies. Most rodenticides are stomach poisons and are often applied as baits. Even rodenticides which act by contacting the pest are usually not applied over large surfaces because of the hazard to domestic animals or desirable wildlife. They are usually applied in limited areas such as runways, known feeding places, or as baits.

Nematicides Molluscicides Repellents

Nematicides are chemicals used to control nematodes. Nematodes are tiny hir-like worms, many of which live in the soil and feed on plant roots. Very few of these worms live above ground. Usually, soil fumigants are used to control nematodes in the soil. However, a few contact insecticides and fungicides are also effective against these tiny worms.

Molluscicides are chemicals used to control snails and slugs. Usually the chemicals must be eaten by the pest to work. Baits are often used to attract and kill snails or slugs in an area.

A **repellent** is a pesticide that makes a site or food unattractive to a target pest. They are registered in the same way other pesticides are and must be used according to the label. Insect repellents are available as aerosols and lotions and can be applied to skin, clothing, or plants to repel biting and nuisance insects. Vertebrate repellents are available as repel biting and nuisance insects. Vertebrate repellents are available as concentrates to be mixed with water, powders, and granules. They can be sprayed or painted on nursery crops, ornamental plantings, orchards, vineyards, vegetables, and seeds. Repelling deer, dogs, birds, raccoons, and others can protect sites from damage.

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Handling and mixing

Take precautions to avoid exposure when wettable powders, dust or granules are added to the sprayer tank. When you add materials to the sprayer tank, air is forced out and carries some of the pesticide particles with it. If the solvent in the pesticide is toxic or flammable (or both), be sure the mixing operation is performed in an area where ventilation is adequate. The addition of small amounts of materials such as emulsifiers or thickeners will drastically alter the physical properties of the spray solution. Therefore, the applicator should check the pesticide label to be sure she or he is operating according to instructions.

Many types of solvents, some of which are chlorinated, are used in the pesticide formulation processes. Vapors of chlorinated solvents are very dangerous to breathe. They can cause a "high," dizziness, or even unconsciousness. They also can cause permanent damage to the kidney, liver, and nervous system in workers exposed to the vapours for a prolonged time.

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Field applications

Always be aware of the meteorological conditions existing during pesticide application. Loss of spray from a treated area increases during high winds or low humidity. Usually, low wind and high humidity conditions are most prevalent before 10 a.m. and after 6 p.m.

Avoid spraying near beehives, lakes, streams, pastures, houses, schools, playgrounds, hospitals or sensitive crops whenever possible. If these areas must be sprayed, do not spray during windy or low humidity conditions and always spray downwind from the sensitive area.

If possible, begin spraying in the end of the field that will permit any drift from the sprayer to be blown away from the next area to be treated. Likewise with airblast sprayers; direct the air blast from the sprayer with the prevailing wind and away from the next area to be treated. These two procedures will minimize the amount of pesticide that will be blown onto the operator. Remember, these are only guidelines and are intended to supplement the good judgment of the pesticide operator.
To minimize drift hazards, use the lowest pressure possible, the lowest boom height and the largest spray tips, and add thickeners (if the pesticide label permits) in areas where drift is likely to be particularly hazardous.

Be alert for nozzle clogging and changes in nozzle patterns. If nozzles clog or other troubles occur in the field, shut the sprayer off and move to an unsprayed area before dismounting from the sprayer to work on it. If nozzles must be cleaned in the field, use a toothbrush or a toothpick for cleaning - never a metal object. A metal object can damage the orifice in the spray tip and significantly alter the spray pattern. We recommend carrying extra spray tips on the sprayer so that plugged tips can be replaced with clean ones. Never try to unclog a nozzle by blowing through it.

Check the pesticide label for re-entry and preharvest intervals. The re-entry interval is the elapsed time after a pesticide application before workers can safely re-enter a field. The preharvest interval is the elapsed time between a pesticide application and harvest of the crop.

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Equipment cleaning and storage

Trained personnel should thoroughly clean the inside and outside of mixing, loading, and application equipment immediately after use. People who clean contaminated equipment should wear proper protective clothing, including rubber boots, a rubber apron, goggles, and possibly a respirator. A specific area should be designated for cleaning operations. Use a rack or cement apron with a well-designed sump to catch contaminated wash water and pesticides. The cleanup process is important because many chemicals will rapidly corrode some metals and may also react with succeeding chemicals, thus possibly causing a loss of effectiveness.

To clean a sprayer, mix about two pounds of detergent per 40 gallons of water in the tank. Circulate this mixture throughout the bypass or agitator nozzles for 30 minutes and then drain, allowing some solution to pass through the booms or nozzles. If phenoxy herbicides such as 2,4-D, 2,4,5-T, or brush killer were used in the sprayer, rinse with an ammonia or charcoal solution.

To make an ammonia rinse, fill the tank one-third to one-half full and add two quarts of household ammonia per 25 gallons of water. Circulate the solution and allow a small amount to flow through the nozzles. Allow the remaining solution to stand overnight to neutralize any herbicide remaining in the equipment. Then pump the solution through the nozzles. After rinsing with detergent or ammonia, flush thoroughly with clean water.

When the sprayer is to be stored for a prolonged time, add one to five gallons of lightweight oil (about one gallon of oil per 40 gallons of water) before the final flushing. As the water is pumped from the sprayer, the oil will leave a protective coating on the inside of the tank, pump and plumbing.

To prevent corrosion, remove nozzle tips and screens and store them in a can of light oil, such as diesel fuel or kerosene. Follow directions in the owner's manual regarding the proper procedures for storing engine-equipped sprayers. Before storing the sprayer, all lines, hoses, valves and the pump should be inspected for damaged parts or leaks. Damaged parts should be replaced before the sprayer is stored.

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Storage of chemicals

Store pesticides in a locked and posted facility where children or other untrained people cannot get to them. Read the labels on pesticide containers for correct storage procedures. Select a storage site high enough that damage from flooding will be unlikely and downwind and downhill from sensitive areas such as houses, play areas and ponds. Pesticide storage facilities should also be located away from homes and livestock facilities to avoid or minimize contamination.

Pesticide and expended pesticide containers are best stored in a separate building, room, or enclosure, depending on the size of the pesticide inventory. The storage area should be on the first floor to minimize contamination from a possible leaky container, and the storage area must keep the pesticides dry, cool and out of direct sunlight. The latter requirements are necessary because some pesticides are rendered useless if they become too hot or damp, if they freeze, or if they are exposed to ultraviolet radiation from the sun.

Do not store pesticides near food for human consumption, animal feed, fertilizer, seed, veterinary supplies, or other stored products. To prevent contamination or to avoid accidentally using the wrong pesticide, store different pesticides in separate locations within the storage area.

Store pesticides only in the original container, with the label plainly

Store pesticides only in the original container, with the label plainly visible. Never store pesticides in anything used as a food or drink container, even for a short time. Storage of pesticides in such containers is a common cause of accidental poisoning.

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Preparing the sprayer

Before a spraying operation is started, rinse out the sprayer; remove and clean all nozzles, nozzle screens and strainers. Make sure strainers and nozzle screens are 50 mesh or larger when wettable powders are used. Check all lines, valves, seals and the tank after filling the sprayer with water and during calibration to be sure there are no leaks in the spray system. For the operator's safety, replace weather-cracked or worn hoses. Adjust the nozzle height and spacing as suggested by the nozzle manufacturer or as specified on the pesticide label. These requirements differ for a given pest or crop.

Only water that is clean enough should be used in the sprayer. A small amount of silt or sand in the water rapidly wears pumps and other parts of the sprayer system.

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Disposal of pesticides and containers

To avoid having to dispose of a tank load of the wrong pesticide, check out the job carefully before selecting the pesticide. After you have selected the proper pesticide, mix only enough for the particular job. Preventing a pesticide surplus is the best way to prevent a disposal problem.

Despite your best efforts, however, you cannot always avoid surplus pesticides, and you must take steps to dispose of them properly.

If you mix too much pesticide for a job, try to find other areas with the same pest problem and use any extra tank mix or rinse water on these areas. In some cases, small amounts of surplus pesticide can be diluted and reapplied to the treated area. Take extreme care to prevent excessive residues, especially with herbicides, by making sure that the total application rate does not exceed the maximum rate for which the pesticide is labeled.

To dispose of large quantities of pesticide, contact nearest krishibhavan for assistance in properly disposing of excess pesticides in an environmentally safe manner.

So-called empty pesticide containers are not really empty. They still contain small amounts of pesticides, even after they have been properly rinsed. All containers, regardless of their type, should be rinsed three times before disposal. The rinse water should be dumped into the sprayer tank. Otherwise, the rinse water must be treated as a surplus pesticide and disposed of properly. Rinse water should never be dumped on the ground. Use the following rinse-and-drain procedure to prepare containers for disposal:

Empty the container into the spray tank and drain in a vertical position for 30 seconds.

Refill the container one-fifth to one-fourth full with rinse water.

Rinse thoroughly, pour into the spray tank and drain in a vertical position for 30 seconds.

Repeat steps 2 and 3 until the container has been rinsed three times. Empty the container into the spray tank and drain in a vertical position for 30 seconds.
Rinsed containers should not be used for any other purpose.

Disposal of any pesticide container or pesticide related waste by open

Disposal of any pesticide container or pesticide-related waste by open dumping or open burning is illegal.

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Bio control

The biological control of pests involves using natural enemies of the pest to control it - instead of chemical agents like insecticides and herbicides. Not only should this be safer for the environment, but - once established - the natural enemies might be able to sustain their population avoiding the need for future treatments.

Most of the species that we consider pests are plants ("weeds") or animals (especially insects) that have invaded a new habitat without being accompanied by the natural enemies that kept them in check in their original home. With increasing international travel and trade, this problem becomes increasingly severe.

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IPM

Integrated Pest Management (IPM) is a process consisting of the balanced use of cultural, biological, and chemical procedures that are environmentally compatible, economically feasible, and socially acceptable to reduce pest populations to tolerable levels.

Integrated means that many strategies are used to avoid or solve a pest problem. These strategies come from different disciplines, such as disease information from plant pathologists, weed information from agronomists, and insect information from entomologists.

Pests are unwanted organisms that are a nuisance to man or domestic animals, and can cause injury to humans, animals, plants, structures, and possessions.

Management is the process of making decisions in a systematic way to keep pests from reaching intolerable levels. Small populations of pests can often be tolerated; total eradication is often not necessary.

Reasons for having a broader approach to Integrated Pest Management (IPM) han just the use of chemicals.

Keep a Balanced Ecosystem. Every ecosystem, made up of living things and their non-living environment, has a balance; the actions of one creature in the ecosystem usually affect other, different organisms. The introduction of chemicals into the ecosystem can change this balance, destroying certain species and allowing other species (sometimes pests themselves) to dominate. Beneficial insects such as the ladybird beetle and lacewing larvae, both of which consume pests, can be killed by pesticides, leaving few natural mechanisms of pest control.

Pesticides Can be Ineffective. Chemical pesticides are not always effective. Pests can become resistant to pesticides. In fact, some 600 cases of pests developing pesticide resistance have been documented to date, including common lamb's-quarter, house flies, the Colorado potato beetle, the Indian meal moth, Norway rats, and the greenhouse whitefly. Furthermore, pests may survive in some situations where the chemical does not reach pests, is washed off, is applied at an improper rate, or is applied at an improper life stage of the pest.

IPM Is Not Difficult. Although some of the terms and ideas may be new to you, practicing IPM is not difficult. Believe it or not, you will have done much of the "work" for an IPM approach if you've figured out the problem (the pest), determined the extent of the damage, and decided on the action to take. These steps are the same ones used in IPM.

Save Money. IPM can save money through avoiding crop loss (due to pests), and avoiding unnecessary pesticide expense. For example, farmers in Kuttanad have saved more than half there expense for plant protection after the inception of ORP for pest surveillance and forecasting.

Promote a Healthy Environment. We have much to learn about the persistence of chemicals in the environment, and their effect on living creatures. However, more cases of contaminated groundwater appear each year, and disposal of containers and unused pesticides still pose challenges for applicators. Even though long-term documentation on the effects of all pesticides is still unavailable, it is generally agreed that fewer pesticides means less risk to surface water and groundwater, and less hazard to wildlife and humans.

Maintain a Good Public Image. Recent public outcry about the use of growth regulators and the presence of pesticide residues on produce has heightened pesticide applicator awareness of the level of public concern about chemicals. Consumers are pressuring food stores, which in turn are pressuring producers, for produce that has been grown with as few pesticides as possible. Growing food under integrated pest management can help allay public concerns. Structural pest control professionals can suggest improvements in housekeeping or structural modifications as substitutes for chemical control.

The Basic Steps of IPM
All of the components of an IPM approach can be grouped into four major steps. The first step is taking preventative measures to prevent pest buildup, the second is monitoring, the third step is assessing the pest situation, and the fourth is determining the best action to take.

Preventative Measures
Many IPM practices are used before a pest problem develops to prevent or stall the buildup of pests.

Cultural Controls are those that disrupt the environment of the pest. Plowing, crop rotation, removal of infected plant material, sanitation of greenhouse equipment, and effective manure management are all cultural practices that are employed to deprive pests of a comfortable habitat. The management of urban and industrial pests has improved when sanitation programs have been improved, pest harborages eliminated, garbage pickup frequency increased, or when lights are installed that do not attract insects.

Structural Modifications - by preventing support timbers from soil contact, damage from several different wood destroying pests can be avoided. Wood absorbs moisture and is more susceptible to attack by carpenter ants and termites when in direct contact with the soil.

Construction Site Sanitation - removing tree stumps and lumber scraps from construction sites, which are prime food sources for subterranean termites, can prevent problems in the future.

Biological Controls - using natural enemies (biological control agents) to keep pests in check can be put into place before pest problems increase. Examples of biological control agents are beneficial mites that feed on mite pests in orchards, the milky spore disease that kills harmful soil grubs, and Encarsia formosa , a wasp that parasitises the greenhouse whitefly. Many biological control agents are commercially available.

Physical Barriers such as netting over small fruits and screening in greenhouses can prevent crop loss. Physical barriers are important in termite, housefly, and rodent control.

Use of Pheromones (natural insect scents) has become widely used in pest management. Sometimes a manufactured "copy" of the pheromone that a female insect emits to attract mates can be used to confuse males and prevent mating. This technique is used in curbing damage from the grape berry moth.

Pest-Resistant Varieties are those that are less susceptible than other

Pest Resistant Varieties are those that are less susceptible than other varieties to certain insects and diseases. Use of resistant varieties often means that growers do not need to apply as many pesticides as with susceptible varieties. Potato growers control the golden nematode by planting resistant cultivars. Apple growers can save up to eight fungicide applications a year by growing Liberty and Freedom cultivars, which resist diseases. Farmers growing alfalfa and wheat keep several pests at bay by planting resistant varieties.

Once a pest manager has taken precautions to prevent pest infestations, it is important to watch regularly for the appearance of insects, weeds, diseases, and other pests.

Monitoring (Scouting)
Monitoring pests involves:
regular checking of the area;
early detection of pests;
proper identification of pests;
identification of the effects of biological control agents.

Regular checking of a warehouse, bakery, restaurant, field, greenhouse, golf course, or other areas and early detection of pests can function together like an early warning system for pests, helping to avoid or prevent a pest problem.

Proper identification of pests is an extremely important prerequisite to handling problems effectively. For example, the brown banded and German cockroach can be easily confused with each other. Identification is important because certain management practices may control only one species and not the other. Correct identification enables you to manage the real source of the problem and avoid merely treating the symptoms (or controlling non-pests). Some pests cause similar evidence. Unless the pest is identified, the control program may have the wrong pest as its target. Identification enables you to cure the pest problem and avoid injury to non-target organisms, particularly if you:
use a pesticide that is specific to the pest;
control the pest effectively during the most susceptible stage of its life cycle;
consider the use of a non-chemical control.

Identifying the effects of biological control means knowing which creatures are helpful and determining if pests have been affected by the beneficial organisms. Sometimes pests are kept in check naturally, and at other times the pest populations increase sharply.

Assessment is the process of determining the potential for pest populations to reach an economic threshold or an intolerable level. Is a grower likely to suffer financially? Is the pest likely to transmit a disease? How can you tell? There are important differences between the assessment of crop pests and urban pests.

Forecasting can help you determine if weather conditions will be favorable for the development of diseases and insect pests. For example, by "plugging in" values (such as the number of rainy days and the temperatures for those days), growers can predict outbreaks and spray only when conditions are favorable for diseases. Growers who have kept good records of pests in previous years can use these records to help determine if problems such as weeds, insects, and diseases will reoccur. They might be able, for example, to apply the most effective herbicides at the proper time for early control of a problem.

Thresholds, or more specifically economic thresholds, are levels that mark the highest point a pest population can reach without risk of economic loss. Populations above these thresholds can reach the economic injury level, where they cause enough damage for the grower to lose money. At the economic injury level, the cost of control is equal to the loss of yield or quality that would result otherwise.

Thresholds for many pests and crops have been scientifically determined. The advantage of thresholds is that if a pest has not reached threshold, there is no risk of economic loss. Therefore, there is no need to spray. Once the pest density (number of pests per unit area) has reached threshold, action is justified. The costs of control will be less than equal to the estimated losses that the pests would cause if justify uncontrolled.

Urban pest thresholds are often related to aesthetics rather than economic considerations. Where health concerns or individual sensitivities exist, the tolerable level of the pest may be zero. A zero threshold forces action, even if only one pest has been detected. Zero thresholds exist in hospitals, food production, warehousing, and retail facilities.

Action (Control Measures)
Once a pest has reached the economic threshold, or intolerable level, action should be taken. In some situations, cultural controls can destroy pests. One example is early harvesting to avoid pest problems, which prevents crop loss and can sometimes be more economical than a pesticide application.

Chemical pesticides are used as a control measure when no other strategies will bring the pest population under the threshold. In fact, the success of waiting until a pest reaches threshold usually hinges on the availability of a pesticide that will bring the pest populations down quickly.

In summary, an IPM approach means that pest managers use multiple tactics to prevent pest buildups, monitor pest populations, assess the damage, and make informed management decisions, keeping in mind that pesticides should be used judiciously.

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Weed management

Integrated pest management of weeds, like insect IPM, focuses on prevention, beginning with identification of weed species and controlling the population in the field.

Localized use of weed control tools may be necessary in areas with high concentrations of perennial weeds

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Prevention

Avoid weed establishment; eliminate individual survivors.
Employ sanitary procedures; prevent weed spread.
Clean equipment between sites or infestations.
Examine nursery plants, seed, and imported soil or media.
Screen irrigation water where weed seed contaminates surface water transported in canals and rivers or stored in lakes or ponds.
Control weeds and seed sources around the field or site.
Establish national and state weed laws and noxious weed control programs.

Biological
control weeds using organisms which feed/infect/pest on the weed.

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Cultural

Integrate numerous components to minimize impact of weeds.

Select manageable fields (identify weeds and choose crop according to feasibility of weed management strategies)

Rotate crops (disrupt weed life cycles or suppress weeds in competitive crop followed by planting a noncompetitive crop).

Plant competitive fallow crops in rotation to improve soils and crop management. Consider legumes to supplement nitrogen requirements.

Consider specific vegetation which remain uniform on soil surface; either perennial or large-seeded crops can be planted through undisturbed mulch.

Alter planting dates (plant for maximum growth or delay planting to control first weed flush).

Transplant slow-growing crops.

Place and time of fertilizer application, especially nitrogen is highly decisive. Band or spot fertilizer beside plant or seed (reduces availability to surface-germinating weeds). Time additional top dressings for maximum crop growth or to minimize weeds.

Develop crop canopy that shades weeds, suppresses weed germination.

Select crops or varieties that form canopy quickly.

Space plants in equidistant (triangular) arrangements and vary density depending on crop management constraints or harvest requirements.

Interplant crops in space and time.

Combine broadleaf and taller, narrow leaf crops.

Relay plantings or harvest short-duration crops within longer maturing crops
Manage appropriate living mulch (grass or legume) between perennial crop rows.
Improve pasture management by reseeding and/or fertilizing with or without control measures to reduce weed infestation (weeds often are a sign of poor management).
Apply mulch or geo-textiles

Solarisation Thin plastic secured tightly over loose, moist soil for 10 to 12 weeks will suppress weed infestations and other pests during hot season; data unavailable for Oregon.

Top...

Mechanical

Weed debris turned under; annual weeds controlled; perennial weeds suppressed if repeated every 10 to 14 days.

Tillage practices

Seedbed preparation/planting (plough down/mix debris). Use Plough/ rotovater/ discharrow (compacts wet soils).

Cultivators for weed control. Sweeps, rolling cultivators, finger weeders, push hoe, rotary hoes, etc.

Hand pulling or hand hoeing.

Minimum or no-till systems (often requires specialized equipment).
Seedbed preparation/planting accomplished in one operation where trash is separated, soil loosened, and crop planted.

Weed control achieved with herbicides or sometimes cultivators, depending on debris.

Flaming (requires temporal difference between crop and weed growth).

Water management (drip placement or timing to reduce weed growth).

Stale seedbed (planting after controlling first weed flush).

Top...

Herbicidal

Requires precision calculations, equipment, and application.

Selectivity

Crop naturally tolerates herbicide (internal selectivity).

Placement of herbicide prevents crop exposure.

Timing of application to avoid susceptible stage of growth.

Labeling requires extensive testing.

Toxicology includes acute, subacute, and chronic toxicity; teratology (fetus); reproduction, mutagenicity (cancer); neurotoxicity (nerves); and metabolism studies along with worker exposure.

Environmental fate includes breakdown, groundwater, ecological effects on plants and animals.

Tolerance assessment considers normal application procedures and preharvest intervals for assessing residues within food products.