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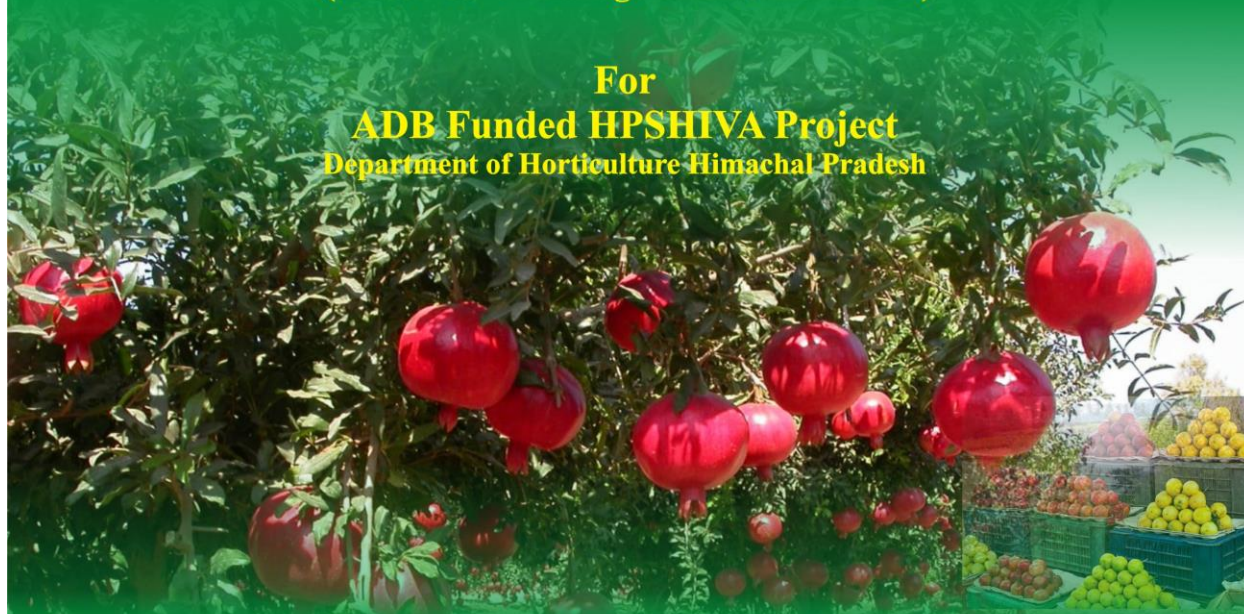


PRODUCTION OF SUBTROPICAL FRUITS

FREQUENTLY ASKED QUESTIONS

Developed by
Dr. YSP University of Horticulture & Forestry
COHF-Neri, Hamirpur
(Under CS-04 Package of HPSHIVA PRF)

For
ADB Funded HPSHIVA Project
Department of Horticulture Himachal Pradesh





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Himachal Pradesh

Expert Team of Package of Practices of Subtropical Fruit Crops of Himachal Pradesh CS04 under HPSHIVA

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FREQUENTLY ASKED QUESTIONS FRUIT CROPS OF HIMACHAL PRADESH

Part – I : Production Technology

1. What is the function of Pollination and Fertilization?

Pollination: The transfer of pollens from the male part to female part of the flower of a plant is called pollination. After pollination the process of fertilization takes place which forwards the reproduction. When the pollen of one flower are transferred to another flower of same plant or flower of another plant the process is called pollination.

Fertilization: Sexual reproduction in plants occurs when the male gamete present in the pollens fuses with the female gamete present in the ovule and the process is called as fertilization.

2. What is the difference between the symptoms found on the leaves due to deficiency of Nitrogen and Potassium in the plants?

Symptoms of nitrogen Deficiency:

- a) The colour of plant leaves turn yellow or light green.
- b) The plant growth slows down or stops completely and production also declines.
- c) Most of the fruits drop prematurely and size of the fruit also reduces.
- d) On green leaves, white spots appear (first in old leaves) and chlorosis occurs.

Symptoms of Potassium Deficiency:

- a) The symptoms of Potassium deficiency appears firstly on the old leaves. The edge of these leaves appear scorched/burned.
- b) In some fruit trees, excessive leaf fall occurs during the flowering period.

3. What is the difference among the deficiency symptoms of Magnesium, Manganese and Iron?

Deficiency Symptoms of Magnesium: The loss of green colour between the vein of leaves occur the usually starts from the lower leaves and increases towards the upper leaves. The veins of leaves remain green. In citrus plants, yellow coloured irregular spots appear on the leaves. These yellow leaves fall later on.

Deficiency Symptoms of Manganese: The deficiency of this nutrient reduces the growth production. The deficiency symptoms appears on old soft but fully mature leaves which

turn yellow from green and a weak netlike structure is visible on the green veins. The symptoms usually appear on the upper surface of the leaves. Old leaves turn thicker and their distal end becomes round.

Deficiency Symptoms of Iron: In case of deficiency of Iron, first the young leaves shows abnormal lack of green colour which later on appears on the old leaves also and the plant growth stops.

4. Name the commercial fertilizers of Nitrogen, Phosphorus, Potassium, Zinc, Boron and Calcium?

Nitrogen: Calcium Ammonium Nitrate, Urea, Ammonium Nitrate, Ammonium Sulphate, Sodium Nitrate, Ammonia Solution.

Phosphorus: Single Super Phosphate, Ammonium Phosphate, Di- calcium Phosphate

Potassium: Muriate of Potash, Potassium Sulphate, Potassium Nitrate

Zinc: Zinc Sulphate, Zinc Chloride

Boron: Borax, Boric acid,

Calcium: Calcium Cyanamide, Calcium Ammonium Nitrate.

5. Name fertilizers soluble in water?

Urea Phosphate (17:44:0), Sulphate of Potash (0:0:50)

NPK(19:19:19), Potassium Nitrate (13:0:45)

Urea Phosphate (18:18:18), Mono Potassium Phosphate (0:52:34)

Mono Ammonium Phosphate (12:61:0)

6. How is ethylene helpful in fruit ripening?

Ethylene compound is helpful in fruit ripening. The ethylene increases the level of enzymes like amylase at intercellular level which converts the starch into sugar due to which the fragrance, taste, colour and external appearance of fruit changes. Ethylene is used for artificial ripening of fruits wherein fruits appear fresh and ripe before time. Ethylene also enhances the process the fruit ripening.

Pectinase enzyme turns pectin responsible for hardness of fruits into water soluble form. Other enzymes convert the green chlorophyll part of the fruit into yellowish, bluish or reddish. The process of ripening involves the conversion of starch into sugar which leads to change in the colour, taste, fragrance and outer appearance of the fruit.

Method of Fruit Ripening:

Keep unripe fruits in ventilated plastic baskets. Place these fruits in a close airtight room and put the required amount of Etheral in a container inside the room and add a defined amount of Sodium hydroxide (Caustic soda) to the container to release the ethylene gas and close the room immediately. Use a small fan for proper transmission of the released ethylene gas in the entire room. After 18-24 hours, to complete the process of fruit ripening place the fruits outside at room temperature. The baskets/crates of fruit should be filled at 70 percent of their capacity. The fruits ripened using ethylene are good in taste and colour.

In case of Mango, fruits are placed in 100ppm ethylene solution for 24 hours ripen in five days without any loss in quality otherwise it required 10 days for ripening.

7. Describe the process of making 50 ppm solution of IBA and GA₃?

$$1\text{ppm} = \frac{\text{mg of solute}}{\text{Volume of Solution (litre)}}$$

To prepare 1 ppm solution, add 1 mg of GA₃/IBA powder in little amount of ethanol and make it 1 litre using water. For 50ppm solution, add 50mg of GA₃/IBA in 20-30ml of ethanol and make it 1 litre using water.

8. What is the meaning of contact and systemic herbicides?

Contact Herbicides:

These chemicals kill the weeds instantly on coming in contact with them. Such type of herbicides come directly in contact with the cells of the plant and destroys them. They are usually sprayed completely on the stem and leaves. They are effective on different weeds only when they are in seedling stage.

Systemic Herbicides:

These chemically come in contact with the leaves, stem and roots of the weeds and get transported to the different parts of the plant through internal activity and kill them.

9. What is the availability of Nitrogen, Phosphorus and Potash in acidic and alkaline soils?

The maximum availability of these nutrients is found at pH values given below:

Availability of Nitrogen: 6.0-8.0 pH

Availability of Phosphorus: 6.5-7.5 pH

Availability of Potash: 6.0-7.0pH.

10. What are the main essential and micronutrients important for fruit plants?

Plants also utilize nutrients for their growth and development. The deficiency of these nutrients impedes the plant growth. Plant require 17 essential nutrients and without them plant development is not possible.

Among these, Carbon, Hydrogen, Oxygen, Nitrogen, Potassium and Phosphorus are the primary nutrients. First three out of them are usually taken by the plants from the atmosphere. Plant nutrients are classified as per their requirements as given below:

Major Nutrients: Nitrogen, Phosphorus, Potassium, Calcium, Magnesium and sulphur.

Minor Nutrients: Iron, Zinc, Boron, Manganese, Copper, Molybdenum, Chlorine and Nickel.

11. What are the precautions to be taken while using herbicides in the orchard?

- To uniformly spray in the chosen area, properly measure the diameter of the sprayer.
- Make a proper solution on the basis of the area of application, formulation and active ingredients of the herbicides.
- Prepare proper herbicide solution half hour before the spray in the fields.
- Use Flat Fan Nozzle for spray of the herbicides.
- Always use protective shield on the nozzle of the sprayer while using non- selective herbicides.
- Spray herbicides uniformly over the entire area. Do not apply less or more on any part of the field.
- Use different chemicals alternatively every year.
- Keep herbicides away from the reach of children.
- Do not spray herbicides during strong winds so as to avoid drifting to nearby field which may damage some sensitive crops.
- Do not spray herbicides if there is possibility of rain.
- Choose herbicides for use in mixed cropping according to the crop type.
- Do not apply herbicides by mixing them with sand, fertilizer or soil.
- Do not spray herbicides against the favourable direction of wind.
- Always use protective clothing, boots, gloves, sunglasses and mask while spraying herbicides.

- After spraying dispose of the empty container either by burning or burying it under the ground.
- Clean your hands and other body parts properly using soap after spraying.

12. Explain the method of calculating the amount of herbicide?

The rate of herbicide is expressed in terms of active ingredient per acre. The herbicide is applied uniformly over the entire area or in a single bed. The application rate should be same for both in entire area or in a single bed. For calculation using the value of active ingredient then following method is used:

Powder: active ingredient per acre/concentration

If 1000 g per acre is required / 0.80 concentration

=1250 g per acre is required.

Divide the amount of active ingredient per acre with its concentration in the product. If 1000 g active ingredient is required for one acre and concentration of active ingredient in the product is 80 % then to get 1000 g active ingredient divide 1000g with 0.80 so 1250 g herbicide powder is required.

For liquid herbicides, concentration is given in emulsifiable concentrate (EC) and concentration in the product given in pounds per gallon is divided by EC to calculate the amount. For example, if 3 pound is required as per EC and product contains 2 pounds per gallon, then divide 3 by 2 and spray 1.5 gallon per acre.

13. Why the production of fruits declines under drought conditions in un-irrigated/rainfed areas?

The soil of rainfed areas are not just water deficient but are standard also. As in these regions, due to water and soil erosion and deficiency of nutrients the fertility of soil is low. Due to lack of moisture, nutrients available in the soil are not properly utilized which directly results in lower production. Plant growth also impedes due to less soil moisture.

14. Why deficiency of Nitrogen lowers the plant growth?

Nitrogen is used in protein synthesis which is an integral part of protoplasm and takes part in the formation of chlorophyll. Nitrogen plays a vital role in the growth and development of plants. It gives dark green colour to the plants. It is also useful for the plant vegetative growth, fruit setting and production.

15. How does the climatic parameters / factors harm fruit trees and what are the methods to protect them?

Climate change impacts the agriculture in different ways. Fertile soil, water, favourable environment, protection from insects and different diseases etc contribute significantly in increasing the agricultural productivity. Every crop requires a favourable temperature, fertile soil, rainfall and moisture for its gradual development and any change in any of these influences the crop production.

Climate change impacts the soil processes and soil moisture availability. Due to alteration in soil water balance, dry soils become drier and as a result the demand of irrigation water will rise. Fruit crops are highly sensitive o climate change in comparison to the other agricultural crops. Climate plays a crucial role in the productions of fruit crops. The favourable temperature and moisture conditions vary with the crops as some crops require high temperature and moisture whereas, others require less moisture and temperature.

Some fruit trees require more chilling hours for good production while others like Mango and Papaya cannot tolerate cold conditions and get harmed.

In mango trees, cold conditions harm the plant and extremely high temperature and rainfall during the fruiting period results the outbreak of different diseases.

Cure:

To deal with climate change protected farming can be practiced, wherein this climatic parameters can be controlled. The crop choice should be based upon the climate, temperature and types of varieties available.

16. What is the difference between seedling plants and grafted plants?

Seedling plants are produced from the seeds. For this the availability of optimum air, moisture and heat in the seeds is necessary. Some seeds are only viable for few days after fruit ripening, whereas, others stay viable for many years. Some seeds remain viable only for a single year and after that their germinability gets reduced.

Grafted plants are prepared by grafting method. Graft is that part of a plant which is used for vegetative propagation in the horticulture. Mostly this part is a plant branch whose one edge after cutting is planted in the soil and on giving it water and nutrients a new plant starts growing. Other times, this cut portion is attached to cut portion of any other plant having roots. This is called as grafting which results in a plant having the attributes of both the scion and rootstock.

17. In a nursery plants are grown either in beds or polybags. What are the advantages and disadvantages of plant grown in beds and polybags?

There are different benefits and drawbacks associated with plants grown in a bed in the nursery. Large number of plants can be grown in the beds, whereas limited number of plants can only be grown in the polybags. For transplanting during rainy season, evergreen plants need to be uprooted with a ball of earth which may damage roots and as a result many plants die. In case of polybags, plants can be grown in any season as per the water availability with minimum mortality of plants. Plants grown in beds are less healthy as compared to plants grown in polybags. Plants grown in polybags grow fast and become ready for transplanting earlier.

18. Why the survival rate of Mango plants decline after transplanting them in the field?

The ball of earth with mango plants breaks during transplanting in the field due to which root hairs responsible for water and nutrient absorptions get destroyed, this results in the higher mortality of transplanted mango plants.

19. What are the important precautions to be taken while purchasing plants from any nursery?

Following precautions should be taken while purchasing plants from a nursery:

- Give proper attention to leaves: If leaves are curled, withered, yellowish or blackish then this means either plant is facing moisture deficiency or diseased. So be cautious to carefully check leaves.
- Avoid tall and weak plants: Tall and weak / (lanky) plants develop due to insufficient sunlight or excessive fertilizer application which invite insects and diseases in the orchard.
- Inspect plants for insect and diseases: Insects usually hide in the lower side or growing regions of the plants. Properly check plants for common insects like aphids, scales etc.
- Inspect plant roots if possible: If plant roots are soft and brownish coloured then they are not good.
- Avoid buying fully flowered plants: Instead of buying fully established plants buy plants with new buds and healthy leaves.
- Check for grass and weeds: Avoid polybags plants with grass and weeds.
- Collect as much information as possible: If there is still a doubt about the suitability for your orchard, asks the expert for advice.
- The graft union should be 22 cm above the ground/ soil level.

20. Why mango is transplanted in the rainy season?

Mango, Litchi, Papaya, Citrus, Guava, Jackfruit are all fruits of tropical and sub-tropical climate. Therefore, they should be planted in the rainy season after initial showers as mango can only be transplanted when there is sufficient moisture in the soil which is necessary for root establishment and increases the plant survival rate. Usually, Mango is a fruit of such dry regions where it rains heavenly in the period of June-September and otherwise there are lesser drought like conditions.

21. Why mango is transplanted with the ball of earth?

Mango is an evergreen plant and if it is planted by removing the ball of earth in the orchard then the roots of the plant get damaged. Chemicals gets deposited on the tips of roots due to which their ability to absorb water and nutrients from the soil decreases and plants die.

While transplanting mango plants, always remove the polybags/grass etc without disturbing the ball of earth as roots will get damaged. If roots get damaged, it affects the plant growth rate. That is why the mango is transplanted with the ball of earth. During transplanting ensure that the plant should be pressed in the soil upto a depth as it was in the nursery.

22. What is the importance of dripline near plants?

Dripline is the region covering the basin of the plant over which the rainwater from the canopy drips down gradually. Dripline is important as it serves the moisture availability in the plant root zone having maximum density of plant roots which absorb nutrients and water from the soil.

23. What do you understand by slow release fertilizers?

Slow release fertilizers provide nutrient to the plants after some time. Slow release fertilizers are usually in dry or granular form and easy to broadcast on wider areas. These fertilizers release nutrients gradually after every other irrigation. Plants do not absorb toxic amount of fertilizer at once which is beneficial for farmers. Besides the available soil and weather conditions coupled with other things, the rate of release of nutrients is determined based on the solubility of the fertilizer formulation.

24. What is the best method and appropriate time for collection of samples of Mango leaves for inspection of tissues?

Firstly, divide the orchard into small blocks then only collect leaves. Collect leaves when the plant is not in flowering, leaves are fully developed and green in colour. Do not collect

leaves from the end of the branch. Collect 15-20 leaves from the mid of the branch which are 6 month old. Do not collect leaves for sample if nutrient spray is done recently.

25. What is the difference between of the soil samples and tissue samples? Are both of them important?

Soil samples are used to get information about the available soil nutrients and tissue samples give information about the nutrients present in the plants.

26. At what moisture level plant absorb maximum and optimum amount of nutrients from the soil?

Plants absorb maximum nutrients from the soil at its optimum water holding capacity. At optimum water holding capacity the soil is fully saturated with water and the downward seepage of excess water stops.

27. Do we perform pruning on Mango plants also? If yes, then what is its appropriate time and also explain its significance?

After collection of fruits, prune fruit bearing branches upto 10-15cm to get fruits every year. The old orchards having age of 60-70 years with low production can be rejuvenated by pruning which again starts producing fruits.

28. Why Mango trees give fruit only once in two years? What is the solution of this irregular fruiting process?

This cycle is also called as “Biennial fruiting in Mango”. This cycle is not same in the different varieties in all trees of the same variety. Due to careless management in the orchard this cycle sometimes turns into three years also. With proper orchard management ;practices and neutral adaptation, this gap sometimes shortens and trees start producing fruits regularly. After planting, mango trees start producing fruits in 4-5 years. This flowering and fruiting continues normally every year unless a major natural extreme or disaster takes place. If any year due to some reason excessive fruit set occurs or all inflorescence drops with underdeveloped fruits then the usual fruiting cycle changes and irregularity starts. In the initial phases, the reason behind the regular fruiting is the balanced leaf flush and flowering capacity. In the later years, this balance gets disturbed and problem appears. Sometimes new flush emerges in the next spring and these initiate flowering early in the succeeding year. It has been observed that for flowering, there should be optimum Nitrogen and carbohydrate level in the new flush. Apart from this, the

level of auxin like inhibitors should be high and gibberellins should be low. In Barahmasi varieties, fruits can be taken more than once from the plants.

It is a common problem in majority of commercial varieties of Mango wherein they flower and fruit only once in two years. Year in which good fruit crop is produced is called the On year. The year in which less or no fruit crop is produced is called the fruitless year. The Langra and Bombaivarieties of mango fruit biennially or irregularly in Northern India. This problem is moderate in Chausa and Fazali varieties. Some varieties grown in South India viz., Neelum, Banglora and Totapari produce fruits regularly.

The irregular fruiting in some varieties is mainly due to the genetic make- up and is inherent in nature. The lesser new growth in plants besides low level of carbohydrates and nitrogen primarily leads to irregular fruiting.

Due to inherent reasons, next year after the flowering and fruiting on the mango branches, vegetative growth increases on the axillary buds due to which plant remains fruitless. In irregular fruiting varieties, the year in which there is good fruit crop, no new flush is produced and very less growth occurs even after fruit harvest. No flowering occurs in the succeeding year. Sex ratio, pollination, temperature cycle, humidity and rainfall, air, dew and hails, insect and diseases are also somewhat responsible for biennial bearing.

Control Measures: Scientists have suggested various measures to solve the problem of biennial fruiting like cultural practices, regulation of flowering and fruiting, pruning, ringing, use of plant growth regulators and growing regular bearing varieties are the main among them.

29. What is the effect of unreasonable or excess use of pesticides and insecticides on human health? Suggest measures to prevent this?

Pesticides enter human body through mouth, breathing and by coming in contact with the skin. The long term exposure of human body to the pesticides harms the human life and can damage different body systems like respiratory, digestive, reproductive etc. The high incidents of chronic diseases like cancer, Parkinson's disease, Alzheimer, diabetes, serious ailments of heart and kidneys are considered due to the excessive of use of pesticides.

Measures:

- Decrease pesticide use in the agricultural activities.
- Promote organic farming.

- Use less toxic pesticides and follow manufacturer's instructions properly during their application.
- Use meat and poultry products after separating fat from it.
- Do not catch fishes in areas where nearby excessive use of fertilizers is done.
- Apply IPM techniques to control of pest and diseases. If possible herbal and panchgavya product should be used for insect control.

30. Why the fruit trees and vegetables beds must be planted in North-Eastern side?

Fruit trees and vegetables beds must be planted in North-Eastern side because morning sun rays fall over the area helpful in maintaining proper moisture conditions in the beds and orchards. In North-eastern side, sunlight exposure is only for 4-6 hours which lowers the evapotranspiration and soil holds moisture for a longer period.

31. What do you mean by biological control of insects and diseases? Give brief description with its importance in modern perspective?

Biological control of insects and diseases:

The use of other organisms/bio agents for the control of plant diseases causing pathogens and insects is called the biological control. Biological control is that process in which microorganisms are used to control or prevent disease pathogens and insects. The microorganisms used are called as bioagents. These agents infest lower the population of pathogens and insects and control them by preventing their further development. Fungi and bacteria are both being used as bio agents. Diseases and insects are major challenges in the agriculture since all times. Many methods of chemical control have already failed very badly. Farmers are not capable of bearing the expensive cost of pesticides. Today it has been proved that the use of pesticides is not good for human health, environment, ground water and the produce quality. The only stable solution for control is that the farmers should adopt the method of crop rotation so that the harmony of insect and nature is maintained and balance of nature is not damaged.

The soil has turned toxic due to regular use of chemicals. It has serious impact on environment as well as human health. To save farmers from this vicious circle it is important that they adopt biological control methods as it not only helps in the control of disease pathogens and insects but also increase the soil fertility. They are usually prepared manually using the natural resources available in surrounding areas. This also ends the

dependency of farmers on the market. For control and management of insect and disease it is important that:

- Better quality indigenous seeds and compost manures should be used. Favourable environment should be maintained for earthworm and microorganisms by ensuring proper nutrient status.
- Protect the natural enemies of insects. Create better conditions for Insect eaters like birds, frog, snake and friendly insects and maintain the natural diversity as such.
- Grow the type of crop in one portion of the field which is highly attractive to the insect eaters and keeps harmful insects away. Moreover, always inspect the fields regularly to prevent any disease or insect attack.

32. In Himachal Pradesh farmers are shifting to industrial labour. Why this is happening?

Farmers are leaving agriculture and opting to work as industrial labour because the usual grown crops like wheat, paddy, maize based agriculture in hilly areas has become a deal with loss. Under dry conditions, this type of agriculture only gives production of 5-15 quintal per hectare per season.

33. Rural unemployed youth do not want stay in village and do farming. How we can prevent this and turn it into a white collar business? Give your scientific suggestion.

A rural unemployed youth wants all those facilities as enjoyed by their urban counterparts. Today the traditional farming systems are not profitable and require manual work with the need to deal with cow dung manure and soil. Even so, the returns remain less than the cost incurred due to which the interest of youth in farming is declining. This demands a change in the method of farming for which the change in the perception and thinking of farmers is very important. This means cultivation of flowers, fruit crops and vegetables in open field, using modern methods and techniques is a very strong option in which water and fertilizer are applied using drip method and weeds are controlled using organic or plastic mulching methods which reduces manual labour to a very low level. It lowers the cultivation cost and increases the productivity.

34. Why the cultivation cost is increasing and suggest some appropriate methods to reduce it?

There are different reasons for increase in the cost of cultivation. For example, increase in consumption of plants/seeds, fertilizers/manures, pesticides besides increase in prices

high cost of additional labour has increased the overall cultivation cost. This calls for adoption of modern and scientific methods. Other than this, cooperation meaning cluster formation to practice farming and formation of farmer producer organizations for marketing and production can lower the overall cultivation cost as appropriate market of produce price can be estimated

35. In sub-tropical regions of the state the productivity of cereal crops is very low and farmers are abandoning their agricultural fields. How this can be prevented?

In subtropical areas, 80% farmers practice rainfed agriculture and the productivity of cereal crops like wheat, paddy, maize remains very low in comparison to the plain areas of the adjoining states. For example, the productivity in this region of state is 5-15 quintal per hectare whereas it is 60-65 quintal per hectare in Punjab plains. Therefore, cultivation of fruit crops, vegetables and flowers is the right option which can provide a viable option.

36. Why farmers of this region of the state do not practice commercial farming of horticultural crops. Can horticultural crops like guava, mango, citrus, pomegranate, kiwi and peach crops be cultivated at commercial level?

There are unlimited possibilities for horticultural crop production in the sub-tropical region but the farmers here are searching for a better alternative to shift from their usual cropping system which involves cereal crops mainly. In this region commercial cultivation of guava, Litchi, Mango, Pomegranate, citrus fruits and other fruits like pecan nut, peach and persimmon can be practiced.

37. Majority of farmers of the state possess small and marginal landholding category. In this type of situation, how farmers can get profitable price for their produce by practicing the horticultural crops cultivation?

Around 90% farm landholding in the state is of small and marginal category. In this type of small and scattered holding, the adoption of cluster farming for large scale production is a better choice with formation of farmer producer organizations for marketing of produce to fetch higher price. It is as well important to choose only recommended crops and varieties as per your region.

38. Crop diversification adoption is commonly in discussion these days. What does it mean? How its adoption is beneficial?

In last few decades, we have adopted the mono-cropping system due to which the fertility of soil has declined, balance of soil nutrients is disturbed, the outbreak of disease and

insects has increased. In this type of circumstances, by changing the cropping pattern and cultivating different recommended varieties of recommended crops as per the favourable micro-climatic situations in integrated manner is termed as crop diversification. With changing climatic conditions also, crop diversification is a better solution. Under such conditions, different crops can be grown profitably against the negative impact of climate and natural calamities.

39. How climate change influences the production of crops? Explain using examples from the subtropical and temperate areas.

The increase in the temperature due to climate change in case of temperate fruit crops which needs definite amount of chilling period has high implications. It usually results in irregular flowering and fruiting in temperate fruit plants. In subtropical fruit plants, frost cycle after 4-5 years affects the evergreen fruit trees of mango, litchi etc. Under subtropical conditions the increase in temperature and rainfall during the spring season affects the fruit set and production in crops like mango.

40. What do you understand by the elements and techniques for achieving maximum production and quality produce during harvesting?

In subtropical region of Himachal Pradesh, water availability, land and microclimate changes after every 10-15 km. In this type of conditions, to achieve higher production and appropriate quality of produce, the choice of suitable crop and its variety and production method in consideration to the climate is very crucial.

41. How landless and farmers with marginal landholding of the region can achieve their livelihood depending on the agriculture based vocation?

The high density plantation of fruit crops, flower cultivation, vegetable production, nursery and other related activities are horticulture is considered appropriate for small and marginal farmers. In case of landless farmers, mushroom cultivation, apiculture, animal rearing, sericulture etc. can be adopted for livelihood purpose.

42. What type of crop should be selected by keeping in view the climate change dynamics and the physiographic conditions of this region?

By keeping in view, the physiographic conditions of this region farmer should plant orchards of Peach, Pomegranate, Persimmon, pecan nut and citrus fruits at frost affected areas. Mango, Guava, Litchi, and Papaya etc. can be grown in areas with less or no frost at all.

- 43. In this region farmer practice rainfed agriculture, irrigation facility is very less and natural resources are very scarce. Under such conditions, how farmer can achieve profit by practicing farming?**

In this region of Himachal Pradesh, 800-1200 mm of water is obtained in the form of rainfall. This water can be harvested and stored for use in agriculture. For irrigation, drip method should be employed for high water use efficiency and better production as well as better quality of produce.

- 44. In this region the cycle of frost occurrence repeats normally after 5-7 years and damage traditional fruit crops very badly. Suggest profitable options for this region?**

In frost affected areas, pomegranate, citrus fruits, peach, pecan nut, plum, persimmon and protected cultivation of vegetables and flowers can be practiced at commercial level.

- 45. It has been noticed that the whether fruit production is high or low, in both the conditions the product price does not make much difference in the total income. Therefore, to fetch higher price of produce on regular basis, what is your suggestion?**

This subtropical region of state is completely different from the adjoining terai areas of Punjab, Haryana and Uttarakhand and temperate and sub-temperate region of Himachal Pradesh. The produce of this region reaches the market at a different time than above both conditions which eliminates the competition. This produce can even be called as offseason produce.

- 46. The cultivation of pomegranate is being promoted as commercial crop these days by scientists and Horticulture officers. In Karnataka, Maharashtra and Gujarat this fruits is being sold at 10-15 rupee per kg directly from farmer field even when the land holding is comparatively larger in size. Majority of farmers in this part of the state are small and marginal, so how can they achieve higher income from the small holdings ?**

The pomegranate produce from this region arrives in markets in the second week of August when there is very less produce available in the market. Therefore, farmers can fetch better prices for their produce.

47. What do you suggest for controlling the marketing system so that farmers can fetch appropriate prices and price stabilizes in the market?

For controlling marketing situation, suitable crops and recommended varieties should be cultivated with pre-defined goals so that produce enter regularly in the market and will get appropriate price.

48. The low level of production and quality of the traditional fruits grown in this region leads to lower price in the market almost equal to the transportation cost, whereas, in neighbouring states like Punjab and Uttarakhand farmers fetch higher price owing to the higher production and produce quality. Why?

In this region traditionally mango variety planted for commercial production is Dashari and its ripens in the first week of July. At this time, produce from other regions is already available in the market which is better in terms of quality as well, thus, farmers fetch lower prices for their produce. Therefore, one should plant late maturing and ripening varieties for commercial production. Similarly, the winter crop of guava should be promoted.

49. Fruit trees of persimmon are visible commonly in subtropical regions of Mandi, Bilaspur, Kangra and Hamirpur. What is your view about persimmon for this region?

The Fuyu variety of persimmon is usually eaten raw and can be commercially cultivated in this region. Its fruit arrives in market in first or second week of August which is slightly earlier than mid hills or sub- temperate zone.

50. Guava is a traditional fruit crop of this region whose fruits ripe in the rainy season. Ripe fruits usually contain insect larvae and are less sweet in taste making it less profitable. Can we get fruits of this crop in winter season?

The winter crop of Guava can be taken during second week of November to second week of February in this region.

51. Explain about the organic farming?

In India, traditional agricultural methods are in use from hundreds of years. It is also known as organic farming/cow based farming/natural farming. It is fully based on the available natural resources and livestock. The farming done using traditional natural resources is called as organic farming. The nutrients of organic field should remain in the

field. It is a closed system. In this system only agricultural produce goes out of the agricultural fields, crop residues get assimilated in the soil-livestock-crop rotation process.

52. We as farmers buy fertilizers like urea, SSP, Potash and micronutrient from the market and use them for 2-3 years. Is this a correct way?

The maximum utility of any fertilizer like urea, SSP, Potash, 19:19:19 remains only for one year. After that its utility declines. Therefore, fertilizers should be used within one year from the date of packing.

53. In orchardist occupation while purchasing planting material what precautions should be taken?

Always purchase plants of genuine variety, healthy in vigour and the grafted at 22 cm above the soil surface.

54. I have fruit trees of jack fruit, mango and papaya in my home and they are not affected by the frost, whereas, scientists recommend to not cultivate these plants in my region?

In frost affected areas, for orchard planting, open valley is the true representative.

55. The production and size of Kiwifruits at my home in Hamirpur district is very less even when I am completely following scientist recommendations given in the package of practices published by Nauni University?

The university does not recommend Kiwi orchard planting in Hamirpur region.

56. In citrus , why Lemon and orange fruits cracks while still on the trees?

The problem of fruit cracking in citrus fruit most commonly occurs in rainy season when temperature and humidity is very high while fruit cracking in October-November occurs due to deficiency of plant nutrients.

57. What is the timing of pruning of fruits trees in citrus fruits?

Citrus fruits come under the category of evergreen trees and not usually pruned. However, for high density plantation pruning should be done surely and should be completed by 15th February.

58. What is the common difference between Mosambi and Orange?

Mosambi is type of orange group fruit in which the exocarp/outer covering (rind) is attached tightly to the mesocarp whereas in orange the exocarp(rind) is loose, separates easily and segments can be extracted which is not possible in Mosambi.

59. Why a lot of importance is given to nutrient availability and its time in citrus trees?

The fruit trees of citrus being evergreen continue their growth throughout the year during which normal growth flushes occur twice, flowering to fruit harvest period is 9-11 months. The flower initiation, flowering and fruiting process continues during this time due to which the fulfilment of nutrient requirement at different stages is very important to continue these active growth processes without any hindrances.

60. Explain the intercropping in orchards of citrus fruits?

It is very crucial to give attention to crop selection for intercropping in citrus fruit orchards. The primary crop for a farmer should be citrus fruit trees and intercrop remains secondary. Do not cultivate intercrop with high water requirement. Do not cultivate vegetable crops like tomato, pumpkin, okra, eggplant etc. as intercrops. Use crops like pulses and mustard family crops as intercrops. Do not cultivate maize, paddy, barseem, jowar and bajra as intercrops.

61. Why fertigation is being considered important?

In fertigation, plants receive water and nutrient by drip as per their requirement at different growing stages over the time which ensures best resource use efficiency and fertilizer regime for plant growth and production.

62. Why mulching is important?

Mulching is considered highly helpful in maintaining the optimum soil moisture and temperature regime in root zone and plants are able to absorb the required amount of water and nutrients to continue the process of fruiting and growth. The grass mulch after decomposition adds biomass to the soil.

63. What do you understand by organic mulching?

In organic mulching, the available grass and other plant residue with farmers itself is used as mulch and is spread around the plant stem forming a layer of 12-15 cm.

64. What is the importance of mother plant in nursery?

To propagate any fruit plants by grafting it is important to certify the purity of the variety/genotype. This is only possible by achieving the purity, quality and certification of mother plants. Mother plants are not used for fruit production and are always kept in the growing phase with spacing at 2 m.

65. What is the importance of moisture level in soil for better absorption of nutrient by the plants?

Plants usually absorb nutrients from the upper 5-15 cm soil using tertiary roots and nutrients are taken in dissolved form. Therefore, optimum moisture level is important in the soil region from where plant roots absorb nutrients and microorganisms obtain their food. This ensures the continuous absorption of plant nutrients from the soil.

66. Why flood irrigation through channels should not be done?

The amount of soil moisture increases in flood irrigation to a level where all soil pores get completely filled with water and anaerobic conditions prevail in the root zone of the plant. The unavailability of oxygen to plant roots affects the process of root respiration and the incidence of root rot increases.

67. Fruit produce is not getting appropriate price in the market. Why?

Getting appropriate price in the market is the main challenge for the farmers. To deal with this small and marginal landholder farmer should form cluster and fruit crop should be planted according to the agro-climatic conditions and their demand in the consumer market. With high production it is also important to ensure the quality of the produce. The fruit after harvesting should be graded, packed, processed and value added and further marketed as self branded product. There should be minimum involvement of commission agents as intermediaries during movement of the final produce from field to consumer. Marketing as farmer group should be adopted.

68. The agricultural production cost has been on rise. How can we bring it down?

The agriculture has become a loss deal especially in subtropical region where farmers are shifting to other activities and only producing cereal crops which provide low income. The second reason is the high production cost. To lower the production cost nutrient management, drip fertigation and on farm prepared manure and fertilizers by farmer need to be used in efficient manner. Farmers in recent times are highly dependent on the market for seed, fertilizer, pesticide, mulch and machines which are expensive to them and can be easily available to majority of farmers at their fields.

69. The agricultural marketing cost has been on rise. Suggest measures to reduce it?

Farmers can form cluster for value addition at a large scale and can directly sell it to the rural consumers for getting higher benefits. Intermediaries should be minimum as 10-12 of them usually work from producer to consumer which results in profit erosion.

70. What do you mean by quality of agricultural produce?

The quality of agricultural produce is defined in terms of consumer demand that maintains a balance between societal health and is harmony with the environment which ensures optimum utilization of natural resources and is capable to maintain a continuous and sustainable development.

71. Explain spoon feeding of nutrients in drip method?

In drip method, plants receive water and nutrients as per their requirement at different times. The plant growth, fruit production, productivity and quality remain high in this method.

72. Why manure and fertilizer should be applied 45cm-1 m away from plant stem by channel?

In a 5-6 year old plant, the tertiary nutrient absorbing roots stay at 45-50 cm away from the plant stem. Therefore, manure and fertilizer should be applied 45cm-1 m away from plant stem by forming a 5-15cm deep channel so that these fine roots can continue the absorption process regularly. The roots near the plant stem are usually thick and only provide support to the plant.

73. What is the difference between watersprouts and suckers?

Water sprout emerge at 90° from the plant branches growing straight upwards and their growth is more than other branches. This type of flush produces flowers and fruits after a longer time. The suckers will growth fast and increasing number. The suckers and water sprouts should be removed regularly to ensure proper flowering and fruiting in the plant.

74. In hilly areas, what is the significance of fruit orchards in North, South, East and West aspects of hill?

In hilly areas, the sunlight decreases in order from East > South > West>North direction whereas the moisture retaining capacity of soil increases. While planting fruit trees, as per the crop and varietal requirements variety the sunlight exposure and moisture retaining capacity of soil should be kept in mind.

75. What are the main components important for fruit production?

Appropriate variety of suitable crop, water, land and soil, fertilizer, other inputs, modern techniques etc should be in harmony to each other.

76. At what time the seeds of citrus fruits should be extracted for nursery production?

In general, the different citrus fruits mature from last week of August to 15th of September and change colour from green to light yellow. Therefore, seeds should be extracted in the first week of September. The seed should be sown immediately to get higher germination otherwise, the seed viability is lost.

77. Does the process of training-pruning remain same in all fruit trees like apple, peach, mango, guava, lemon and pecan nut?

No, the process of training-pruning is not same in all fruit trees even it varies with the fruit varieties. Thus, proper knowledge of bearing habits and growth habit of plant should be obtained before going in for training and pruning.

78. Fruit trees do not grow and develop properly in clayey soils and are usually affected by the root system diseases. Why?

In clayey soils, the amount of clay is more in comparison to the sand and silt due to which the air circulation in soil is very low and almost anaerobic conditions prevail. In this type of soil, there is deficiency of available water and plant nutrients. That is why fruit trees do not grow and develop properly in clayey soils.

79. What is the function of leaves?

Leaves are very essential part of the plants. They function in different ways like food preparation for plant through the process of Photosynthesis. Leaves exchange different gases in the process of respiration and photosynthesis. Leaves also control the process of evapotranspiration.

80. What is the function of Chlorophyll?

Chlorophyll is a complexproteinaceous chemical compound. This pigment is responsible for green colour of the leaves. Chlorophyll is the main pigment that absorbs the solar radiations. Chlorophyll synthesizes starch, polysaccharides and other complex carbon compounds by using carbon dioxide from the air and absorption of solar energy. It also forms using the solar radiation.

81. Shed light on the primary functions of plant roots?

Plant part that stays hidden underground is called as root. Roots retain the soil particles intact to each other and keep plant stable on the ground. Roots absorb water and nutrients essential to the plants from the soil and transport them to the leaves through the stem.

Part –II : IRRIGATION & FERTIGATION SYSTEM

1. What do you need to know about drip fertigation?

Can organic fertilizer be used in drip irrigation?

The drip irrigation system is a liquid pressure water delivery system and obviously cannot directly use solid organic fertilizer. But we can use the biogas slurry made of organic fertilizer, and apply it after sedimentation and filtration. Chicken manure, pig manure, etc. are filtered and used after composting. A three-stage filtration system is used, which is first filtered with a 20-mesh stainless steel mesh, then filtered with an 80-mesh stainless steel mesh, and finally filtered with a 120-mesh lamination filter. Through the drip irrigation system, the application of liquid organic fertilizer not only overcomes the drawbacks that may be caused by the simple application of chemical fertilizers, but also saves labor and trouble, fertilization is uniform, and the fertilizer effect is remarkable.

2. What problems should we pay special attention to in drip fertigation?

1. The problem of excessive irrigation

The biggest concern with drip fertilization is over-irrigation. Many users always feel that drip irrigation delivers less water, and as a result, the irrigation time is prolonged. One consequence of prolonged irrigation time is wasting water, and another consequence is that nutrients that are not absorbed by the soil are leached below the root layer, wasting fertilizer, especially nitrogen leaching. Usually, water-soluble compound fertilizers contain nitrate nitrogen, which are the most easily washed away. Excessive irrigation often exhibits symptoms of nitrogen deficiency, yellowing of leaves, and stunted plant growth.

2. The problem of pipe washing after drip irrigation and fertilization

Generally, drip water first, and start fertilizing after the pipe is completely filled with water. In principle, the longer the fertilization time, the better. After fertilization, continue to drip water for half an hour to discharge all the residual fertilizer in the pipeline. Many users do not wash the pipe after drip irrigation and fertilization, and finally algae and microorganisms grow on the dripper, causing the dripper to be blocked.

3. How to avoid excessive irrigation in the process of drip irrigation and fertilization?

Drip fertilization only irrigates and fertilizes the root system. It is therefore important to know the depth of the root distribution of the crops being managed. The easiest way is to dig through the root layer with a small shovel to see the depth of the wetting, so you can judge whether there is excessive irrigation.

Part-III : Preparation of field concentrations of insecticides

The success of spray application for the control of the insect pests depends upon the use of accurate quantities of insecticide solutions per unit area. For field application of insecticides, the solutions are prepared generally from the formulations. The formulations are also the concentrated products of insecticides though contain lower quantities of active ingredients than their respective technical products. These are diluted before use in the field for the control/management of the pest. The applicator must determine the quantity of the formulation to be added into the tank to ascertain the correct recommended dosage. For the purpose, the following formulae are given:

A. FOR EMULSIFIABLE CONCENTRATE (EC) AND WETTABLE POWDER (WP) FORMULATIONS:

Formula:

F = Quantity of formulation required (ml or g)

S = Total volume of spray solution to be made (litres)

C = Concentration (%) of the solution to be prepared

a.i.= Active ingredient (%) in the given formulation

Exercise 1. How much spray fluid of carbaryl 0.1% concentration can be prepared from 125g of Sevin 50WP?

Solution : In the present exercise we are given;

$$F = 125\text{g}$$

$$S = ?$$

$$C = 0.1\%$$

$$\text{a.i.} = 50\%$$

$$\text{Applying the formula : } F = \frac{SC}{a.i.} \times 1000$$

$$125 = S \times 0.150$$

$$S = \frac{125 \times 50}{0.1 \times 1000} = \frac{6250}{100}$$

$$S = 62.5 \text{ litres}$$

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$$125 = S \times 0.150$$

$$S = \frac{125 \times 50}{0.1 \times 1000} = \frac{6250}{100}$$

$$S = 62.5 \text{ litres}$$

Exercise 2. Calculate the quantity of Cythion 50 EC required for preparing 50 litres of 0.1 % spray solution of malathion for the control of fruit flies in mango orchards.

Solution: In the exercise we are given;

$$S = 50 \text{ litres}$$

$$C = 0.1\%$$

$$a.i. = 50\%$$

$$F = ?$$

Applying the formula : $F = \frac{SC \times 1000}{a.i.}$

$$F = \frac{50 \times 0.1 \times 1000}{50}$$

$$F = \frac{50 \times 1 \times 1000}{500}$$

$$F = 50 \times 1 \times 2$$

$$F = 100\text{ml}$$

Exercise 3. For the control of fruit borer of litchi, 500ml of Cymbush 25 EC is added in 250litres of water. Find out the concentration of cypermethrin the spray solution.

Solution: According to the question we are given;

$$F = 500\text{ml}$$

$$S = 250\text{litres}$$

$$C = ?$$

$$\text{a.i.} = 25\%$$

Applying formula

$$F = \frac{SC}{\text{a.i.}} \times 1000$$

$$500 = \frac{250 \times C \times 1000}{25}$$

$$C = \frac{500 \times 25}{1000 \times 250}$$

$$C = \frac{1}{20}$$

$$C = 0.05\%$$

Exercise 4. How much volume of spray solution can be prepared from 250g Sevin 50 WP for spray of carbaryl @0.1% to control the defoliating beetles in apple orchards?

Solution: From the exercise we have;

$$F = 250$$

$$S = ?$$

$$C = 0.1\%$$

$$\text{a.i.} = 50$$

Applying formula

$$F = \frac{SC}{\text{a.i.}} \times 1000$$

$$250 = \frac{S \times 0.1 \times 1000}{50}$$

$$S = \frac{250 \times 50 \times 10}{1000}$$

$$S = 125\text{litres}$$

Exercise 5. 500ml of formulation is added in 250 litres of water to prepare a spray solution containing 0.1% a.i. Find out the active ingredient in the formulation.

Solution: From the exercise we have;

$$F = 500\text{ml}$$

$$S = 250\text{litres}$$

$$C = 0.1\%$$

$$\text{a.i.} = ?$$

Applying formula; $F = \frac{SC}{\text{a.i.}} \times 1000$

$$500 = \frac{250 \times 0.1}{\text{a.i.}} \times 1000$$

$$\text{a.i.} = \frac{250 \times 100}{500} \times 1000$$

$$= \frac{25000}{500} = 50$$

Active ingredient (a.i.) in the formulation is = 50%

FOR GRANULAR AND DUST FORMULATIONS:

Formula: $C_1 V_1 = 100 RA$

Where

C_1 = Concentration (%) of the given formulation

V_1 = Amount / Quantity (Kg) of formulation required

R = Recommended rate of application (Kg/ha)

A = Area of be treated (ha)

Exercise 6. Calculate the amount of Furadan 5 G required for application in an 1000m² against the leaf miner of citrus applied @0.25Kg a.i. Carbofuran/ha.

Solution:

In the present exercise we are given;

$$C_1 = 5\%$$

$$V_1 = ?$$

$$R = 0.25\text{Kg}$$

$$A = 0.1 \text{ ha}$$

Applying $C_1 V_1 = 100 R A$

$$5 \times V_1 = 100 \times 0.25 \times 1$$

$$V_1 = \frac{100 \times 25 \times 0.1}{5 \times 100} = 0.5$$

Hence $V_1 = 0.5\text{kg}$

Exercise 7. If 5Kg of granular formulation is applied for treating 1 hectare area @ of 0.25kg a.i/ha, find out the per cent active ingredient in the formulation.

• Solution:

In the present we are given;

$$C_1 = ?$$

$$V_1 = 5\text{Kg}$$

$$R = 0.25\text{Kg a.i./ha}$$

$$A = 1\text{ha}$$

Using the formula:

$$C_1 V_1 = 100 R A$$

$$C_1 \times 5 = 100 \times 0.25 \times 1$$

$$C_1 = \frac{100 \times 0.25 \times 1}{5 \times 100} = 5.0$$

$$C_1 = 5\%$$

Exercise 8. 10Kg of chlorpyrifos 5% granules are used to treat 5000 m² area for the management of white grubs in an apple orchard, find out its rate of application.

• Solution:

In the exercise we are given;

$$C_1 = 5.0$$

$$V_1 = 10\text{Kg}$$

$$R = ?$$

$$A = 0.5\text{ha}$$

According to the formula;

$$C_1 V_1 = 100 R A$$

$$5 \times 10 = 100 \times R \times 0.5$$

$$R = \frac{5 \times 10}{100 \times 0.5} = 1.0$$

$$R = 1.0\text{Kg} / \text{ha}$$

Part – IV : Disease Management

1. What are plant diseases and how can be they recognized?

Ans. Any abnormal growth in the plant leaf, fruit or twigs of the plants or any spot or abnormal symptom on the plant is termed as a disease. These can be recognized by overgrowths, spots, blights, powdery masses, oozes or mushroom like structures on the plant surface.

2. What are the types of diseases?

Ans. Broadly there are three types of diseases; fungal bacterial and viral plant diseases.

3. What are important fungal diseases?

Ans. Fungi can cause powdery mildew, downy mildew, rust, smut, leaf spots, blights, cankers, scab and anthracnose types of symptoms;

Powdery mildew:- Ash like powdery mass on the leaf and plant surface.

Downy mildew:- Grayish sticky fungal growth present on the lower leaf surface making corresponding upper surface appear yellow.

Rust:- Coloured Powdery masses in the form of blisters on the leaf\plant surface.

Smut:- Charcoal like powdery mass present mostly in the floral or reproductive parts of the plant.

Leaf spot:- Circular or irregular blemishes on the leaves turning brown in later stages.

Blight:- A brown lesion leading to sudden death of the plant and giving the infected part a burnt appearance.

Canker:- Cankers are oval or irregularly shaped lesions on the plant surface which are initially smooth but became rough after they split open. They can form after the infection of any injured tissue by fungi or bacteria.

Scab:- Rough encrustations on the leaf or fruits surface.

Anthracnose:- Dark sunken spots on the fruit or leaf surface which bear pinkish, orange or black colored spore mass in the form of small dots in the centre of the spot.

4. What is Damping off?

Ans. It is a nursery disease in which the collar or crown portion of the seedling is infected with the fungal attack and roots also get infected and degenerated leading to toppling down and death of the seedling.

5. What are mosaic symptoms?

Ans. It is a viral disease symptom identified by yellow, white or green stripes on the foliage, curled or wrinkled leaves, yellow veins stunted growth etc.

6. How can we manage the mosaic?

Ans. By removing infected plants or plant parts and destroying them. Always sterilize the farm tools while doing intercultural practices because infected tools can infect the healthy plants or plant part. Insects are responsible for transmitting the viruses, so control of insect vectors by using insecticides is also helpful in managing the mosaic symptoms.

7. What are root rots and how can be they recognized?

Ans. It is common in damp and water logged soil. The roots of the infected plants rot partially or completely. The disease is recognized by poor growth, wilted leaves, early leaf drop, die back and ultimately death of the plants. Dark brown lesions can develop on roots or crown portion.

8. How can we manage root rot?

Ans. It can be controlled by drenching the soil with fungicides, fumigating the soil or soil solarization. Water logging should be avoided and drainage should be improved.

9. What is dieback?

Ans. It is a condition in which the tree starts to decline from tip down wards and ultimately dies. It can be due to certain root and crown rot pathogens or sometimes associated with anthracnose disease.

10. What are wilt disease symptoms?

Ans. When the leaves of the plants droop downwards with or without yellowing it is called wilt. If it is due to water deficiency, it can be easily managed by irrigating the plants. If the wilt is due to the fungus, the lower leaves of the plant or a branch turn yellow first, then wilt and ultimately die. The wilting progresses from lower to upper portions of the plants. In case of bacterial wilt, the plant leaves wilt without turning yellow or if they turn yellow, the yellowing will start from the top and progress downwards.

11. What are the important bacterial diseases?

Ans. Cankers, bacterial wilt, blight, brown spots and crown gall.

12. What is crown gall?

Ans. Appearance of galls or hard swellings at the crown portion of the plants.

13. What is bacterial ooze?

Ans. It is water coming out from the water soaked or infected lesions of the bacterial plant diseases in the form of droplets which later dries up in the form of white encrustation.