waste by the action of micro-organisms. Farmyard, compost and green manures are necessary for the organic farming. By using alternative biological control methods natural enemies of pests can be artificially introduced. These bio insecticides are non-persistent, non-toxic and biodegradable. Bio herbicide involves the biological control of weeds by some living organisms. Integrated pest management, bioremediation and pest resistant crops help to increase productivity through organic farming.

Multiple cropping is the process of growing two or more different crops together in the same field is known as mixed or multiple cropping. It helps in restoring soil fertility as the products and waste material from one crop, help for the growth of other crops. Cotton and groundnut, maize and udid and soya bean are generally grown together in multiple cropping.

Crop rotation is the process in which different types of crops are grown alternately in the same field. Crop rotation by growing alternate leguminous crops of pulses or groundnut helps in making soil rich in nitrogen.

Application of biotechnology in crop improvement has proved useful since it has improved nutritional quality, better nitrogen fixation and production of disease resistant plants. Tissue culture technique and cell fusion are being used by agricultural bio-technologists for introducing the better characters in plants. Plant tissue culture technique is used to select somaclones that are resistant to herbicides. In cell fusion, chromosomes of different species can be combined particularly in those species which are otherwise incompatible.

In integrated agriculture, animal husbandry, poultry and bio gas are the most essential activities. Dairy farming which involves domesticating animals that give milk for commercial purposes. By making use of cow dung's and using decomposing waste materials, generation of bio gas through the bio gas plant is possible.

SECTION – III

RURAL DEVELOPMENT

Many decades ago, Mahatma Gandhi envisioned reformed village community based on sound environmental management. He stressed on the need for sanitation based on recycling human and animal manure and well-ventilated cottages built of recyclable material. He envisioned roads as being clean and free of dust. His main objective was to use village-made goods instead of industrial products. All these principles are now considered part of sound long-term development. Gandhiji had designed a sustainable lifestyle for himself when these concepts were not a part of general thinking. A growing realization of the development strategy that Mahatma Gandhi had suggested many decades earlier is now accepted by experts on development across the world. This is base on his concept that the world could support people's needs but not their greed. It has become obvious that the quality of human life has worsened as economies grew. The world now appears to be at a crossroads. It has taken the path of short-term economic growth and now suffers the consequences of environmental degradation at the cost of loss of 'quality of human life". The earth cannot supply the amount of resources used and wasted by the economically well-of sectors of society as well the day-to-day needs of the ever-growing population in less developed countries. Society must thus change its unsustainable lifestyle based on caring for the Earth.

UNIT VIII

RURAL DEVELOPMENT

MAIN OBJECTIVE

To help students to improve the living conditions of the rural majority and the quality of rural life mainly by integrating development with environment.

LEARNING OUTCOME

- To achieve enhanced production and productivity in rural areas.
- To harness the creative energies of the rural people.
- To enhance the participation of women and youth in the development process.
- To achieve an all-round development of the abundant human resources of the nation.

CONTENTS

1. Modern agriculture and associated problem
2. Organic farming, integrated pest management Bioremediation and Pest resistant crops
3. Sustainable farming
4. Integrated agriculture

MODERN AGRICULTURE AND ASSOCIATED PROBLEMS

Many current problems in agriculture are not new. Erosion and pollution, for example, have been around as long as agriculture. However, agriculture has changed drastically within its ten-thousand-year history, especially since the dawn of the Industrial Revolution in the seventeenth century.

Erosion and pollution are now bigger problems than before and have been joined by a host of other issues that are equally critical—not all related to physical deterioration.

I. EXCESSIVE IRRIGATION

Too much watering in the garden certainly will not cause a canyon to form, but can cause all sorts of other big problems.

Roots rot if the soil is constantly too wet. If the soil stays saturated, roots suffocate from the lack of aeration. Trees that survive saturation of deeper soil strata will disperse their roots shallowly near the less saturated surface, and will consequently be unstable. Shallow roots are also likely to displace pavement and other surface features. Besides all this, excessive watering is wasteful.

There are too many variables, such as exposure, drainage, humidity and temperature, to prescribe irrigation schedules that work for every site. Just remember that most plants like the soil to drain enough for the surface of the soil to at least look somewhat dry before getting watered again. Moss on the surface is an indication that the soil is staying too wet. Plants that like a bit more water than others, like azaleas, rhododendrons, fuchsias, ferns and impatiens, do not mind if the soil stays somewhat damp much of the time, but only if the soil is porous and drains enough to also be aerated

Generally the most drought tolerant plants are also the most sensitive to excessive irrigation; ironically for the first few months after being planted they like to be watered somewhat regularly. This is because they are so reliant on well dispersed root systems which take several months to develop. When freshly planted, their root systems are just too confined to procure enough moisture. Such plants should be monitored closely while young to be sure they do not get too dry or too saturated even though they will need little or no watering once their roots get dispersed.

II. WATER LOGGING

Antique Dutch windmills used to pump water into the embanked river to prevent waterlogging of the lowlands (polders) behind them.

Waterlogging refers to the saturation of soil with water.Soil may be regarded as waterlogged when the water table of the groundwater is too high to conveniently permit an anticipated activity, like agriculture.

In agriculture, various crops need air (specifically, oxygen) to a greater or lesser depth in the soil. Waterlogging of the soil stops air getting in. How near the water table must be to the surface for the ground to be classed as waterlogged, varies with the purpose in view. A crop's demand for freedom from waterlogging may vary between seasons of the year, as with the growing of rice (Oryza sativa).

In irrigated agricultural land, waterlogging is often accompanied by soil salinity as waterlogged soils prevent leaching of the salts imported by the irrigation water.

From a gardening point of view, waterlogging is the process whereby the soil blocks off all water and is so hard it stops air getting in and it stops oxygen from getting in.

III. CHEMICAL POLLUTION

Definition

Chemical pollution occurs when chemicals resulting from human activities enter the environment, contaminating air, water or soil. Acid rain, greenhouse gases and ozone are all examples of chemical pollution

Chemicals That Cause Water Pollution

Pesticides and fertilizers that contain nitrates and phosphates are a source of chemicals that cause water pollution. These chemicals seep into the groundwater and mix with runoff moving to lakes and rivers.

Industrial emissions can also cause water pollution. An example is mercury in waste water from paper manufacturers. Instead of remaining inert as expected, the mercury reacted to bacteria in the water and changed to methyl mercury. Now, mercury levels in fish such as swordfish can pose dangers to people who eat it.

Chemicals that Cause Air Pollution

A major source of chemical pollution in the air is fossil fuels burned by utilities, industries and motor vehicles.

Sulfur dioxide is produced when coal is burned. It is an ingredient of acid rain and can cause lung damage to people who breathe large amounts of it.

Nitrogen oxides are a byproduct of motor vehicles such as cars, trucks and airplanes. These oxides are also an ingredient of acid rain and can cause lung damage to people over time.

Other chemicals that cause air pollution include ozone, carbon monoxide and lead.

CHEMICAL POLLUTION IN SOIL

Chemical pollution in soil can be caused by overuse of fertilizers, pesticides and herbicides. Construction and demolition sites are also sources of soil pollution, as are mines, landfills and foundries.

POLLUTION AND SILT

Besides causing resistance among harmful bacteria, insects, and weeds, pesticides inevitably wash into, and contaminate, surface and groundwater supplies. Chemicals, although problematic, are not as difficult to contend with as the increasingly heavy silt load choking the life out of streams and rivers.

Accelerated erosion from water runoff carries silt particles into streams, where they remain suspended and inhibit the growth of many forms of plant and animal life.

The silt load inAmerican streams has become so heavy that the Mississippi River Delta is growing faster than it once did. Heavy silt loads, combined with chemical residues, are creating an expanded dead zone. By taxing the capabilities of ecosystems around the Delta, sediments are filtered out slowly.

IV. SOIL SALINITY

Soil salinity is the salt content in the soil, the process of increasing the salt content is known as salination. Salt is a natural element of soils and water. Salination can be caused by natural processes such as mineral weathering or the gradual withdrawal of an ocean. It can also be caused by artificial processes such as irrigation.

Causes of soil salinity

Salt-affected soils that are caused by excess accumulation of salts, typically most pronounced at the soil surface. Salts can be transported to the soil surface by capillary transport from a salt laden water table and then accumulate due to evaporation. They can also be concentrated in soils due to human activity, for example the use of potassium as fertilizer, which can form sylvite, a naturally occurring salt. As soil salinity increases, salt effects can result in degradation of soils and vegetation.

Salinization is a process that results from:

- high levels of salt in the water.
- landscape features that allow salts to become mobile(movement of water table).
- climatic trends that favour accumulation.
- human activities such as land clearing, aquaculture activities and the salting of icy roads.

SALINITY DUE TO IRRIGATION

Salinity from irrigation can occur over time wherever irrigation occurs, since almost all water (even natural rainfall) contains some dissolved salts. When the plants use the water, the salts are left behind in the soil and eventually begin to accumulate. Since soil salinity makes it more difficult for plants to absorb soil moisture, these salts must be leached out of the plant root zone by applying additional water. This water in excess of plant needs is called the leaching fraction. Salination from irrigation water is also greatly increased by poor drainage and use of saline water for irrigating agricultural crops.

Salinity in urban areas often results from the combination of irrigation and groundwater processes. Irrigation is also now common in cities (gardens and recreation areas).

CONSEQUENCES OF SALINITY

The consequences of salinity are

- detrimental effects on plant growth and yield
- damage to infrastructure (roads, bricks, corrosion of pipes and cables)
- reduction of water quality for users, sedimentation problems
- soil erosion ultimately, when crops are too strongly affected by the amounts of salts.

Salinity is an important land degradation problem. Soil salinity can be reduced by leaching soluble salts out of soil with excess irrigation water. Soil salinity control involves watertable control and flushing in combination with tile drainage or another form ofsubsurface drainage.

High levels of soil salinity can be tolerated if salt-tolerant plants are grown. Sensitive crops lose their vigor already in slightly saline soils, most crops are negatively affected by (moderately) saline soils, and only salinity resistant crops thrive in severely saline soils.

V. THREATS TO SOIL QUALITY

Soil quality is at risk from a number of threats driven by a range of man-made and natural pressures including climate change, land use change and land management practices.

Human activities have changed the character and quality of our soils over time. We have destroyed protective vegetation cover and have kept soil bare for long periods of time. We also actively add nutrients and pesticides to soils and cover them with housing and infrastructure. All of these activities can impair, or even destroy, the ability of soil to carry out its essential functions.

Once soil is damaged or contaminated it can be extremely difficult, if not impossible, to restore. In some cases, soils can themselves become sources of pollutants. These

pollutants can make their way into watercourses, affecting water quality. Good soil management is therefore essential to maintain and improve Scotland's water quality.
Detailed below are some of the main threats to soil quality.

CLIMATE CHANGE

Climate change is a long-term change of weather patterns including temperature, wind and rainfall. Global warming is enhanced by human activities that increase atmospheric concentrations of greenhouse gases that trap the sun's heat and warm Earth's surface.
The main greenhouse gases produced in Scotland are:

- Carbon dioxide from the burning of fossil fuels such as coal and oil;
- Methane from livestock and livestock manures;
- Nitrous oxide mainly from the use of nitrogen fertiliser (both organic and inorganic).

A number of soil processes will be accelerated by increasing temperatures and rainfall intensity - both likely to occur in Scotland as a result of global warming.

Higher temperatures will increase mineralisation (loss) of organic matter and result in increased CO2 release, especially from organic soils, while mineralisation of wetter soils may result in an increase in methane emissions. Warmer, wetter soils are likely to result in increased N2O emissions from nitrogen-fertilised soils, as these conditions favour denitrification (the conversion of nitrate to nitrogen gas).

Climate change is an overarching driver affecting numerous soil quality issues such as:

- a loss of organic matter because of higher decomposition rates (e.g. increased temperature, drying of wetlands);
- erosion as a result of more frequent extreme rainfall events;
- reduced trafficability as a result of periods of increased soil wetness;
- a reduction in soil fertility;
- increased and changing pest loads;
- a change of vegetation type and an increase in plant growth (both crops and natural vegetation).

SEALING

Sealing is the permanent covering of soil with hard surfaces such as roads and buildings.

The impacts that the sealing of soils can have are:

- loss of all soil functions;
- loss of high quality agricultural land;
- loss of natural habitat;
- increased flood risk by making run-off more rapid and peak discharge greater;
- HABITAT FRAGMENTATION.

COMPACTION

Compaction is the process by which soil particles are forced closer together reducing soil porosity. This is caused by heavy machinery traffic and, to a lesser extent, by animals trampling on wet soils. The impacts this can have are:

- the number and size of pores within soil is reduced, especially larger pores needed to circulate air throughout the soil;
- a reduction in the capacity of water that soil can hold;
- an increase in anaerobic subsurface conditions, reducing the amount of oxygen available to organisms and increasing the risk of nitrogen dioxide and methane production;
- formation of cemented layers;
- a reduction of root growth and therefore plant development;
- loss of biodiversity as pores become too small to allow soil invertebrates to move through the soil;
- an increase in run-off and flooding.

EROSION

Erosion is a naturally occurring process in which soil particles become detached (usually from the soil surface) by wind or water. Erosion rates can be increased as a result of human activities such as the removal of protective vegetation cover by farming, over-grazing, down-hill ploughing and soil compaction, all of which threaten soil quality. The effects that soil erosion can have are:

- a reduction in soil fertility due to loss of nutrient-rich topsoil;
- loss of carbon stored in the soil;

- diffuse pollution of surface watercourses with nutrients and contaminants (e.g. pesticides, fertilisers);
- increased flood risk;
- increase in sediment in watercourses resulting in the destruction of spawning grounds in rivers and reduced reservoir capacity which may affect aquatic life.

Landslides

Landslides are a mass movement of soil, rock or debris that flow down a slope as a result of gravity. They can occur for a number of reasons; however, in Scotland they are caused mainly by soil saturation after heavy rain fall or snowmelt. The effects that landslides can have are:

- exposure of subsoils and bedrock;
- burying of soils and vegetation where the slide comes to rest;
- potential for death and injury if people are caught up in a landslide;
- potential disruption to infrastructure;
- introduction of sediment into watercourses that can block the watercourse, lead to damage to aquatic life, reduce drinking water quality and increase flooding potential.

Organic matter decline

Organic matter decline is the loss of organic material from soils and is caused by intensive farming, drainage of carbon-rich soil (e.g. peat and wetlands), soil erosion and climate change. The impacts that a decline in organic matter can have are:

- a potential for biodiversity loss as most soil organisms require organic matter as food;a reduction in soil quality for most land uses, particularly agriculture;
- carbon loss to the atmosphere, accelerating climatic warming. This is particularly important in Scotland, where soil organic matter content is generally high;
- a potential for increased water pollution, as many pollutants (e.g. heavy metals, pesticides) are bound to organic matter;
- an increase of dissolved organic carbon concentration in surface water courses, leading to discolouration of drinking water.

Contamination

Contamination occurs when substances are added to soil, causing an increase in concentrations above background or reference levels. Contamination can come from diffuse (e.g. atmospheric deposition, waste to land) or point sources (spills).

Atmospheric deposition

The burning of fossil fuels by industry, households and vehicles releases gaseous emissions of sulphur dioxide and oxides of nitrogen that can travel hundreds of miles in the atmosphere. These gases can be dissolved in rainwater to form sulphuric and nitric acids. These will subsequently be deposited on soil and result in soil acidification which can cause:

- reduced drainage water quality due to increased leakage of acidic compounds and toxic elements;
- a loss of above and below ground biodiversity, as certain species are unable to survive in acidic soils;
- structural damage to soil minerals.

In addition, excess nitrogen deposition can result in soil eutrophication. Intensive agriculture can release high concentrations of ammonia which tends to be deposited close to the source. Soil eutrophication can result in:

- loss of biodiversity and changes to vegetation and ecosystems;
- the potential for increased microbial activity resulting in more rapid organic matter decomposition and greenhouse gas emission;
- the potential for an increase of nutrients in surface water and groundwater.

Waste to land contamination

The application of waste products to land, such as farmyard manure, sewage sludge and organic materials from industrial processes can have many agricultural and environmental benefits if they are well managed and the appropriate amounts of organic waste applied. However, if they are not well managed they may have adverse effects such as:

- an accumulation of toxic components of waste in the soil, e.g. trace metals;
- a risk of (soil) biodiversity decline;

- unhealthy plant growth caused by unbalanced nutrient supply;
- the potential for water eutrophication through nutrient transfer from soil;
- the potential for increased production of greenhouse gases to the atmosphere.

We inspect and monitor certain industrial and agricultural activities to prevent pollution to Scotland's land.

Change in soil biodiversity

The over-exploitation of land and soils, land use changes and climate change all have an effect on soil biodiversity, reducing the number and variety of soil species. The impacts that this can have are:

- the potential for a reduction of soil functions;
- disruption of food supplies and webs;
- loss of potential resources for future applications (e.g. biotechnology, drugs).

The technological improvements in Indian agriculture since mid sixties have brought about revolutionary increase in agricultural production. Interestingly, the growth rate of food grain production particularly in case of wheat and rice was much higher than the growth rate of population. The country was facing acute food shortages till eighties has now become not only self sufficient but also a net exporter of food grains. This has been made possible due to evolution of high yielding crop varieties, increased use of chemical fertilizers, development of irrigation facilities and plant protection measures accompanied by effective price support programmes of farm products. The increased use of purchased inputs in agriculture necessitated to raise their use efficiencies though mechanization. The increase in the use of human and bullock labour and rising wage rates and cost of up-keep of bullock further made the case of farm mechanization still stronger.

VI. Constrain in mechanisation

It is true that farm mechanization has shown good results as of raising the agricultural production and improving the standard of living of cultivators within very short period. But a number of arguments have been advanced against farm mechanization such as:

1. Small size and scattered holdings of the farmers stand in the way of mechanization. As a result of this, farm machinery generally remains underutilized.

2. Majority of small cultivators are poor who are not in a position to purchase the costly machinery like tractors, combine harvesters etc.

3. The use of tractor operated machinery may render some of the draft cattle population surplus. Studies under AICRP on Energy Requirement indicate that tractor owning farms do use draft animals for certain jobs. Like-wise farms using animate sources of farm power, use tractor on custom service for certain jobs.

4. The farm machinery have large turning radius and thus require comparatively larger farm for economical use. Mechanization may lead to structural change in agriculture in respect of the occupational distribution in the rural economy. No doubt, the increasing farm mechanization is going to increase employment in secondary and tertiary sectors but it does displace labour in farm operations.

5. Lack of proper knowledge of farmer to purchase farm machinery, operate and maintain it properly leads to wrong choice, makes it uneconomical and risky too.

6. There is great shortage of diesel in the country as a whole. Thus, to use so extensive oil based farm machinery is not desirable.

7. The lack of repair and replacement facilities especially in the remote rural areas is another hindrance in efficient small farm mechanization.

8. Due to the seasonal nature of the agriculture, the farm machinery remains idle for much of the time. Thus, idle machinery means unnecessary high costs unless proper alternate use of such machinery in the off-season is made.

According to Verma, Singh and Mittal (1994), the chief bottlenecks of farm mechanization can be cited under following three heads:

A. Research development and testing of farm machinery and equipment, particularly suitable to small farms, dry farming, for operations such as paddy transplanting, sugarcane and fodder harvesting, spraying tall plants such as fruit and forest trees, cotton, sugarcane etc., sugarcane planter, cotton picking and so on.

B. Manufacture, standardization and quality control: Poor quality and lack of matching and standard designs of equipment and acute shortage of testing facilities.

C. Education, training and Popularization of farm equipment: Inadequate training facilities for farmer-users and artisans, inadequate service centers and lack of regulations on custom hiring services.

VII. Food preservation

Food preservation usually involves preventing the growth of bacteria, fungi (such as yeasts), and other micro-organisms (although some methods work by introducing benign bacteria, or fungi to the food), as well as retarding the oxidation of fats which cause rancidity. Food preservation can also include processes which inhibit visual deterioration, such as the enzymatic browning reaction in apples after they are cut, which can occur during food preparation.

Many processes designed to preserve food will involve a number of food preservation methods. Preserving fruit by turning it into jam, for example, involves boiling (to reduce the fruit's moisture content and to kill bacteria, yeasts, etc.), sugaring (to prevent their re-growth) and sealing within an airtight jar (to prevent recontamination). There are many traditional methods of preserving food that limit the energy inputs and reduce carbon footprint.

Maintaining or creating nutritional value, texture and flavour is an important aspect of food preservation, although, historically, some methods drastically altered the character of the food being preserved. In many cases these changes have come to be seen as desirable qualities – cheese, yoghurt and pickled onions being common examples.

Advantages and disadvantages of Food Preservation Methods

Drying

Advantages :

- Produces concentrated form of food.
- Inhibits microbial growth & autolytic enzymes.
- Retains most nutrients.

Disadvantages:

- Can cause loss of some nutrients, particularly thiamin & vitamin C.
- Sulphur dioxide is sometimes added to dried fruits to retain vitamin C, but some individuals are sensitive to this substance.

Smoking

Advantages:

- Preserve partly by drying, partly by incorporation of substances from smoke.

Disadvantages:

- Eating a lot of smoked foods has been linked with some cancers in some parts of the world.

Refrigeration

Advantages

- Slows microbial multiplication.
- Slows autolysis by enzymes.

Disadvantages:

- Slow loss of some nutrients with time

Freezing

Advantages

- Prevents microbial growth by low temperature & unavailability of water.
- Generally good retention of nutrients.

Disadvantages:

- Blanching of vegetables prior to freezing causes loss of some B-Group vitamins and vitamin C.
- Unintended thawing can reduce product quality.

Adding Salt or Sugar

Advantages

- Makes water unavailable for microbial growth.
- Process does not destroy nutrients.

Disadvantages:

- Increases salt and sugar content of food.
- High heat processing (e.g. pasteurisation)

Advantages

- Inactivates autolytic enzymes
- Destroys microorganisms.

Disadvantages:

- Loss of heat-sensitive nutrients.

Canning (involves high heat processing)

Advantages

- Destroys microorganisms & autolytic enzymes.

Disadvantages:

- Water-soluble nutrients can be lost into liquid in can.

Chemical Preservatives

Advantages

- Prevent microbial growth
- No loss of nutrient.

Disadvantages:

- Some people are sensitive to some chemical preservatives.

Ionizing Radiation

Advantages

- Sterilizes foods (such as spices) whose flavour would change with heating.
- Inhibits sprouting potatoes
- Extends shelf life of strawberries and mushrooms

Disadvantages:

- Longer shelf life of fresh foods can lead to greater nutrient losses than if eaten sooner after harvesting.

VIII. Ripening of Fruits

Ripening is a process in which the fruits become edible when left undisturbed for a considerable period of time. But the shocking news is most of the fruits are not allowed to ripen on the tree. It is because there are chances of ripe fruits getting spoiled during transportation. So, the traders pick raw, unripe fruits and made them to ripen by means of some artificial methods which are very much hazardous to health. Most of the fruits which we eat today are artificially ripened.

According to the "Prevention of Food Adulteration Act,1954,and the Prevention of Food Adulteration Rules,1955, artificial ripening is strictly banned and the violators are subjected to an imprisonment of six months and a fine of Rs.1000.Calcium carbide is one of the artificial ripening agents used by the fraudulent traders for artificial ripening of fruits.

What is Calcium Carbide?

Calcium Carbide is a chemical compound which is mainly used for welding purposes. The commercially produced calcium carbide is grayish white in color. The color varies depending on the grade. The main use of calcium carbide is in the production of acetylene.

Reasons for using Calcium Carbide

Mostly calcium carbide is used to ripen fruits like mangoes, bananas and papayas. Traders prefer calcium carbide because the cost of 1 kg of calcium carbide is Rs.30 and it can ripen 10 tonnes of fruits. Usually the traders keep small packets of the chemical near the pile of bananas or the boxes of mangoes. The boxes are kept in dark rooms for one to two days. The chemical reaction takes place due to the moisture content present in the fruit and acetylene gas is produced which enhances the ripening of fruits.

The disadvantages of artificial ripening

1. Calcium carbide is a carcinogenic chemical compound. It causes many short term and long term health problems.

2. The short term exposure to the chemical causes diarrhoea, irritation in the eyes, headache, dizziness and thirst.

3. The chronic exposure to the chemical results in mouth ulcers, food poisoning and even cancer.

4. Calcium Carbide is also hazardous for people who handle it. The chemical can cause severe seizures and blisters when it is touched with wet hands.

5. The artificially ripened fruits are toxic and also tasteless though they have a very appealing color.

6. The organic composition and the nutritional value of the fruit is also lost when it is artificially ripened.

Measures to be practised by consumers

1.Consumer awareness is the only way to get rid of these illegal activities.

The issue must be brought to the notice of concerned officials if we see such illegal activities in our nearby areas.

2. Wash the fruits thoroughly in running water before consuming it.

3. Do not buy fruits if it has come to the market well ahead of the season.

4. Do not buy fruits if it has some powder stains over it or it is punctured at some points.

IX. LOSS OF GENETIC DIVERSITY

When humans initially started farming, they used selective breeding to pass on desirable traits of the crops while omitting the undesirable ones. Selective breeding leads to monocultures: entire farms of nearly genetically identical plants. Little to no genetic diversity makes crops extremely susceptible to widespread disease. Bacteria morph and change constantly. When a disease causing bacterium changes to attack a specific genetic variation, it can easily wipe out vast quantities of the species. If the genetic variation that the bacterium is best at attacking happens to be that which humans have selectively bred to use for harvest, the entire crop will be wiped out.

A very similar occurrence is the cause of the infamous Potato Famine in Ireland. Since new potato plants do not come as a result of reproduction but rather from pieces of the parent plant, no genetic diversity is developed, and the entire crop is essentially a clone of one potato, it is especially susceptible to an epidemic. In the 1840s, much of Ireland's population depended on potatoes for food. They planted namely the "lumper" variety of potato, which was susceptible to a rot-causing oomycete called Phytophthora infestans. This oomycete destroyed the vast majority of the potato crop, and left one million people to starve to death.

The natural world has several ways of preserving or increasing genetic diversity. Among oceanic plankton, viruses aid in the genetic shifting process. Ocean viruses, which infect the plankton, carry genes of other organisms in addition to their own. When a virus containing the genes of one cell infects another, the genetic makeup of the latter changes.This constant shift of genetic make-up helps to maintain a healthy population of plankton despite complex and unpredictable environmental changes.

Cheetahs are a threatened species. Low genetic diversity and resulting poor sperm quality has made breeding and survivorship difficult for cheetahs. Moreover only about 5% of cheetahs survive to adulthood. However, it has been recently discovered that female cheetahs can mate with more than one male per litter of cubs. They undergo induced ovulation, which means that a new egg is produced every time a female mates. By mating with multiple males, the mother increases the genetic diversity within a single litter of cubs.

X. Organic Farming in India

Definition

Organic farming is the form of agriculture that relies on techniques such as crop rotation, green manure, compost andbiological pest control to maintain soil productivity and control pests on a farm. Organic farming excludes or strictly limits the use of manufactured fertilizers and pesticides, plant growth regulators such as hormones, livestock antibiotics, food additives, and genetically modified organisms.Organic farming usually involves mechanical weed control (via cultivating orhoeing) rather than herbicidal weed control.

Organic farming in India

Organic farming was practiced in India since thousands of years. The great Indian civilization thrived on organic farming and India was one of the most prosperous countries in the world, till the British ruled it.

In traditional India, entire agriculture was practiced using organic techniques, where the fertilizers, pesticides, etc., were obtained from plant and animal products. Organic farming was the backbone of the Indian economy and cow was worshipped (and is still done so) as God. The cow, not only provided milk, but also provided bullocks (for farming) and dung (which was used as fertilizers).

Shift to Chemical Farming in 1960s

During 1950s and 1960s, the ever increasing population of India and several natural calamities lead to severe food scarcity in the country. As a result, the government was forced to import food grains from foreign countries. To increase food security, the government had to drastically increase food production in India. The Green Revolution (under the leadership of M. S. Swaminathan) became the government's most important program in the 1960s. Several hectares of land were brought under cultivation. Hybrid seeds were introduced. Natural and organic fertilizers were replaced by chemical fertilizers and locally made pesticides were replaced by chemical pesticides. Large chemical factories such as the Rashtriya Chemical Fertilizers were established.

Before the Green Revolution, it was feared that millions of poor Indians would die of hunger in the mid 1970s. However, the Green Revolution, within a few years, showed its impact. The country, which greatly relied on imports for its food supply, reduced its imports every passing year. In 1990s, India had surplus food grains and once again became an exporter of food grains.

As time went by, extensive dependence on chemical farming has shown its darker side. The land is losing its fertility and is demanding larger quantities of fertilizers to be used. Pests are becoming immune, requiring the farmers to use stronger and costlier pesticides. Due to increased cost of farming, farmers are falling into the trap of money lenders, who are exploiting them no end, and forcing many to commit suicide.

Both consumers and farmers are now gradually shifting back to organic farming in India. It is believed by many that organic farming is healthier. Though the health benefits of organic food are yet to be proved, consumers are willing to pay higher premium for the same. Many farmers in India are shifting to organic farming due to the domestic and international demand for organic food. Further stringent standards for non-organic food in European and US markets have led to rejection of many Indian food consignments in the past. Organic farming, therefore, provides a better alternative to chemical farming.

According to the International Fund for Agriculture and Development (IFAD), about 2.5 million hectares of land was under organic farming in India in 2004. Further, there are over 15,000 certified organic farms in India. India, therefore is one of the most important suppliers of organic food to the developed nations. No doubt, the organic movement has again started in India.

Benefits of Organic Farming

- Organic farming proves to be more profitable than the age old traditional farming methods.
- It has been found that organic farming reduces the production cost by about 25-30%, as it does not involve the use of synthetic fertilizers and pesticides, which thus makes organic farming cost effective.
- Soil is the most important component in farming and organic farming preserves soil by reducing soil erosion up to a large extent.
- Organic farming also enables the farmers to use the soil for a longer period of time to grow crops as soil fertility is maintained for a long time.
- Organic farming has a positive effect on the ecosystem, as it proves vital in supporting the survival of wildlife in the lowlands. It even provides safe pasture lands for grazing
- Organic farming is not only beneficial for farmers, but it also has proved useful for the dairy industry. Cattle grazing on organic farmlands have been found to be less prone to diseases and they yield more milk. These are definitely good signs for a consumer of these dairy products from health perspective and for a dairy organization from the profit perspective.
- Products or foodstuffs produced from organic farming neither contain any sort of artificial flavors or preservatives nor do they contain any harmful chemicals.
- The original nutritional content of food is preserved due to the absence of synthetic fertilizers and pesticides.
- Organic products moreover are tastier than the products yielded from traditional farming.

- Consumption of products obtained from organic farming minimizes the risks of physical ailments such as heart attacks. Scientific studies have proven that organic foods are healthier than the inorganic ones

Although some valid concerns do arise regarding the potential negative effects of organic farming, you must take care to realize where the information you read originates.

Proponents of genetically engineered food, pesticides, and added growth hormones occasionally release alarming warnings about organic farming without overtly revealing their own interests in the matter.

Potential Negative Effects of Organic Farming

While organic farming generally receives high praise from the media and environmental experts, there are also some critics who make the claim that the negative effects of organic farming outweigh the benefits. Some critics doubt that organic farming can be a global solution.

Effects on the Earth

Organic foods are marketed as being more environmentally sound that other foods are because they utilize farming methods that have less of an impact on the environment. Organic farmers also usemethods prescribed for organic farms to deal with pests and other problems.

In other words, organic farming will generally not include the use of pesticides, herbicides, and other compounds that have been shown to be potentially detrimental to the environment.

Critics of organic farming point out that conventional farming methods yield more product than organic farms, concluding that organic farming is inefficient. They point out that while organic farming may be attractive to consumers who can afford the foods, one of the negative effects of organic farming is that it may not be able to feed everyone within the world.

Naysayers of organic foods have doubts that organic farmers can produce the foods needed to match the current amount of farming outputs.

Since organic farms are not located as prevalently throughout the world as conventional farms are, some critics point out the environmental impact of shipping the organic foods to merchants. Although organic farming strives to have as small of an environmental impact as possible, the food may still be shipped using less than environmentally friendly methods. Some environmentalists make the claim that it may be better to purchase foods that are produced locally, regardless of whether they come from an organic farm, because of the lack of environmental impact of shipping.

Effects on the Body

Organic foods are generally regarded as more healthy than conventionally produced foods because they lack added growth hormones and other questionable elements. This does not exclude organic foods from criticism, though, as many critics attack the methods by which organic foods are produced and the effect they may have on the body.

For example, organic farms turn to natural fertilizers for growing crops, which often translates into using animal feces combined with other components instead of chemically constructed fertilizers. Opponents of organic farming warn that some foods - such as lettuce, parsley, and other foods - may harbor harmful bacteria that can be passed on to the consumer. While foods produced through conventional farming have similar risks, critics warn that the threat is heightened in organic foods.

Consumers may be less likely to take the same precautions with organic foods that they do with other types of food. For example, some consumers may buy organic apples and then assume that there is no need to wash the apple thoroughly prior to eating it because of its organic origins. This issue, of course, is not the fault of organic farmers, but it is a cited concern nonetheless.

XI. Integrated pest management (IPM)

Integrated pest management (IPM), also known as Integrated Pest Control (IPC) is a broad-based approach that integrates a range of practices for economic control of pests. IPM aims to suppress pest populations below the economic injury level (EIL). The Food and Agriculture Organisation of the UN defines IPM as "the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms." Entomologists and ecologists have urged the adoption of IPM pest control for many years. IPM allows for a safer means of controlling pests This includes managing insects, plant pathogens and weeds.

Globalization of markets and increased movements of people all over the world are allowing for increasing numbers of invasive species to be brought into countries. Appropriate responses to these pests are needed and development and implementation strategies should be arranged. It is essential that the option that poses the least risks while maximizing benefits is needed and that the strategy may include all components related to integrated pest management strategies.

An American IPM system is designed around six basic components:

1. Acceptable pest levels: The emphasis is on control, not eradication. IPM holds that wiping out an entire pest population is often impossible, and the attempt can be expensive and environmentally unsafe. IPM programmes first work to establish acceptable pest levels, called action thresholds, and apply controls if those thresholds are crossed. These thresholds are pest and site specific, meaning that it may be acceptable at one site to have a weed such as white clover, but at another site it may not be acceptable. By allowing a pest population to survive at a reasonable threshold, selection pressure is reduced. This lowers the chance of pests developing resistance to chemicals, because if many of the pests are killed then any that have resistance to the chemical will form the genetic basis of the future population. By not killing all the pests there should be unresistant pests left that will dilute the prevalence of any resistant genes that appear. Similarly, the repeated use of a single class of chemicals will create pest populations that are more resistant to that particular class, whereas alternating between different classes helps prevent this.

2. Preventive cultural practices: Selecting varieties best for local growing conditions, and maintaining healthy crops, is the first line of defense, together with plant quarantine and 'cultural techniques' such as crop sanitation (e.g. removal of diseased plants, and cleaning pruning shears to prevent spread of infections). Beneficial fungi and bacteria are added to the potting media of horticultural crops vulnerable to root diseases, greatly reducing the need for fungicides.

3. Monitoring: Regular observation is the cornerstone of IPM. Observation is broken into two steps, first; inspection and second; identification. Visual inspection, insect and spore traps, and other measurement methods and monitoring tools are used to monitor pest levels. Accurate pest identification is critical to a successful IPM program. Record-keeping is essential, as is a thorough knowledge of the behavior and reproductive cycles of target pests. Since insects are cold-blooded, their physical development is dependent on the temperature of their environment. Many insects have had their development cycles modeled in terms of degree days. Monitor the degree days of an environment to determine when is the optimal time for a specific insect's outbreak. Plant pathogens also follow similar patterns of response to weather and seasonal changes.

4. Mechanical controls: Should a pest reach an unacceptable level, mechanical methods are the first options to consider. They include simple hand-picking, erecting insect barriers, using traps, vacuuming, and tillage to disrupt breeding.

5. Biological controls: Natural biological processes and materials can provide control, with minimal environmental impact, and often at lower cost. The main focus here is to promote beneficial insects that eat or parasitize target pests. Biological insecticides, derived from naturally occurring microorganisms (e.g.: Bt, entomopathogenic fungi and entomopathogenic nematodes), also fit in this category.

6. Responsible Pesticide Use: Synthetic pesticides are used as required and often only at specific times in a pests life cycle. Many of the newer pesticide groups are derived from plants or naturally occurring substances (e.g.: nicotine, pyrethrum and insect juvenile hormone analogues), but the toxophore or active component may be altered to provide increased biological activity or stability. Further 'biology-based' or 'ecological' techniques

are under evaluation. Applications of pesticides must reach their intended targets. Matching the application technique to the crop, the pest, and the pesticide is critical. The use of low-volume spray equipment reduces overall pesticide use and labor cost.

XII. Bio re-mediation

Bioremediation is the use of micro-organism metabolism to remove pollutants. Technologies can be generally classified as in situ orex situ. In situ bioremediation involves treating the contaminated material at the site, while ex situ involves the removal of the contaminated material to be treated elsewhere. Some examples of bioremediation related technologies are phytoremediation,bioventing, bioleaching, landfarming, bioreactor, composting, bioaugmentation, rhizofiltration, and biostimulation.

Bioremediation can occur on its own (natural attenuation or intrinsic bioremediation) or can be spurred on via the addition of fertilizers to increase the bioavailability within the medium (biostimulation). Recent advancements have also proven successful via the addition of matched microbe strains to the medium to enhance the resident microbe population's ability to break down contaminants. Microorganisms used to perform the function of bioremediation are known as bioremediators.

Not all contaminants, however, are easily treated by bioremediation using microorganisms. For example, heavy metals such ascadmium and lead are not readily absorbed or captured by microorganisms. The assimilation of metals such as mercury into the food chain may worsen matters. Phytoremediation is useful in these circumstances because natural plants or transgenic plants are able tobioaccumulate these toxins in their above-ground parts, which are then harvested for removal. The heavy metals in the harvested biomass may be further concentrated by incineration or even recycled for industrial use.

The elimination of a wide range of pollutants and wastes from the environment requires increasing our understanding of the relative importance of different pathways and regulatory networks to carbon flux in particular environments and for particular compounds, and they will certainly accelerate the development of bioremediation technologies and biotransformation processes.

Advantages

There are a number of cost/efficiency advantages to bioremediation, which can be employed in areas that are inaccessible without excavation. For example, hydrocarbon spills (specifically, petrol spills) or certain chlorinated solvents may contaminate groundwater, and introducing the appropriate electron acceptor or electron donor amendment, as appropriate, may significantly reduce contaminant concentrations after a long time allowing for acclimation. This is typically much less expensive than excavation followed by disposal elsewhere, incineration or other ex situ treatment strategies, and reduces or eliminates the need for "pump and treat", a practice common at sites where hydrocarbons have contaminated clean groundwater.

XIII. Pest resistant crops

Pesticide resistance describes the decreased susceptibility of a pest population to apesticide that was previously effective at controlling the pest. Pest species evolve pesticide resistance via natural selection: the most resistant organisms are the ones to survive and pass on their genetic traits to their offspring.

Manufacturers of pesticides tend to prefer a definition that is dependent on failure of a product in a real situation, sometimes called field resistance. For example, the Insecticide Resistance Action Committee (IRAC) definition of insecticide resistance is 'a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species'

Pesticide resistance is increasing in occurrence. Farmers in the USA lost 7% of their crops to pests in the 1940s; over the 1980s and 1990s, the loss was 13%, even though more pesticides were being used. Over 500 species of pests have evolved a resistance to a pesticide. Other sources estimate the number to be around 1000 species since 1945.

Examples

Resistance has evolved in a variety of different pest species: Resistance to insecticides was first documented by A. L. Melander in 1914 when scale insects demonstrated resistance to an inorganic insecticide. Between 1914 and 1946, 11 additional cases of resistance to inorganic insecticides were recorded. The development of organic insecticides, such as DDT, gave hope that insecticide resistance was an issue of the past. Unfortunately, by 1947 housefly resistance to DDT was documented. With the introduction of every new insecticide class – cyclodienes, carbamates, formamidines, organophosphates, pyrethroids, even Bacillus thuringiensis – cases of resistance surfaced within two to 20 years.

- In the US, studies have shown that fruit flies that infest orange groves were becoming resistant to malathion, a pesticide used to kill them.
- In Hawaii and Japan and Tennessee, the diamondback moth evolved a resistance to Bacillus thuringiensis about three years after it began to be used heavily.
- In England, rats in certain areas have evolved such a strong resistance to rat poison that they can consume up to five times as much of it as normal rats without dying.
- DDT is no longer effective in preventing malaria in some places, a fact which contributed to a resurgence of the disease.
- In the southern United States, the weed Amaranthus palmeri, which interferes with production of cotton, has evolved widespread resistance to the herbicide glyphosate
- Colorado potato beetle has evolved resistance to 52 different compounds belonging to all major insecticide classes. Resistance levels vary greatly among different populations and between beetle life stages, but in some cases can be very high (up to 2,000-fold).

Although the evolution of pesticide resistance is usually discussed as a result of pesticide use, it is important to keep in mind that pest populations can also adapt to non-chemical methods of control. For example, the northern corn rootworm (Diabrotica barberi) became adapted to a corn-soybean crop rotation by spending the year when field is planted to soybeans in a diapause.