Happy New Year 2024
Dear Farmers and Farm women,

Wishing you a happy and prosperous New Year, 2024!

Horticulture an art of production, utilization and improvement of horticultural crops, such as fruits and vegetables, spices and condiments, ornamental, plantation, medicinal and aromatic plants. Horticulture plays a major role in the economy by generating employment, providing raw material to various food processing industries, and higher farm profitability due to higher production and export earnings from foreign exchange. It can play crucial role in changing the face of agriculture in Punjab by virtue of its diversification, employment generation and export potential. Presently, area under horticultural crops in Punjab state is 420022 ha, out of which 93615 ha is under fruits; 287744 ha is under vegetables; 2177 ha is under flowers and 36486 ha is under spices and aromatic crops. There is a need to create niche areas for horticultural crops to diversify farmers’ income and to conserve natural resources. PAU has developed various technologies for higher yield, better quality and for increasing resistance to biotic and abiotic stresses in these crops. PAU is providing technical expertise for increase in yield as well as production in the limited area available for horticulture. The state department of Horticulture is also providing subsidies for planting new orchards and reviving old orchards apart from many other schemes. Processing and value addition of horticultural crops plays very important role in their promotion and adoptions apart from creating export potential. PAU provides hands on trainings to farmers and farm women for preservation, processing and value addition of these perishable crops. Punjab Agro Industries Corporation has also set up a Mega Food Park in Ludhiana to promote investment in food processing industries.

Agriculture is our wisest pursuit, because it will in the end contribute most to real wealth, good morals, and happiness. With these words, I hope that we will approach the New Year 2024 with resolve to find the opportunities hidden in each new day. Once again, on behalf of PAU, I wish all the readers a very happy and joyful New Year, 2024.

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Planning and planting of deciduous fruit plants

SARVPRITIYA SINGH AND CHETAK BISHNOI

Krishi Vigyan Kendra, Bathinda

Orchard is a long-term investment; if one is not committed at the initial phases, it can cause heavy losses in the near future. It requires well drained soil (pH less than 8.5, EC < 0.5-1.0 mmhos/cm, Calcium carbonate <5-10 %, Lime concentration <10-20 %) and water sampling (don’t irrigate alkaline or saline water), planning, site selection, provision of irrigation channels, paths and roads, buildings and plantation at suitable spacing, procurement of healthy nursery plants, etc. The deciduous fruit plants like pear, peach, plum etc. are planted during December-January, whereas grapes and soft or semi soft pear can be planted up to mid-February. Systematic layout of orchard plays a significant role in plants’ distribution, easy supervision, maximum number of plants in acre and sufficient available space for cultural operations like weeding, irrigation, spraying, manure and fertilization, intercropping and harvesting.

Plantation of orchard

The plants are planted at right angle to each other and every unit of four plants forms a square. For high density plantation, rectangular systems should be followed for establishment of orchard. This system has advantage over the square system as space between the rows can be utilized properly. However, the diagonal system is followed in pear due to long juvenile phase. The peach and plum can be planted as filler plants for short duration and should be removed after few years when the main fruit crop comes into commercial bearing. It gives an additional income to the growers during the juvenile period of the main orchard.

In young and non-bearing orchards, the intercropping is done up to 3-6 years (depending upon the type of fruit plant). The leguminous crops preferably like guara, moong, mash, cowpea, gram, peas, lentil, etc. and vegetables like onion, tomato, radish, beans, cauliflowers, cabbage, leafy vegetables etc. can be done in the vacant space between the rows to generate additional income and improve the soil physico-chemical characteristics.

**Spacing of deciduous fruit plants under square and rectangular system**

<table>
<thead>
<tr>
<th>Fruit Plant</th>
<th>Spacing (m)</th>
<th>Number of plants/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peach</td>
<td>6.5 x 6.5</td>
<td>90</td>
</tr>
<tr>
<td>Soft Pear/Plum</td>
<td>6.0 x 6.0</td>
<td>110</td>
</tr>
<tr>
<td>Grapes (Bower system)</td>
<td>3.0 x 3.0</td>
<td>440</td>
</tr>
<tr>
<td>Rectangular system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grapes (Y-Trellies system)</td>
<td>4.0 x 1.5</td>
<td>660</td>
</tr>
<tr>
<td>Peach/Plum</td>
<td>6.0 x 1.5</td>
<td>440</td>
</tr>
<tr>
<td>Patharnakh</td>
<td>8.0 x 4.0</td>
<td>120</td>
</tr>
</tbody>
</table>

**Selection of nursery plants**

Care should be taken while selection of nursery of fruit plant. It should be healthy, free from diseases and insect-pests, and should be obtained from a reliable nursery. Always purchase plants of known pedigree which are medium in height and grown on the recommended rootstock. Indecisuous fruit plants are lifted from nursery beds with bare roots. A spade/digger is used to dig deep trench on the both sides of the grafted plant rows at a convenient distance. Trimming of the exceptionally long roots is done to avoid injury during transportation. These plants are tied in bundles of suitable sizes for easy handling.

**Digging and filling of pits**

The site selection should be laser leveled and properly laid out with proper paths, water channels and position of each plant. Dig one meter deep and one meter wide round pit manually or with the help of mechanical pit digger for each plant. Refilling of the pit should be done with the mixture of top soil and farm yard manure in equal parts, just nearly 2-3 inches above the ground level, so that after watering, the loose soil may settle down to the actual ground/plinth level.

**Planting and care of young plants**

The fruit plant should be planted in the center of the filled pit with the help of a planting board. It should be taken in consideration that bud union of the plant remains about nine inches above the ground level. After pressing the soil firmly around the plant with feet, apply water immediately. Staking should be done to keep the plant erect. In addition, excessive rainwater should not be allowed to stand in the orchard. To control white ants, apply half liter chloropyriphos per acre followed by light irrigation.

After the establishment of new orchard, keep regular check for insects, pests and diseases. The recommended doses of fertilizers should be applied and follow the spray schedule for insects, pests and diseases in the successive years.

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In Punjab, area under fruit is 96,686 ha with an annual production of 21.41 lakh tones. The fruits cover only 2.0 per cent area out of the total cropped area, which needs to be increased up to 7% as per the recommendations of Second Johl Committee in 2002 on Crop Diversification. Citrus fruits occupy around 55% (53,672 ha) of the total area under fruits. *Kinnow* is a major citrus fruit of Punjab covering around 48% (46,841 ha) of the total area under fruits, while sweet oranges (3,800 ha), limes and lemon (3,031 ha) are other important citrus fruits grown. Recently, area under guava increased rapidly and it covers an area of 12,173 ha with a production of 2.8 lakh tones. It is followed by mango (8,897 ha), pear (4,335 ha) and litchi (3,653). Low chill peach, nectarine and plums are also grown on an area of 224 ha among important fruits of Punjab.

There is a huge demand for quality nursery plants in the Punjab state. The sustainable enhancement in fruit production can be achieved by supplying genuine, healthy and high-quality planting material of recommended varieties. There is always persistent threat of spread of bud transmissible diseases and root rot with nursery plants when grower’s procure plants from non-authentical sources. Due to rapid increase in area under fruit crop like guava, sometime growers procured these plants from unregistered sources, outside the Punjab which led to spread of soil borne and others pests in new area.

There are only 83 registered nurseries in Punjab. Out of these, 50 nurseries are in private sector, 26 are Punjab Government nurseries and PAU has nine nurseries. The nurseries in Punjab are regulated by the state Department of Horticulture, Chandigarh. The fruit nurseries are registered under the Punjab Fruit Nurseries Act 1961 which came into force on 1st April, 1961 and amended by Amendment Bill 2021. The Ministry of Agriculture and Cooperation, Government of India formulated “Protocols and standards for vegetative propagation of fruit crops” in year 2012 (Table 1), which clearly described the set procedures and standards for quality nursery plants of fruit crops.

<table>
<thead>
<tr>
<th>Fruit Crop</th>
<th>Citrus, Guava, Mango, Ber, Amla, Pear, Peach and Plum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of Propagation</td>
<td>Budding/ grafting</td>
</tr>
<tr>
<td>Plant age</td>
<td>Not less than one year old</td>
</tr>
<tr>
<td>Plant height</td>
<td>&gt; 60 cm</td>
</tr>
<tr>
<td>Stem diameter</td>
<td>&gt; 0.5 cm</td>
</tr>
<tr>
<td>Grafting/ Budding height</td>
<td>Not below 8 inches</td>
</tr>
<tr>
<td>Disease and pest incidence</td>
<td>Free from Insect pest and diseases</td>
</tr>
</tbody>
</table>

Apart from this PAU, Ludhiana has also prescribed technologies for nursery production of fruit crops in the Package of Practices for Cultivation of Fruits. These standards help nurserymen for propagating the fruit plants. To cater to the increasing demand of quality nursery plant, there is an urgent need of establishing model fruit plants nurseries by public and private sector. These nurseries will be helpful for supplying quality plant materials and to meet the target of diversifications. The general requirement for establishment of these nurseries is as follow:

- General requirements for nursery establishment
- Well-maintained mother block with proper labelling and nursery records.
- Maintenance of rootstock block.
- Nursery should maintain the documents for the source of planting material/pedigree, nursery raise register, nursery sale registers, etc.
- Proper labelling of grafted/budded plants like name of variety, date of grafting, rootstock, etc.
- Uniformity in the grafts of a particular variety.
- Minimum hardening period of three months.

**Site selection:** The establishment of nursery starts with site selection and the major points to be considered during site selection are: nearness to road/easy accessibility, suitable climate as per requirement of the fruit crops to be propagated, sufficient sunlight, good irrigation facilities and good soil texture.
and fertility.

**Facilities for nursery:** Nursery should have certain facilities for proper functioning and to carry over the day-to-day activities. These facilities include: fencing, working platform/ work shed, net house/shade house/ screen house, substrate or growing media, root trainers/grow bags, nursery tools, budding and grafting tools, electricity and storage facilities.

**Mother block:** Mother block is the most important part of the nursery. It should be well maintained and from a known pedigree source. Mother block plants should be free from insect-pest and diseases which can be assured by indexing for crop specific viruses. Most of the mother plants are being maintained in open field condition except citrus. Mother plants are kept healthy by proper irrigation and fertilizer application which is done according to the age of plants to get healthy and vigorous bud sticks. Reproductive growth is strictly avoided, whereas vegetative growth is permitted, so that maximum bud sticks are produced.

**Rootstocks block and Recommended rootstocks for different crops:** Natural ventilated poly house is used for raising seedling of root stock and grafting on these root stock seedlings. Some of the fruit’s plants like papaya, phalsa and karonda are propagated only through seed. Seed propagated plants are usually healthy and less prone to diseases but plant productivity decreases and fruits produced are of lower quality. However, seed propagation is the most convenient and economical method of rootstock propagation. Papaya seed are sown in polyethylene bags of 25 x 10 cm size from second fortnight of July to third week of September. Eight to ten holes are punched in polyethylene bags for the drainage of excess water. Bags are filled with farm yard manure, garden soil and sand mixed in equal proportion. Information about selection of suitable rootstocks for different fruit trees, their sowing time and method of propagation have been given in the Table 2.

### Table 2: Suitable rootstock and time of sowing of seed

<table>
<thead>
<tr>
<th>Fruit plant</th>
<th>Rootstock</th>
<th>Rootstock sowing time</th>
<th>Method</th>
<th>Budding/grafting time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus</td>
<td>Rough lemon</td>
<td>August-September</td>
<td>T-budding</td>
<td>Mid-February-March and August September</td>
</tr>
<tr>
<td>Guava</td>
<td>Sardar or Portugal</td>
<td>August or March</td>
<td>Patch budding</td>
<td>May to June February</td>
</tr>
<tr>
<td>Mango</td>
<td>Desi mango</td>
<td>August</td>
<td>Side grafting</td>
<td>July to September February</td>
</tr>
<tr>
<td>Pear</td>
<td>Kainth</td>
<td>End-September to first week of October</td>
<td>Tongue grafting</td>
<td>January to February May to July</td>
</tr>
<tr>
<td>Litchi</td>
<td>-</td>
<td>-</td>
<td>Air layering</td>
<td>July to September</td>
</tr>
<tr>
<td>Ber</td>
<td>Katha ber/ Desi ber</td>
<td>April</td>
<td>T-budding</td>
<td>June to September</td>
</tr>
<tr>
<td>Peach</td>
<td>Sharbati or Flordaguard</td>
<td>First fortnight of February</td>
<td>Tongue grafting</td>
<td>January to February May to July</td>
</tr>
<tr>
<td>Plum</td>
<td>Kala Amritsari / Kabul Green Gage</td>
<td>Cuttings are made from end December to January</td>
<td>Tongue grafting</td>
<td>End-December to January</td>
</tr>
<tr>
<td>Sapota</td>
<td>Khirni</td>
<td>July</td>
<td>Veneer grafting</td>
<td>July-August</td>
</tr>
<tr>
<td>Grapes</td>
<td>Cuttings</td>
<td>January to first fortnight of February</td>
<td>Cuttings made from one year old shoots</td>
<td>Mid-January to Mid-February</td>
</tr>
</tbody>
</table>

### Important points to be taken care by fruit growers at time of purchasing of plants

- Always buy the fruit plant from recognized nurseries.
- Consult an expert from PAU Ludhiana, PAU Research Stations, *Krishi Vigyan Kendras*, Farm Advisory Service Centres, officials from state department regarding the recommended crops and varieties for your region.
- The fruit plants sold by the approved nurseries are only of recommended varieties which perform better and they are produced by standard vegetative propagation methods.
- Most of the fruit plants are available in approved fruit nurseries at nominal rates, hence, do not buy fruit plants at exorbitant rates from hawkers and private floricultural nurseries.

*NK Arora:81465-00221*
Importance of soil testing in orchards

ARSH ALAM SINGH GILL AND VIJAY KANT SINGH

Department of Soil Science

Planting an orchard is a large investment. For this reason, it is important to thoroughly assess soil properties before the orchard is established. The costs for an in-depth assessment of soil properties are much lower than the costs accruing from planting an orchard at an inappropriate site. Soil test-based fertilization is a crucial aspect of carrying out sustainable agriculture in the area. The only way to evaluate a soil’s natural fertility or capacity to give nutrients, which establishes the crop’s fertilizer needs, is through soil testing. Farmers have long been advised of the need for soil testing, but they still need to be educated on the scientific technique of soil sampling.

Soil sampling for the orchard plantation serves three major purposes:

- Determine soil properties such as pH, texture, nutrient availability, or salinity.
- Identify unsuitable areas due to physical barriers to root growth or drainage.
- Assess the variability in soil properties within the field to develop nutrient management plans.

Soil testing is technique used for analyzing different parameters i.e. chemical parameters such as pH, EC, nitrogen, phosphorous, potassium and all other essential nutrients in soil that are essential for checking the plant growth and soil degradation through salinity and alkalinity. Soil testing includes three major steps which are sampling, analyzing and interpretation. In Punjab, 93,616 ha area is under the fruit crops as compared to the cereal crops such as rice which has 31 lakh ha and wheat that has 35 lakh ha. In orchards, soil testing is typically conducted only once, primarily before the establishment of the orchard, in order to assess the initial condition of the soil. But soil testing once in three years must be done for fruit crops to know the fertility status of soil.

**Importance of soil parameters**

On the basis of pH of soil, farmers can plant the best crop according to the acidic or alkaline nature of the soil. For example, in slightly acidic soil, farmers can grow grapes, papaya, citrus and in alkaline soil sapota, pomegranate, guava, etc. Thus, pH testing of soil is helpful in selection of fruit crops. Soil testing provides information about the nutrient content in the soil. Essential nutrients like nitrogen, phosphorus, potassium, calcium, and magnesium are critical for fruit crop growth. Understanding these levels helps determine if any nutrients are deficient or excessive, allowing farmers to adjust fertilizer applications accordingly. Armed with soil test results, farmers can tailor their fertilizer applications. This precision ensures that the right nutrients are applied in the right amounts, avoiding over-fertilization, which can lead to environmental issues, and under-fertilization, which can stunt plant growth and reduce yields. Soil tests can indirectly indicate root health. Compacted or poorly aerated soils can impede root development. By addressing soil structure issues revealed through testing, farmers can promote better root growth, leading to healthier and more productive fruit crops. Certain soil-borne diseases can affect fruit crops. Soil testing can identify conditions conducive to these diseases, allowing farmers to take preventive measures. For example, if a soil test indicates poor drainage, steps can be taken to improve it and reduce the risk of root diseases.

Soil for an orchard should be deep, well drained, loamy, fertile and free from hard pan up to a depth of two meters. Water table should be below three metres and not fluctuating. Waterlogged, marshy and salt affected soils should be avoided for fruit growing. The nutritional status and other conditions of the sub-soil are also important for the growth of fruit trees. As all know, soil testing is a foundation for nutrient management. A soil test provides baseline information about the amounts of nutrients available in your soil, and what is needed for healthy plant growth. Fruit crop growers should test their soil at least every 2-3 years. By applying only what is needed, you will also minimize any adverse environmental impacts from fertilizer overuse. Excess soil nutrients contribute to problems such as algal growth in lakes (too much phosphorus) or nitrates in groundwater (too much nitrogen). This helps to mitigate the harmful effects of global warming, while also lowering the total cost of production without lowering yield of fruits.

**Scientific techniques of soil sampling**

The scientific collection of soil samples is the first step in the region’s soil testing program for climate-smart orchard farming. Soil testing is often used to determine fertilizer recommendations for horticultural crops based on the results of a small sample of representative soil that is analysed in the laboratory. Collect 500 g soil samples separately from each soil layer i.e. for top 15 cm, 15 to 30 cm, 30 to 60 cm, 60 to 90 cm, 90 to 120 cm, 120 to 150 cm and 150 to 200 cm either by soil auger or by digging a pit. It should be represented as exactly as possible by the one to ten grams of soil for each element study (Figure 1). Samples from different depths should be collected with
augers or by exposing a soil profile and collection should be done from different horizons separately. In the case of a hard pan or concrete layer, note its depth and thickness; collect a separate sample and label each sample separately indicating the depths of the layer from which samples have been taken. As a result, soil samples must precisely reflect the whole area, emphasizing the need for proper soil collection methodologies. Because this 2-meter depth of soil contains the bulk of root (rhizosphere) activity, a soil sample is taken up to this depth when suggesting the suitability of land for the orchard plantation. If there is any concretion layer, sample it separately and note down its depth and width.

**Labeling of sampling bag:** Label the sample bag with information such as field number, depth of the sample, name of the farmer, address, date of sampling, etc. Prepare two labels one to be inside the bag and the other to be tied on the bag.

**Suitability limits of soils for orchard plantation**

There are some suitability limits of soil for orchard plantations. Conductivity should be less than 0.5 mmhos/cm for citrus and peach, and less than 1 for other fruit crops. Calcium carbonate should be less than 0.5 % in citrus and peach, and less than 10 % for other crops. Lime concentration should be less than 10 % for citrus and peach, and less than 20 % for other fruit crops. Soil testing practices in orchards are not just best practices; it is a strategic investment in optimizing nutrient management, ensuring environmental responsibility, and fostering sustainable orchard management for long-term success.

**Table 1: Suitability limits of soils for orchard plantation**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Peach and Citrus</th>
<th>Other Fruit plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>&lt;8.5</td>
<td>Upto 8.7</td>
</tr>
<tr>
<td>For depth of 60 cm only, in the lower layer it may go upto 9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Conductivity (dS m⁻¹)</td>
<td>&lt;0.5</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Calcium carbonate (%)</td>
<td>&lt;5</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Lime concretions (%)</td>
<td>&lt;10</td>
<td>&lt;20</td>
</tr>
</tbody>
</table>

**Soil sampling precautions**

It is critical to avoid obtaining soil samples in unusual places such as freshly fertilized regions, ancient bunds, marshy areas, below trees, built pits, and so on. Soil samples obtained in these sites will be tested incorrectly, thus we must avoid collecting samples from these unusual locations. To identify soil samples, the cloth bag should be suitably labelled with the information sheet. If the soil sample is wet, allow it to dry in the shade before placing it in the cloth bag.

**Benefits of soil testing**

- Soil analysis enables farmers to make better-informed judgments regarding fertilisation plans for various orchards based on natural soil fertility, therefore increasing long-term farm profitability.
- It determines the quantity of various plant-available macronutrients in the soil.
- It detects nutrients that may be yield-limiting, and hence their long-term use will enhance both economic yields and benefits.
- It measures soil health parameters such as pH, EC, and OC, which influence nutrient availability to crops and hence, yields and profitability.
- Aids in reclaiming problematic soils such as sodic soils from where yields could be enhanced.
- It also provides a farm management tool with the potential advantage to the farmer of better yields, lower operational costs, enhanced environmental risk management, and improved land productivity of various crops and farmers’ livelihoods.

**Soil and water samples are tested by the following laboratories in Punjab**

1. Soil Testing Laboratory, Department of Soil Science, Punjab Agricultural University, Ludhiana.
2. Soil Testing Laboratory, Regional Station (Punjab Agricultural University), Gurdaspur and Bathinda.
3. Soil Testing Laboratory, KVKs, Amritsar, Bathinda, Faridkot, Ferozepur, Gurdaspur, Bahowel (Hoshiarpur), Langroya (Shaheed Bhagat Singh Nagar), Patiala, Ropar, Kheri (Sangrur), Noormahal (Jalandhar), Samrala (Ludhiana), Kapurthala, Goneana (Sri Muktsar Sahib), Bathinda (Moga) and Fatehgarh Sahib.
4. MARKFED and the Department of Agriculture and Farmers’ Welfare, Punjab have also established Soil Testing Laboratories in the state.

*Arsh Alam Singh Gill: 84770-00001*
Nursery raising techniques for early cultivation of summer vegetable crops

DILPREET TALWAR, SARVPRYA SINGH AND PRITPAL SINGH

Department of Vegetable Science

The quality nursery production is a new venture for the nursery growers. The major summer season vegetable crops i.e. tomato, chilli, brinjal and capsicum are grown through seedlings. In cucurbits, farmers can take advantage of early or off-season cultivation if they grow seedlings in pro-trays or polythene bags during winter season. The nursery raising is the best alternative from the farmer point of view; farmers can get high quality seedlings and earn by selling of seedlings to other farmers. These seedlings of vegetable crops can be grown successfully under open field conditions as well as under the poly-house/net-house structures or even under cost-effective low tunnel technology. Out of these technologies, the low tunnel technology has become the most ideal for the small and medium farmers with low investment and easy to maintain, rather than other protected cultivation techniques which require huge amount for maintenance. If farmers can start their own business by selling the seedlings and produce, they can get more return from per unit area.

Methods of nursery growing

The site and selection are the most important aspects for successful cultivation of summer vegetable crops. The soil should be fertile, well drained with high water holding capacity and free from weeds. Conventionally, the beds should be prepared 3 feet wide and 20 cm raised beds from ground level and length of the beds can be kept as per requirement of the farmer. The seed of these vegetable crops is sown in rows 1 to 2 cm apart from each other and at a depth of 2 cm. After the germination of seeds, a blank foliar application of Captan or Bavistan @ 2 g/per liter should be done for preventing the fungal infections. The seeds should be sown as per recommendation basis i.e. 100 g seeds for tomato, 300-400 g seeds for brinjal and 200 g seeds for cultivating chilli/capsicum on an area of one acre. The nursery would become ready for field transplanting after 25 to 30 day after sowing. Seedling transplanting should be done in evening hours. Care should be taken not to irrigate the nursery seedlings at least 2 days before uprooting of seedlings. It gives vigor to seedling and reduces mortality rate during transplanting time. In conventional method, the seedlings raised in open field conditions remain exposed to weather. It suffers with diseases and insect infestation, whereas damping off may cause mortality of seedlings even before or after germination in the nursery. The mortality of seedling may cause huge loss for vegetables crops, particularly for those having costly seeds. It is difficult to raise nursery for off-season vegetable cultivation.

In plug-trays, soilless media is used for raising of vegetable nursery. Firstly, wash the coco-peat twice to ensure that acidic substances and excess salt leach out from the media and pH level remains between 6 and 7. Mix all the three ingredients (coco-peat: vermiculite: perlite: 3:1:1) well to prepare the mixture. It should be ensured that there is no excess water which may not cause rotting of the seed. To ensure optimum moisture level in the mixture, take a hand full of the mixture, and squeeze the mixture in the palm to check the optimum moisture level in the media. Fill the pro-trays with the mixture and sow one seed in each plug/cup and cover the seed with the mixture. Spread a thin layer of vermiculite on the trays to reduce evaporation of water from the trays. The media prepared from mixture of coco-peat, perlite and vermiculite can be used to grow all vegetables for off season conditions. The roots and stems of the seedlings grown under this technique

Temperature and days required for seed germination

<table>
<thead>
<tr>
<th>Crop</th>
<th>Required temperature (°C)</th>
<th>Time taken to germinate during summer season (Days)</th>
<th>Time taken to germinate during summer season (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato</td>
<td>18-27</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Egg plant (Brinjal)</td>
<td>13-21</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>20-25</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Capsicum and Chilli</td>
<td>20-25</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Cucurbitaceous family</td>
<td>18-28</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>
are healthy and grow quickly after their field transplanting. This technology helps growers to enhance and take early-late vegetables.

The time taken for the germination of seedlings in cucurbitaceous is 15-20 days, while for tomato, chillies and capsicum, it is 35-40 days. After that, application of nutrients (N:P:K @ 2 g/L) should be done for 8 to 10 days; after 15-20 days, application of Calcium Nitrate or Magnesium Sulphate 1 g/L should be done, whereas weekly spray of fungicides (Captan/Bavistan @ 1 g/L) is required to prevent fungal infections. It is necessary to know the characteristics of healthy nursery - physical and genetic purity, free from insect attack, healthy and fresh, dark green leaves and uniform plant growth, short and thick branch, white and long roots, and equal development of stem and roots.

**Problems and solutions associated with nursery**

**Damping off of seedlings:** This disease spreads very fast in the greenhouses. With this disease, the stem above the soil becomes discolored/ring/cut appears and weaken causes mortality of seedlings. This disease sometimes occurs in vegetable nursery prepared in pro-trays. To prevent this disease, treat the seed with Captan or Thiram at 3 g per kg seed. After 12 to 15 days after sprouting, drenching of the roots with Elite or Ridomil gold (0.5 g per L water) is required.

Use yellow and blue cards for the management of insect-pests. Yellow cards are indicators of insect (sucking pests) arrival, while the blue cards are used for the arrival of thrips. Apply Imidacloprid at 0.5 ml/litre of water or Actara at 0.5 g/litre for the control of sucking pests. Fenvalate or Malathion should be applied at 1 ml/litre to protect the seedlings against the attack of larvae of lepidoptera insect.

* Dilpreet Talwar: 95927-72123

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**Coping malnutrition with soybean**

**NAVJOT KAUR DHILLON**

*Department of Plant Breeding and Genetics*

In India, due to excessive use of flour made from wheat, maize and bajra, majority of the population is not getting sufficient nutrition. This leads to malnutrition in public. For balanced diet, pulses as source of nutrition should be added to the meal. Soybean, also known as soyabean, is a versatile food item that is rich in various nutrients. It is a great source of protein, which is essential for maintaining healthy body. Incorporating soybean into your diet is crucial for meeting protein needs, especially for individuals following a vegetarian or vegan diet. This plant-based protein is unique as it contains approximately 40% protein content. In addition to protein, soybean is abundant in beneficial nutrients such as omega-3 fatty acids, essential amino acids, and nearly 10 times more polyunsaturated fats than saturated fats.

Soybean offers a complete protein source that compares favorably with animal-based proteins. It provides around 20% oil, which is beneficial for individuals concerned about cholesterol levels, as it contains no harmful transfats. It is important to note that soybean does not contain lactose, making it an excellent alternative for individuals, especially young ones with lactose intolerance. This makes soybean a favorable substitute for dairy products.

Soybean contains important compounds like isoflavones and genistein, which have been associated with various health benefits. These compounds play a significant role in preventing conditions such as cancer and promoting cardiovascular health. Isoflavones and genistein, found in soybean, contribute to the improvement of the immune system and act as antioxidants.

Soybean can be incorporated in our daily meals in many different forms, viz. soybean flour, soymilk, soy yogurt, tofu, soy ice cream, etc. Soybean seeds can be consumed as snacks by roasting it. With soybean flour, one can make soybean biscuits, soybean bread, **soybean mathi**, etc. Soy milk can be easily prepared from soybeans, and it is a nutritious alternative to dairy milk. To make approximately 6-8 liters of soy milk, start by soaking soybeans in water for about 8-10 hours. Subsequently, the soybeans can be blended with water to create a liquid mixture. In the soy milk mixture, approximately 90% is water, 2.5 g of fat, 3.5 g of protein, and other nutritional elements are present. The blended mixture can then be strained to separate the liquid soy milk from the solid residue.

From soy milk, tofu can also be produced. To make tofu, soy milk is coagulated, forming curds. The resulting curds can be pressed to extract excess liquid and create a solid block of tofu. This tofu block can be cut into various shapes and used in a variety of dishes. Soy tofu, rich in nutrients, can be a versatile ingredient in the kitchen. With approximately 72% water, 14% protein and 9% fat, soy tofu can be used in a variety of dishes, including stir-fries, curries, and salads. Soybean can be included in curries in various ways, such as soybean curry, soybean milk curry, soybean yogurt curry, soybean paneer curry and soybean cream curry. Soybean can also be used to make dishes like soybean cutlets and soybean broth. To enhance the taste and nutritional content of soybean curry, various spices and condiments such as soy sauce, soy vinegar, and soy Worcestershire sauce can be added. Soybean curries can be enriched with ingredients like soy onions, soy garlic, soy ginger, and soy coriander to add flavor and nutrients.

In conclusion, soybean is a valuable addition to a balanced diet, providing essential nutrients and contributing to overall health. However, moderation is key, as excessive consumption of any food item may have adverse effects. Incorporating soybean into your diet, along with a diverse range of foods, can contribute to a well-rounded and nutritious eating plan.

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The continuous cultivation of rice-wheat cropping system has witnessed stagnancy in crop yield, infestation of weeds, contamination of groundwater, incidence of pests-diseases and deterioration of soil health. Therefore, it is essential to adopt crop diversification in agriculture and agroforestry has emerged as one of the viable alternatives to crop monoculture. Poplar (Populus deltoides) is one of the most acceptable tree cash crops for farmlands in Punjab and its adjoining states. The farmers adopted this species for growing under agroforestry systems due to its short duration, ease of regeneration, easy availability of quality planting material, good market demand and its compatibility with agricultural crops. The poplar based agroforestry system is a resource conserving system compared with the existing land management systems involving few crops like rice, wheat, sugarcane and cotton, which are extremely resource-exhaustive be it in terms of natural, financial or human resources. It is needless to emphasize myriad uses of poplars in paper and pulp, plywood, matchwood, packing cases and light construction timber. This article provides information regarding nursery raising, field planting and control of insect-pests and diseases.

**Climate and Soils:** It thrives best in subtropical climate where temperature extremes are not too severe. It prefers well drained sandy loam soils having 20-30 % clay content with pH between 6.5-8.5. Its growth is poor in heavy soils or salt affected soils. The good irrigation facilities are pre-requisite for poplar cultivation.

**Planting time:** The optimum time for nursery or field plantation is mid-January to end of February. The PAU has recommended the following clones for commercial cultivation:

**Central-plan region:** PL-1, PL-2, PL-3, PL-4, PL-5, L-47/88, L-48/89

**Semi-arid region:** PL-3, PL-6, PL-7, L-48/89

**Nursery raising:** Poplar nursery can be raised from stem cuttings, having a length of 20-25 cm and 2-3 cm diameter prepared from one year old plants. Soak the cuttings in fresh water for 48 hours before planting. Plant the cuttings in the beds prepared after adding FYM @ 8-12 tons/acre. Plant the cuttings at 50x50 or 60 x 60 cm apart during mid-January to end of February. Make the holes with the help of planting rod and insert the cuttings in soil by keeping one bud above the surface. After first irrigation, spread the rice straw @ 4 tons per acre for better weed control. In one acre nursery, use 50 kg nitrogen (in two splits), 70 kg phosphorus and 30 kg potassium. Apply light irrigation at 7-10 days interval. Hoeing, weeding and de-budding are required in nursery. Plants are ready for transplanting after one year.

**Spacing:** In block plantations, plant poplar at spacing 5m between rows and 4m plant to plant. For higher crop yields, the spacing can be 8 x 2.5 m. Keep the row direction North to South. For bund planting, the spacing should be 3 m.

**Field planting:** Prepare the field by deep ploughing and the pits of 15 cm diameter should be dug out as per spacing. The pit depth should be 100 cm in sandy soils to avoid the wind throw. While planting, keep the plant in center of the pit; fill it with mixed soil and 2 kg FYM, and the fertilizers as per soil testing. For medium fertility soils, use 50 g urea and 85 g DAP. Irrigate the field immediately and apply frequent irrigations till the plants sprouts.

**Pruning:** It is very important to judiciously follow the practice of pruning of branches along the main trunk of the tree to attain maximum volume and quality wood production. The clear bole without knots fetches higher price. Prune the big branches which compete with the main stem. Apply Bordeaux paste on the cut ends. The excessive pruning leads to the epicormic branching.

**Field management:** Regular irrigation at 7-10 days interval is required during summer months for nursery as well as in plantation. The tress having water stress lead to reduced productivity and mortality as well. Avoid burning near the plants, as poplar is very sensitive to...
Farmers can produce seeds of asiatic types varieties of root vegetables recommended by Punjab Agricultural University, Ludhiana under Punjab conditions because these varieties do not require low temperature for flowering and seed production.

Seed production technology of root vegetables: Seed production of root vegetables can be undertaken following seed-to-seed or root-to-seed method.

Root-to-seed method is most effective for the quality seed production because it ensures proper root selection, maintenance of uniform plant spacing and it produces high quality seeds.

Isolation requirement: Proper isolation is required to maintain purity and quality of seed. It has been recommended by central seed committee that an isolation distance of 1600m and 1000m for radish and turnip and 1000m and 800m for carrot around the foundation and certified seed field respectively should be maintained to separate it from the field of other varieties and fields of same variety not conforming to varietal purity requirements.

Replanting of stecklings: When roots are fully mature, they are dug out and selected for truecness to the type. Medium sized roots of radish and turnip about 55-60 days whereas 90 days after sowing in carrots should be dug out. Over aged and immature roots should not be transplanted because they produce low seed yield due to delay in bolting.

Selection of roots: After harvesting, examine each root critically for foliage and root characteristics namely, size, shape, colour, texture, sponginess etc. Reject roots having off-type foliage, roots not conforming to varietal characteristic, diseased, malformed, forked etc. Roots raised in one acre are sufficient to plant 4 to 5 acres of seed crop.

Preparation of stecklings from selected roots: After selection, hold the top/foliage of roots in your hand just near the shoulder of the root and cut the foliage which remains out of your fist. Transplant stecklings of ¾ root length and one third of the top (foliage) in carrot and radish so that the growth of the seed crop is quick and the seed-bearing branches emerge quickly. Select roots having diameter more than 5 cm for turnip seed production.

Stecklings transplanting time and spacing: Transplant stecklings of radish var. Punjab Safed Mooli-2 after middle of November. Seed of turnip and carrot can be produced by transplanted in the first week of December and in the second fortnight of December respectively. Transplant stecklings of radish, carrot and turnip at 60x22cm, 45x30 cm and 45x15cm, respectively in the field for seed production.

Manuring: Apply 30 kg N (65 kg Urea) and 8 kg P205 (50 kg. Superphosphate) per acre. Add whole of P205 and half of N before planting and the remaining half of N after 30 days of planting.

Rouging and field inspections: The rouging operations in root crops are done at four stages, vegetative stage, steckling planting stage, before flowering and seed formation stage.

After 20 to 30 days, crop raised for steckling production should be inspected. Plants showing excessive vigor should be removed. Foliage characters like leaf colour, leaf number and leaf pattern should be taken into consideration.

Another observation should be made at the time of stecklings formation/before planting of stecklings for selection of desirable root characters of the variety.

Roots showing atypical shape and colour should be rejected. Roots may also be selected on the basis of core colour. Roots with heavy top, forking and more adventitious roots are removed.

Third inspection should be done to rouge out plants showing atypical growth characters before flowering. Remove very early and late bolting plants. The fourth inspection should be done at the time of seed formation stage so that the size, texture, color etc.of pod matches the main variety.

Harvesting of seeds: Harvest radish and turnip seeds when the color of the pod turns red-brown. It is the king umbel (primary umbel) or umbel of the first order that flower first. Secondary, tertiary and other orders of umbels flower at an interval of 8-12 days from each-other. The best time of harvest is when the secondary umbels (heads) are fully ripe and tertiary heads begin to turn brown.

After harvesting, dry the plants under shade for a few days and remove the seeds. The seed should be thoroughly cleaned and dried before packing.

Certified seed standards:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Radish</th>
<th>Carrot</th>
<th>Turnip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Seed (Minimim)</td>
<td>98.0%</td>
<td>95.0%</td>
<td>98.0%</td>
</tr>
<tr>
<td>Low (maximum) dust and clay</td>
<td>2.0%</td>
<td>5.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Any other type of seed (max.) (No. of seeds)</td>
<td>10/kg</td>
<td>10/kg</td>
<td>10/kg</td>
</tr>
<tr>
<td>Weed seeds (max.) (No. of seeds)</td>
<td>20/kg</td>
<td>20/kg</td>
<td>10/kg</td>
</tr>
<tr>
<td>Germination (Minimum)</td>
<td>70%</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>Moisture in seed (max.)</td>
<td>6%</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>Moisture for closed containers</td>
<td>5%</td>
<td>6%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Ravinder Kaur: 94630-66782
Total 17 elements are essential for the growth and development of plants. Deficiency of an essential nutrient makes it impossible for the plant to complete the vegetative or reproductive stage of its life cycle. Each plant has its optimum nutrient range as well as a minimum requirement level. Below this minimum level, plants start to show nutrient deficiency symptoms. Such deficiency is specific to the element in question and can be prevented or corrected only by supplying that element.

**Nitrogen:** Nitrogen deficiency usually appears in the vegetable crops like cauliflower, radish, carrot, okra and chilli. The deficiency symptoms firstly appear on the old leaves. The leaves tips become pale yellow in color, which over the time extends towards leaf bud through the primary leave vein. Normal green color of leaves fades to solid pattern of yellowish-green. Plant may become entirely yellow in extreme cases. Plants growth retarded with stems slender, fibrous and hard with less flowering.

**Remedy:** Apply recommended farm yard manure and nitrogen at the right time to the crop.

**Phosphorus:** During winter season deficiency of phosphorus usually occurs in cauliflower, cabbage and coriander due non availability of phosphorus to plant from soil. In deficiency of Phosphorus, leaves become small and often darker green than normal. The undersides of leaves develop reddish-purplish cast and in acute deficiency the whole plant and lowers appear purplish color and growth retarded. Setting of fruit and maturity delayed.

**Remedy:** As per crop recommendation apply recommended dose of phosphorus at the time sowing into the soil.

**Potassium:** Potassium deficiency generally appears vegetable crop like potato and okra. First indication of deficiency is development of ashen gray-green leaves at base of plant. Leaves develop a bronze and yellowish-brown color. Leaf margins become brown and cup downward. Specks develop along veins of leaf. Tissue deteriorates and dies. Roots poorly developed and brown.

**Remedy:** As per crop recommendation apply recommended dose of potassium at the time sowing.

**Sulphur:** The major vegetable crops suffers from sulphur deficiency are peas and chillies. The symptoms first appear on the younger leaves with fading of the normal green colour. The topmost leaves become light yellow except for the tip, while the lower leaves retain green colour for a longer time. This is distinctly different from the nitrogen deficiency where the yellowing starts with the lower leaves.

**Remedy:** In Sulphur deficient soils, preferably use single superphosphate. Where phosphorus was not applied as single superphosphate, apply 50-100 kg of gypsum per acre before sowing to meet the Sulphur requirement of the crop.

**Manganese:** Manganese deficiency generally appears in cauliflower, radish and coriander. The deficiency symptoms appear on the new leaves as interveinal chlorosis with light greyish yellow to pinkish brown or buff coloured specks of variable size. Later, the specks coalesce forming a streak or band in between the veins which remain green. In acute deficiency whole of the plant may die.

**Remedy:** As the deficiency symptoms appears, give one spray of 0.2-0.5% manganese sulphate solution (200-500 gram manganese sulphate in 100 litres of water). Afterwards, give 2-4 sprays at weekly intervals on sunny days.

**Iron:** Iron deficiency most commonly seen in chilli crop. The high content of copper, zinc and phosphorus in soils may also leads to iron deficiency. In deficiency, new leaves develop light-yellow color, first between veins. Later entire leaves become yellow. Necrosis and dying of tissue usually absent. In acute deficiency, the new leaves become whitish in colour.

**Remedy:** As the deficiency symptoms appears, give one spray of 0.2-0.5% iron sulphate solution (200-500 gram manganese sulphate in 100 litres of water). Afterwards, give 2-3 sprays at weekly intervals as per the severity of deficiency.

Farmers are advised for soil testing as a soil test is important for several reasons: to optimize crop production, to protect the environment from contamination by runoff and leaching of excess fertilizers, to aid in the diagnosis of plant culture problems, to improve the nutritional balance of the growing media and to save money and conserve energy by applying only the amount of fertilizer needed.

**Opinder Singh Sandhu: 98884-60091**
Management of insect and mite pests using soybean oil and cotton seed oil in citrus

RAJWINDER KAUR SANDHU, SANDEEP SINGH AND P K ARORA

C

Rice fruit comprising mandarins (mainly Kinnow), sweet oranges, limes, lemons and grapefruit, are of major economic importance in Punjab. Kinnow ranks first with respect to area and production followed by sweet oranges, lime and lemons. Fazilka, Faridkot, Ferozepur, Hoshiarpur, Pathankot, Sri Muktsar Sahib and Bathinda districts are the main citrus growing districts of Punjab. The production of citrus is affected by a number of insect-pests. Out of sucking insect and mite pests, psylla, aphids, thrips and mites are major damage causing insect and mite pests.

Identification and damage symptoms

1. Citrus psylla

Citrus psylla is a serious pest of citrus which remains active throughout the year but peak activity is from March to mid-October. Psylla nymphs are orange yellow in colour, while adults are grey. Nymphs are flat (Pic 1a), circular and orange-yellow; they are found congregated on terminal shoots and buds. Adults (Pic 1b) are found on the underside of leaves. Both nymphs and adults suck cell sap from buds, leaves and young shoots. The leaves get curled downwards and infested twigs die off from tip backwards. In severe infestation, wax secretions are observed on plants (Pic 1c) and black sooty mould grows on honeydew secreted by nymphs and adults (Pic 1d). It also acts as a vector of citrus greening disease.

2. Aphids

Aphids are regular pest of citrus. There are three species of aphid which cause damage to citrus. Toxoptera aurantii adults are shiny black and nymphs are dark brown. Myzus persicae adults are usually green, but can be pale brown and Aphis gossypii adults are pear shaped but are of variable colour. Their adults are pale yellowish-green during high temperature conditions and dark green during winter. Nymphs are greenish brown (Pic 2a) or yellow. Their activity coincides with the onset of mild weather conditions and they remain active during February-April and September-October. Both nymphs and adults suck the cell sap from young leaves (Pic 2b), flowers and tender twigs. In severe infestation, curling and deformation of young leaves take place, resulting into stunted growth. They secrete honeydew on which black sooty mould grows.

3. Thrips

Nymphs are cigar shaped and orange yellow (Pic 3a). Adults are reddish-orange. The pest starts appearing in the first week of March and activity continues up to third week of April. Nymphs feed on tender leaves (Pic 3b) and small fruits near peduncle. Damaged leaves roll inwards along the margins. The attacked flowers dry up and shrivel. Feeding on the fruit appears as light silvery white abrasion around the peduncle (Pic 3c). The affected fruits lose market value due to blemish rind.

4. Mites

The adults are orange or dark red in colour and newly hatched larvae are light yellowish brown. These are very minute in size. Their incidence is maximum

Contd on page 15
Effect of wind speed and direction on dispersal of pollutants

PAVNEET KAUR KINGRA AND SUKHJEET KAUR
Department of Climate Change and Agricultural Meteorology

Every year there are so many hue and cries over the increased air pollution levels and smog during the months of October and November in north-west India. As a result of increase in the concentration of toxic and harmful materials in the air, the air quality index (AQI) deteriorates beyond the tolerable limits resulting in respiratory problems. Based on the specific concentration ranges of different pollutants in the air, the AQI is grouped into six air quality descriptor categories namely good (AQI = 0-50), satisfactory (AQI = 51-100), moderately polluted (AQI = 101-200), poor (AQI = 201-300), very poor (AQI = 301-400) and severe (AQI = 401-500). As the air quality deteriorates, it has severe health implications.

Temporal variation in the air quality

The analysis of monthly average AQI of NCR for the recent years indicates that the region suffers from poor air quality throughout the year. The air quality observed to be satisfactory (AQI = 51-100) only in August, moderately polluted (AQI = 101-200) in May, June, July and September, poor (AQI = 201-300) in February, March, April and October and very poor (AQI = 301-400) in November, December and January. Thus, August is the only month in the year with satisfactory air quality in the region. Comparatively better air quality during monsoon period might be due to the fact that the pollutants mix / fall with the rain water and air becomes clear. As a result, lowest pollution is observed in August. However, as rainfall activity decreases during September, pollution level again starts rising.

In addition to this, festival season commences during October and November during which a large number of crackers are burnt by people, which further increases pollution level in the atmosphere. Other important activity during the months of October and November is crop residue burning, which results in emission of various pollutants in the air, thus deteriorating its quality. However, the changing weather conditions during October and November have more significant impact on the air quality in the region. Due to the onset of winter season, the atmospheric conditions become very stable. As a result, there is no dispersion of pollutants in the air and they keep on accumulating in the surrounding atmosphere, thus deteriorating the air quality and making it unhealthy.

Effect of weather on dispersal of pollutants

Wind speed in the range of light breeze (6-11 km/hr) or at least 4 km/hr is required for the movement of pollutants in the air. For the movement of smoke / pollutants from Punjab towards NCR, light breeze with North / North-west direction is required. However, the analysis of wind speed and direction for Punjab during the recent years (2021-2023)
has indicated that such conditions are rarely met during these months (Fig.). Rather, due to increased stability in the atmosphere, there were calm conditions or with very low wind speed. Secondly, the wind direction was also not favourable for a considerable period. The decrease in temperature near the ground surface results in the formation of inversion layer in the air with stable / calm atmospheric conditions. As a result, near calm weather conditions have been recorded in Punjab during second fortnight of October and first week of November 2023. So, there is no dispersal / movement of smoke / pollutants, rather they get locked up and stay over the same place for many days mainly due to radiational cooling, thermal inversion, stable / calm weather conditions and absence of WD / rainfall.

Under such conditions, there is least possibility of movement of pollutants / smoke towards adjoining areas. Thus, the highest Air Quality Index (AQI) during winter months of November to January might be attributed to the festivities and stable weather conditions at the onset of winter season, which results in accumulation and locking of pollutants in air till January and February and air quality improves after that when temperature starts increasing. Thus, this fact cannot be denied that the NCR has its own pollution sources, in the form of vehicles / large population and industrial processes etc. During rainy season, air quality becomes better as the pollutants mix / fall with rain water and again AQI starts increasing with cessation of monsoon rains and these pollutants keep on accumulating in the surrounding air under stable winter weather conditions till January. Thus, to improve air quality, there is dire need of checking and managing these pollution sources so as to keep it within the satisfactory limits and healthy for people throughout the year.

* Pavneet Kaur Kingra: 94787-61003

Contd from page 13... Management of insect and mite pests

2a. Nymphs of aphids

2b. Damage of aphids on leaves

Pic 2: Aphids–different life stages and damage

3a. Nymphs

3b. Damage on leaves

3c. Damage on fruits

Pic 3: Thrips–nymphs and damage

4a. Mite damage on leaves

4b. Mite damage on fruits

Pic 4: Mite damage

during May-June and sometimes in August-September. Mites damage the leaves, flowers and fruits. The leaves and fruits have minute specks due to feeding of mite and give dusty appearance (Pic 4a and 4b).

Management

Spray 10 litres of Soybean oil or 10 litres of Cotton seed oil + 1.25 kg of detergent powder (surfactant) in 500 litres of water per acre during March and again in the first week of September for psylla, aphids and thrips. For mites, spray during third-fourth week of April and/ or third-fourth week of August. Repeat after 10 days if required.

Note 1: Time of application may be adjusted with the appearance of the pest.

Note 2: There should not be any water stress in the orchard at the time of spray of Soybean oil, Cotton seed oil and MAK HMO.

Note 3: Spray may be avoided at the time of flowering period.

Note 4: During extreme hot months of May-June, spray of oils should be carried out in evening hours to avoid phytotoxicity. High doses of these oils may cause phytotoxicity.

* Rajwinder Kaur Sandhu: 97798-61180
The recent growing concerns about the environment and the lesser use efficiency of conventional granular fertilizers has prompted scientists to develop more efficient fertilizers and formulations. At present, urea is the most popular fertilizer. In this regard, the development of Nano fertilizers is getting impetus.

Rice and wheat remove 20 and 25 kg N per ton of grain yield respectively. A variety of agronomic practices have been optimized to improve the use efficiency of urea such as its application in two or three splits to soil as basal dose followed by broadcasting of the granule at active tillering and panicle initiation with a recommended dose varying from 105 to 120 or even 150 kg N/ha for rice and wheat crops respectively. The first nano-N fertilizer has been launched by IFFCO India in June 2021. IFFCO nano-urea contains 4% nano-N solution or 40g N per litre which has been recommended by IFFCO to be applied twice as foliar spray (at 500 mL nano urea/125 litre water/acre) and has been claimed to save 50% of the conventional urea applied to the soil for cultivation of the rice and wheat crops.

In this regard field experiments were conducted for two consecutive years at research farms of Department of Soil Science, PAU on both rice and wheat crops. In these experiments, the foliar spray treatment comprising 50% N application to soil+2 sprays of nano-urea as per IFFCO recommended protocol exhibited 13 & 21.6% decrease in the yield of rice and wheat respectively 17 & 11.5% decrease in grain N content of rice and wheat crops respectively as compared to the recommended 100% N-fertilizer application to soil. In India these two cereals form the staple food source for the protein and carbohydrates. A decrease in the grain N-content reflects lowered protein content which will deplete the protein energy requirements of the population. Therefore, it does not seem...
to be imperative even if as claimed by IFFCO equivalent grain yields can be obtained by use of nano-urea at the cost of lowered grain-N content. Even if 100% use efficiency is achieved by this nano formulation, requisite nitrogen nutrient could not be provided to the growing crop compared to nitrogen provided by 45 kg of conventional urea. In the experiments performed at PAU, Ludhiana, the grain yields obtained with foliar application of nano-urea and granular urea were found to be equivalent. However, the cost of the nano formulation is ~10 times higher than the granular urea. The experiments also revealed that the aboveground tiller biomass and root volume was lesser by application of nano-urea fertilizer (Fig. 1). The lower root volume indicates decreased available roots surface area that can culminate to lowered N and other nutrient uptake processes by the root as well as lesser root biomass addition after harvest of the crop. The straw thus generated by IFFCO nano urea spray treatment showed lowered N-content compared to straw generated in conventional practice of 100% recommended N or urea applied on to soil treatment (Fig. 2). On incorporation in soil this low-N straw will also exhibit still higher C:N ratio and would be difficult to accomplish its degradation in soil. It seems the over-claim of obtaining grain yields equivalent to recommended dose of conventional urea with IFFCO nano urea will require further long-term field evaluation for at least 5 to 7 years to optimize the dose and correct timing of application for crops. Thus, as per the know-how and information generated so far the results are not encouraging and that the use of IFFCO nano urea cannot be recommended on rice and wheat.

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**Important tips for successful …contd from page 10**

heat stress. Apply the fertilizers after the soil testing.

**Pest management:** In Punjab, eight pests have been identified infesting poplar in agroforestry systems. The important among these pests are the defoliators (leaf defoliate and leaf webber) and bark eating caterpillar. The management of these insects is given below.

**Leaf defoliators:** The peak period of activity of the defoliate is July-November and the over wintering occurs in pupal stage. The first three instars are gregarious in nature and voracious feeders. They scrap the epidermis and skeletonize the leaves. The older larvae are solitary in nature and eat away all the tissues of the leaves, leaving behind only the veins. Grow tolerant poplar clones to reduce attack of defoliator in nursery and subsequently in plantations. Collect and destroy yellow creamy egg masses laid on leaves by burning or crushing them. Deep ploughing in winter helps in preventing attack during next year by burying pupae in soil debris.

**Leaf webber:** The peak period of activity of this insect is July- November. The young larvae web 2 or 3 leaves with silken threads and eat epidermis resulting in drying of leaves. The webbed leaf folds give scorched appearance when seen from below. Pupation occurs in webbed leaves. The control measures are the same as for leaf defoliators.

**Bark eating caterpillar:** The peak period of activity is July- October. Its larvae make holes in stem and feed on the bark while covering body with web made of frass of wood and its faecal pellets. Its attack is also found on the branches and externally appears as thick, ribbon like silken webs. Proper irrigation in summer is required as water scarcity makes plantations more prone to attack. Remove the web and fill the holes. Inject kerosene oil into the holes.

**Disease management**

**Leaf spots:** The peak period for leaf spots is rainy season i.e. from July-September. Severe infection of leaf spots cause blightening and premature defoliation. For disease control, give three to four sprays with Bordeaux mixture (0.8%) starting from first week of July/onset of monsoon and subsequent sprays at fortnightly interval. Avoid raising nursery on same place where infection was observed in previous year. In case of severe infection, collect the defoliated diseased leaves and burn or burn them. Proper sanitation by ploughing the plantation at fortnightly intervals helps in quick decomposition of the litter and disease inoculum.

**Cutting rot (Botryodiplodia spp.):** Cutting rot is a serious disease of nurseries raised in March. It appears on the bark of newly planted cuttings and with the advancement of infection, the tissue below the bark turns brown and is covered with black mass of the fungus. Ultimately the cuttings rot and bark appears as shredded fibers leading to the death of the plant. The problem aggravates in termite infested soils. For disease control, use cuttings made from healthy, disease free nursery plants only. Treat the cuttings with Bavistin @ 0.5% by dipping them for 15 minutes before planting. Drench the soil around the cuttings with Bordeaux mixture (0.8%), if disease attacks the plant in nursery. Avoid growing poplar in water logged areas.

**Harvesting and marketing:** The trees are ready for the harvesting when they attain the girth of 90 cm which is attained in 7 years. Under well managed conditions and sites near the rivers, plants are ready in 5 to 6 years. Contact the near plywood or packing ease factory for the marketing. It is advisable to sell the standing trees to the contractors.

* GPS Dhillon: 81463-00636
Pickles: A fusion of traditional flavor and processing

GAJAR-GOBHI KA ACHAR (pickled carrots and cauliflowers)

Ingredients: Carrots (cut into 1½ inch pieces): 250 g, cauliflower (separated into medium florets): 250 g, turnips (peeled and cut into 1½ inch pieces): 250 g, red chili (10 g), turmeric powder (10 g), coriander: 10 g, fenugreek seeds: 5 g, mustard seeds: 5 g, black pepper: 10 g, fennel Seeds (Sauf): 10 g, fenugreek seeds: 5 g, cumin seeds: 5 g, carom seeds: 5 g, cardamom (small and large): 2 g each, nutmeg: 2 g, cloves: 2 g, cinnamon: 2 g, cardamom: 10 g, salt: 150 g, coriander: 10 g, turmeric powder: 10 g, black pepper: 10 g, fennel seeds: 5 g, cumin seeds: 5 g, carom seeds (ajwain): 5 g, red chili: 10 g, black pepper: 10 g, fennel Seeds (Sauf): 10 g, fenugreek seeds: 5 g, cumin seeds: 5 g, carom seeds: 5 g, green chilies: 10 g.

Recipe
- Wash all the vegetables thoroughly and cut them into appropriate sizes.
- Place the vegetables in a muslin cloth and branch them in boiling water for 4-5 minutes.
- Spread the cut vegetables on a clean cloth and let them air dry for 2 hours.
- Mix jaggery with vinegar and keep it aside.
- In a kadai, heat mustard oil and then add all the vegetables, stir, and cook for 3-4 minutes.
- Stir for 2-3 minutes, turn off the heat, and let it cool.
- Store it in a clean glass jar.

LEMON AND GREEN CHILI

Ingredients: Lemon (500 g), green chili (250 g), ginger (250 g), salt: 150 g, coriander: 10 g, turmeric powder (10 g), red chili: 5 g, black pepper seeds: 5 g, fennel seeds: 5 g, fenugreek seeds: 5 g, mustard seeds: 5 g, cloves: 2 g, cinnamon: 2 g, cardamom: 10 g, salt: 150 g, coriander: 10 g, turmeric powder: 10 g, red chili: 5 g, black pepper: 10 g, fennel Seeds (Sauf): 10 g, fenugreek seeds: 5 g, cumin seeds: 5 g, carom seeds: 5 g, cardamom (small and large): 2 g each, nutmeg: 2 g, mace: 2 g, and mustard oil: 200 ml.

Recipe
- Wash and quarter the lemons, slit the green chilies and cut ginger into suitable sizes.
- In a fry pan, dry roast all the intact spices (mustard seeds, fenugreek seeds, and fennel seeds) after cooling, grind them into a coarse powder.
- In a kadai, heat mustard oil and then allow it to cool down a bit.
- In a large mixing bowl, combine lemons, ginger and green chilies.
- Add the ground spice mixture, turmeric powder, red chili powder and salt to the bowl. Mix well to coat the ingredients evenly.
- Add oil in the bowl and ensure that the oil covers all the ingredients.
- Mix thoroughly and transfer the pickle into a sterilized jar and keep it in sunlight for 4-5 days.

TURMERIC PICKLE

Ingredients: Fresh turmeric roots (cut into 1½ inch pieces), salt: 150 g, coriander (10 g), fennel seeds: 10 g, fenugreek seeds: 10 g, nigella seeds: 10 g, cumin seeds: 10 g, cloves: 2 g, cinnamon: 2 g, cardamom (small and large): 2 g each, nutmeg: 2 g, mace: 2 g, turmeric powder: 10 g, red chili powder: 10 g and mustard oil: 250 ml.

Recipe
- Clean the fresh roots of turmeric and cut into appropriate size.
- Heat the oil in a kadai and cool to room temperature. Add turmeric pieces and mix them well.
- Add all the spices and mix it thoroughly again.
- Store it in sterilized glass jars.

GOOSEBERRY (AMLA)

Ingredients: Fresh gooseberries pieces without seed (amla): 1 kg, coarsely ground ginger: 50 g, coarsely ground garlic: 50 g, mustard oil: 250 ml, salt: 150 g, coriander (10 g), turmeric powder (10 g), red chili: 10 g, black pepper: 10 g, fennel Seeds (Sauf): 10 g, fenugreek seeds: 5 g, cumin seeds: 5 g, carom seeds (ajwain): 5 g, red chili: 10 g, black pepper: 10 g, fennel Seeds (Sauf): 10 g, fenugreek seeds: 5 g, cumin seeds: 5 g, carom seeds (ajwain): 5 g, green chilies: 10 g.

Recipe
- Wash and then boil it in water until tender. Remove boiled amla, cool on a muslin cloth, and deseed.
- Dry roast the intact spices as mentioned in the above recipes.
- Heat mustard oil in a kadai, add garlic and ginger, and sauté until golden brown.
- Add deseeded amla pieces, and stir it for 4-5 minutes.
- Add all the spices and mix it well.
- Stir for 2-3 minutes, turn off the heat, and let it cool.
- Store it in sterilized glass jars.

Gurpreet Dhillon, Rupinder Kaur and Poonam Aggarwal

Regional Research Station, Bathinda
Mentha cultivation-A viable option

RAJENDER KUMAR, VAJINDER PAL KALRA AND AMANPREET

School of Organic Farming

Mentha is an important aromatic crop, grown as an annual in sub-tropical parts of North India. The over-ground herb (foliage) on distillation yields an essential oil, containing high menthol content. The oil has a bitter cooling taste, harsh odour and is the principal source of menthol. It is used in combating cold; used as an ingredient in cough drops and related pharmaceuticals; cosmetics, mouth washes, scenting of tobacco products and flavouring of beverages. Synthetic menthol has also come in market but its volumes are meagre due to high cost of production. Besides, natural menthol is preferred in food and flavour industry. Mentha can also play an important role as a diversification crop to prevailing rice-wheat cropping system. The area under mentha cultivation is increasing steadily with present spreading of 15,000 hectares in Punjab. Japanese mint (Mentha arvensis L.), peppermint (Mentha piperita), spearmint (Mentha spicata), and bergamot mint (Mentha citrata) are the four most common mentha species, although only Japanese mint (Mentha arvensis) and Peppermint (Mentha piperita) are grown in Punjab. A rainfall between 200-250 cm and bright sunshine is good for the growth of crop.

Important varieties

The important varieties of menthol mint i.e., CIM Kranti and Kosi are recommended for commercial cultivation in Punjab. The detailed description of varieties is given below:

**CIM Kranti:** It is a high yielding variety of menthol mint suitable for planting from end of January to mid of February. It contains oil in herb which ranges from 0.6-0.7%. The average herb yield is 110 q/acre and it gets ready for harvesting after 140-150 days of planting.

**Kosi:** It is also a high yielding variety of menthol mint which produces 100-125 q/acre herb yields with oil content of 0.6-0.7%. It gives the higher herb and oil yield when harvested at 150 days after planting.

**Soil type**

The soil having high organic matter, well-drained with neutral pH is highly suitable for mentha cultivation. However, acidic, saline/alkaline soils along with water logged conditions are not fit for mentha cultivation. Two or three ploughings followed by planking are necessary to get a fine seedbed. The field should be free from stubbles and weeds.

**Propagation**

Mentha is propagated through suckers. About 2 quintals of freshly dug 5-8 cm long suckers are enough for one acre. This quantity can be had from half kanal (10 marla) of mentha. Selection of disease free healthy suckers is most important factor and contributes to achieve higher yield. Sprouted suckers causes poor emergence therefore it should be avoided in planting. After digging, wash the suckers and cut into 5-8 cm inch pieces for planting.

**Time of planting**

The best planting time is the mid-January to the end of January, however, Kosi and CIM Kranti should be planted from end of January to mid of February. The crop can also be raised by transplanting in April. The field should be free from weeds and stubbles. Therefore, the land should be ploughed by 2-3 times with cultivator followed by planking to obtain a good tilth.

**Method of planting**

Mentha can be planted on flat beds, raised bed (67.5 cm) or ridges (60 cm). In case of flatbed method, The suckers are laid end to end, 4-5 cm deep in furrows, 45 cm apart and are then covered with soil by planking lightly. For higher biomass production and water saving, planting should be done on 67.5 cm wide beds (two rows) or ridges should be made at 60 cm spacing after broadcasting the suckers. Apply 24 quintal of paddy straw mulch per acre and apply a light irrigation after planting as this practice improves emergence. Light irrigation should be done just after planting.

**Intercropping**

Onion can be intercropped in between two rows of mentha using row to row spacing of 45 cm with 7.5 cm plant to plant spacing. Both the crops can be simultaneously planted from mid-January to end January. For planting mentha in sugarcane, sow one row of mentha using 1.0 quintal of mentha suckers per acre in between two rows of sugarcane during first fortnight of February. However, two rows of mentha can also be intercropped in sunflower using 1.5 quintals of suckers in between two rows of sunflower (planted in North-South direction with row to row spacing of 120 cm and plant to plant spacing of 15 cm) and it should be planted at the end of January.

**Fertilizer application**

Mentha responds well to organic manures, therefore 10-15 tonnes of well rotten FYM/acre should be applied during the land preparation. In addition to FYM, 60 kg of nitrogen and 16 kg of phosphorus/acre should also be applied which can be met through application of 130 kg urea and 100 kg of SSP, respectively. Drill one-fourth of nitrogen and the full quantity of phosphorus at planting. Apply...
another one fourth of nitrogen about 40 days after planting. Add the remaining half dose of nitrogen in two equal splits after the first cutting of the crop. The first split may be applied immediately and the second split 40 days afterwards.

**Weed management**

To obtain good yield and high-quality oil, the crop should be kept free from weeds at all the stages of growth. In the early stages of growth, a wheel-hoe may be used to control weeds. Application of paddy straw mulch @ 24 quintals per acre immediately after planting also helps in reducing weed infestation.

**Water management**

Mentha requires frequent but light irrigations. Irrigate at 10 days interval till the end of March and at five or six days interval till the onset of the monsoon. During the rainy season, irrigate according to the need. The utmost care should be given while irrigation in the rainy season or if the crop is retained for second cutting.

**Harvesting**

The crop should preferably be harvested at the flower initiation stage. If the lower leaves of the plants turn yellow and start shedding, harvesting may be done earlier. Harvest the crop, leaving 6-8 cm long stumps to secure better sprouting. Two cuttings can be taken, first in June and the second in September. The yield of the crop is 100-125 quintals per acre of fresh herbs which contains 0.5 to 0.75% oil

**Processing/Oil extraction**

Crop is allowed to wither for overnight in the field after harvesting. It will reduce the water content and ease the distillation process for oil extraction. There are many distillation units available in Punjab for extraction of oil. Farmers are advised to ensure nearby availability of mentha distillation unit before taking up mentha cultivation.

* Rajinder Kumar: 94173-45565

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**Fruit Research Station at Jallowal: A boon for fruit growers**

**TANJEET SINGH CHAHAL AND VIKRAMJIT SINGH**

*Fruit Research Station, Jallowal-Lesriwal*

**Punjab**, being an agrarian state, has made a significant progress in the field of agriculture. It has been contributing major share of food grains to the Central pool. However, this achievement has come at a cost. Due to high water consumption, excessive use of pesticides and chemical fertilizers, the depletion in soil fertility and lowering of groundwater level is increasing day by day. Therefore, in current scenario, special attention should be given to planting fruit trees to maintain the balance of natural resources. The Punjab Agricultural University, Ludhiana is making efforts from time to time to increase the income of the farmers and to save environmental resources.

The Punjab Agricultural University and its Regional Research Stations are playing a significant role in the growth of fruit cultivation in the state. In Punjab, the total area dedicated to fruit cultivation is 93,616 hectares, out of which 50,168 hectares are primarily used for citrus cultivation. The University has taken several initiatives for the production of disease free citrus nursery over time. One of these initiatives is the establishment of Fruit Research Station Jallowal, located on the Jalandhur Pathankot highway. The station has been maintained by the University since June 2012 and is engaged in large-scale nursery production of fruit plants. The work at the center is based on a hi-tech and scientific approach to prepare disease-free nursery plants, with a special focus on the citrus groups such as mandarin, sweet orange, grapefruit, *kagzi* lime and *baramasi* lemon. The citrus nursery at the station is 100% containerized, i.e., in citripots or plastic bags. The station has set up green houses for the production of rootstock seedlings and screen houses for the establishment of mother blocks.

The station produces recommended rootstock varieties in protrays with sterile media. All the work, from seeding to planting, is done in a highly technical manner in various structures. The station employs advanced techniques to ensure the production of high-quality seedlings.

This station also produces pear, pomegranate, plum, fig and mango plants. Farmers from various districts of the state come here to obtain seedlings. Not only from Punjab, but farmers from other states such as Jammu and Kashmir, Haryana, Himachal, Rajasthan, and Maharashtra also visit this center to purchase fruit trees on a commercial level. The saplings from this center have also been provided for commercial planting in the Nilgiri Hills.

The research station is not only engaged in nursery production but also provides technical information to fruit growers. The Ph.D and M.Sc. students conduct research on various fruit science aspects at this station. The station is playing a significant role in encouraging the farmers of the state to adopt fruit cultivation as a source of crop diversification.

**Citrus plants produced at Fruit Research Station, Jallowal-Lesriwal**

<table>
<thead>
<tr>
<th>Group</th>
<th>Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandarin</td>
<td>Daisy, <em>Kinnow</em>, PAU <em>Kinnow 1</em> and W. Murcott</td>
</tr>
<tr>
<td>Sweet Orange</td>
<td>Early Gold, Blood Red, Jaffa, Musambi, Vaniglia and Valencia</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>Star Ruby, Red Blush and Marsh Seedless</td>
</tr>
<tr>
<td>Lemon and Lime</td>
<td>PAU <em>Baramasi Lemon 1</em>, Eureka lemon and <em>Kagzi lime</em></td>
</tr>
</tbody>
</table>

* Tanjeet Singh Chahal: 98141-37547
Tips for water saving and successful cultivation of spring maize

MAHESH KUMAR, TOSH GARG AND SK SANDHU

Department of Plant Breeding and Genetics

Maize is the third most important food crop after rice and wheat in India. It is a versatile crop and can be grown under different agro-climatic conditions. Maize is well known for its uses like industrial application, cattle and poultry feed, and as a staple food. In Punjab, maize crop is grown in kharif as well as spring season. Spring maize cultivation is an important cash crop for the farmers as it is highly profitable and commercially viable after harvesting of potato crop. The high water requirement of the crop can be rationalized by timely sowing, adopting bed sowing and drip irrigation practices. The following tips should be adopted for its successful cultivation and to save water:

The sowing of spring maize should be completed between 20th January - 15th February depending on the weather conditions. The planting should preferably be done on the Southern face of East-West ridges by dibbling the seed 6-7 cm above the base of the ridge by keeping 20 cm plant to plant distance or on 67.5 cm spaced beds by keeping plant to plant distance of 18 cm.

The crop sown after 15th February encounters high shoot fly infestation and temperature stress. Moreover, low relative humidity particularly in May at the time of flowering period may lead to pollen desiccation, tassel blasting/firing, leaf firing, premature drying of the silks and ultimate yield loss. The late sown crop needs more irrigation. On the other hand, sowing spring maize before 20th January due to low temperature will cause delayed seedling emergence, making the seed/seedling vulnerable to seed rot diseases.

The choice of suitable varieties is an important factor for getting better economic return from the crop. For spring season, Punjab Agricultural University has recommended high yielding single cross hybrids namely PMH 10, DKC 9108 and P 1844.

Use 10 kg of recommended hybrid seed to sow one acre. For effective control of shoot fly during spring season, treat the seed with Gaucho (Imidacloprid) 600 FS @ 6 ml per kg seed before sowing of the crop. Preferably use this seed within 14 days of treatment.

To ensure ecological viability of spring maize cultivation, irrigation requirement should be optimised. To rationalise water requirement, adopt drip irrigation in spring maize. For drip irrigation, prepare 120 cm broad beds at base and 80 cm at top, so that the furrow between the beds is 40 cm wide. On each bed, dibble the seeds in two rows at a distance of 60 cm with a plant to plant distance of 20 cm. A lateral pipe is used to irrigate these two rows with drippers spaced at 30 cm considering the discharge of water @ 2.2 litres per hour per dripper. Follow the timing of irrigation as given below:

<table>
<thead>
<tr>
<th>Month</th>
<th>Timing of irrigation (min)*</th>
<th>Month</th>
<th>Timing of irrigation (min)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>22</td>
<td>April</td>
<td>120</td>
</tr>
<tr>
<td>March</td>
<td>64</td>
<td>May</td>
<td>130</td>
</tr>
</tbody>
</table>

If discharge rate is different, time of irrigation may be adjusted proportionally by the formula: 

\[
\frac{2.2 \times \text{Time of irrigation (min).} \times \text{Discharge of dripper (litre/hr)}}{1000}
\]

Uniformly spread 30 q/acre of paddy straw mulch at the time of sowing to save irrigation water.

The first irrigation should be applied at 25-30 days after sowing depending on the rain. Then subsequent irrigation should be given at two weeks intervals upto 10th April and thereafter at one week interval till maturity.

Ensure irrigation during flowering to grain filling stage as high temperature prevailing at that time can adversely affect the grain yield.

Maize crop responds well to organic manures. The basal dose of nutrients including nitrogen, phosphorus, potassium and zinc can also be omitted if recommended dose of good quality FYM @ 6 tonnes per acre is used in the field year after year. In medium fertility soils, apply 110 kg of urea, 150 kg of super phosphate or 55 kg of DAP and 20 kg of muriate of potash. If DAP @ 55 kg per acre has been used, then reduce the urea dose by 20 kg per acre.

Efficient utilization of nutrients can be achieved by application of fertilizer at critical growth stages of plant i.e. one third urea and whole of phosphorus and potash should be applied at the time of sowing, one third dose of urea at knee high stage and the remaining one third urea should be top dressed at the pre-tasseling stage.

Apply 10 kg of zinc sulphate/acre if the Zn deficiency is earlier known in the field.

Weeds reduce the crop yield considerably, if not controlled at the proper stage. Annual grasses and broadleaf weeds in the crop can be effectively controlled by pre-emergence spraying of Atrataf 50 WP (Atrazine) @ 800 g/acre on medium to heavy textured soils and 500 g/acre in light textured soils within ten days after sowing using 200 litres of water per acre.

Shoot fly is a major constraint infesting...
the crop at seedling stage (3-7 days), resulting in dead heart formation and the insecticidal sprays are not effective after its infestation. Therefore, seed treatment with Gaucho should be followed for effective and economical management of this pest.

The young larvae of fall armyworm feed by scraping the leaf surface and make papery windows. The bigger larvae feed voraciously on the central whorl leaves, causing round to oblong holes and produce a large amount of faecal matter. The larva can be identified by predominant white-coloured inverted Y-shaped mark on the head and presence of four spots arranged in square pattern at the tail end.

To limit multiplication and spread of fall armyworm, sow the spring maize in recommended time only. Avoid staggered sowing of maize in adjacent fields to minimize spread of this pest.

To control fall armyworm, spraying of insecticide at optimum dose with appropriate methodology is most important. Spray Coragen 18.5 SC (chlorantraniliprole) @ 0.4 ml/ litre or Delegate 11.7 SC (spinetoram) @ 0.5 ml/ litre or Missile 5 SG (emamectin benzoate) @ 0.4g/ litre using 120 litres of water per acre, for crop up to 20 days old. Thereafter, the amount of water used per acre needs to be increased up to 200 litres with corresponding increase in dosage of above insecticides. For effective control, direct the nozzle towards the whorl.

Harvest the crop when the husk covers turn brown in colour and grains become hard. Shelling should be done after the proper drying of the ears. For this purpose, efficient manually and power operated shellers, shellers cum dehusker are available in the market. After shelling, the grain should properly be dried to fetch the higher market price. These days economic and easy harvesting with combines is also becoming popular. The farmers are advised to consult the agriculture experts immediately if they face any problem in raising the crop.

- Mahesh Kumar: 94786-27910

Dhingri mushroom: A functional food for maintaining healthy well-being

SHIVANI SHARMA, JASPREET KAUR AND SHAMMI KAPOOR
Department of Microbiology

Functional foods can be defined as foods that affect one or more target functions in the body, beyond adequate nutritional effects in a way that is relevant to either improved state of health and well-being and/or reduction of risk of disease. Dhingri mushrooms, generally consumed for their organoleptic characteristics and culinary qualities, contain high nutritional and pharmacological content, making it a functional food.

Dhingri is universally known as oyster mushrooms and recognized as one of the most popular mushrooms worldwide. From a nutritional point of view, dhingri mushroom is characterized by high protein, ash, total dietary fiber and β-glucan contents, but low levels of fat, sugars, and calorific value. The nutritional value, antioxidant activity and the presence of several health-promoting compounds in dhingri, make it potentially rich ingredient in food formulations.

It contains essential polyunsaturated fatty acids (PUFA) that have shown a positive role in preventing human diseases such as cancer, autoimmune, inflammatory diseases and other health risks. It contains good amount of β-glucans which are not digested by humans. Therefore, they arrived intact in the human colon, where bacteria can hydrolyze and metabolize sugars. Hence, β-glucans can be considered a potential source of prebiotics. A unique β-glucan of dhingri mushroom is pleuran, having potential health benefits for humans including antidiabetic and lipid-lowering effects as well as on its therapeutic effects in respiratory infections. Due to potential health benefits, it should be cultivated and consumed for maintaining healthy well-being. The cultivation process of this mushroom is as follows:-

Chopped wheat or paddy straw, pre-wetted with fresh and clean water, is kept for overnight. Next day, wetted substrate should be placed in slanted position to remove excess of water. The final moisture content of substrate should be 65-70%. The wetted straw should mix with spawn @ 10% dry weight basis and filled into the bags of size 26× 16, 30’×14’. After filling the bags, bags should be tightly tied with gunny thread. The corners of the bags should be slightly trimmed in order to remove excessive moisture. The prepared bags will be placed in growing room or hut. Mushroom mycelium will penetrate into the straw and bag will turn white in colour. Appearance of small bump on the surface of bag indicated the right time to remove polythene. Once bags are opened, they should be watered regularly with fine sprinkler. Subsequently, white pin heads will start appearing; within 4-5 days, mushroom can be harvested by gently twisting them.

Post-harvest care: The relatively high water content of fresh dhingri makes this mushroom a highly perishable commodity, featuring a short shelf life: 24-48 h at ambient conditions, and from seven to ten days in cold storage. During post-harvest, different changes may appear, such as microbial decay, stipe elongation, surface discoloration and cap expansion. Therefore, processing of oyster mushrooms is highly recommended to extend their shelf life. Processing of mushrooms generally starts with washing to remove adherent soil and other soil impurities, or with blanching to inactivate mushroom enzymes. Drying and further dehydration, however, represent the most widely used processes to produce dhingri powder, which in this way can be stored and used for further industrial exploitations and can be consumed during off-seasons. The technical knowledge, dhingri spawn and ready to fruit bags are available with the Department of Microbiology, PAU, Ludhiana with prior booking of 25 days.

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Dhingri mushroom: A functional food for maintaining healthy well-being

SHIVANI SHARMA, JASPREET KAUR AND SHAMMI KAPOOR
Department of Microbiology

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As the universal agricultural landscape scuffles with resource inadequacy, climate change and energy necessity, solar energy integration appears as a promising substitute for sustainable practices in agriculture and horticulture. This article delves at the various applications of solar energy in these sectors, from solar-powered irrigation and greenhouses to solar drying systems. Solar energy integration into agriculture and horticulture practices can have a number of advantages, ranging from cost savings to environmental sustainability. Here are some illustrations of how solar energy is used in agriculture and horticulture farm applications.

**Irrigation powered by solar energy**

Irrigation can be accomplished with solar pumps, which provide a dependable and sustainable source of electricity for pumping water for crop irrigation. The operation of the Solar Photovoltaic (SPV) water pumping system requires an SPV array with a minimum capacity ranging from 900 Wp to 22500 Wp, as measured under Standard Test Conditions (STC). For an inference, according to Ministry of New and Renewable Energy (MNRE) specifications, 5HP pumps should have a pump capacity of 3750W, a solar panel capacity of at least 4800Wp, and the controller capacity should align with the solar panel capacity. Solar Photovoltaic (SPV) water pumping systems must possess a certificate in accordance with IS 14286/IEC 61215 specifications or equivalent standards at the national or international level. The major components of solar pumps are photovoltaic array (SPV Modules), AC motor pump-set, controller/inverter and module mounting structure. Moreover, MNRE had launched PM-KUSUM scheme in Punjab for installation of off-grid solar pumps ranging from 3 to 10 HP capacity (AC) both surface and submersible for irrigation in agriculture sector. This is especially useful in distant regions where grid electricity may be unavailable.

**Solar Water Heating**

Solar water heaters can provide warm water for a variety of horticultural activities including crop washing and sanitation. This helps to reduce reliance on traditional energy sources for water heating.

**Solar Drying**

Solar energy finds application in horticulture through solar drying systems, which offer a range of options. Solar dryers come in various shapes and structures, catering to different needs. Punjab Agricultural University (PAU) has developed a domestic solar dryer that is suitable for drying vegetables, spices, and various household items like chili, turmeric, ginger, garlic, fenugreek, papad, amla, wadian, and vegetables used in pickle making. In a single batch, it can dry up to 3 kg of products. The drying system comprises an independent solar air heater and a drying chamber. The top of the drying chamber is hinged and contains two trays stacked vertically for placing the products to be dried. To initiate the drying process, the dryer is positioned facing South in an area with continuous sunlight throughout the day. It is equipped with wheels for easy mobility. Typically, the product is dehydrated within 1-4 days. When compared to traditional open-sun drying, the solar dryer significantly reduces drying time by 25-35%. Additionally, the quality of the dried product in the dryer is superior to that achieved through open-sun drying methods. In general, the technical specifications required for drying systems are sunlight hitting area - 2.7 square feet; drying area in which material is placed – 2.3 square feet; and heating volume inside dryer - 0.96 cubic feet.

**Electricity Storage through Solar Energy**

Combining solar energy systems with energy storage options such as batteries allows you to store extra energy generated during sunny periods for use when sunlight availability is limited or at peak energy demand times. For an inference, if a 5 kW solar panel is installed with a size of battery of 10kWh and household electricity consumption during the day between 8:00 am to 6:00 pm is at 70 %, then during peak sunny season, 25.6kWh is generated through the solar system, and daily 9.2 kWh electricity can be stored in a battery. Therefore a potential savings can be accomplished through electricity storage. Above mentioned solar energy applications can help in improving resource efficiency, developing resilience in the face of climatic uncertainty, and encouraging a more sustainable and environmentally responsible approach to agricultural and horticultural practices.
Many diseases such as contagious, vector borne and zoonotic diseases spread during cold weather. Out of these fatal diseases, Foot and Mouth Disease is a major problem for livestock farmers.

Foot-and-mouth (FMD) disease is an infectious disease spread among animals by a virus (Aphthovirus). This disease occurs in cloven hoofed animals such as cows, buffaloes, pigs, sheep and goats, but the much damage caused by this disease is in milch cows and buffaloes. The death rate in this disease is very low but there is a huge reduction in milk production, due to which the livestock keepers suffer a massive economical loss. In India, mainly four types of strains of this virus are found - O, A, C and Asia-1. Among them, ‘O’ type is most common. This disease causes more damage in exotic and mixed (crossbred) breeds of cattle; this virus is not killed by commonly used disinfectants and can survive for several months on the infected dairy farms.

**Causes of disease spread**

This disease spreads very fast among the animals and within a short period of time, it spreads among the animals of the herd or the entire village. This virus sheds from all the body orifices of the sick animal and can spread up to ten kilometers through the air in a suitable environment. The disease occurs in healthy animals through contact and inhalation of sick animals. Other items such as fodder, water, utensils and workers who have come in contact with sick animals also spread the disease. Semen of sick animals can also spread the disease. The virus is found in raw meat and raw milk (unboiled).

**Symptoms**

- High fever (104°-105° F).
- Saliva falls from the mouth and blisters form in the mouth.
- Blisters and sores also occur in the hooves and lameness occurs in the animal.
- The animal does not eat due to which its weight and milk decrease very quickly.
- Pregnant animals get aborted.
- Due to the bad effect of the virus on the heart, calves die suddenly without showing any other symptoms.
- Even after the disease is cured, symptoms like lameness, difficult breathing and drying up of milk remain in the dairy animals.

**Disease diagnoses**

This disease can be identified from the symptoms of the disease. The disease is diagnosed with tests like tissue culture, ELISA and PCR. Therefore, a sample of water from blisters or mouth saliva should be sent to the laboratory.

**Treatment**

The disease is treated according to the symptoms. Oral blisters can be washed with potassium permanganate solution (1:1000), and boro-glycerine 850 ml (glycerine) and borax 120 g can be applied. Foot blisters can also be cleaned with potassium permanganate. Antibiotics may be given to prevent secondary bacterial infection. Due to the lesions in the mouth of the animals, soft and balanced feed should be given to the animals.

**Prevention**

- Before the start of winter season, all the animals over four months of age must be vaccinated against FMD every six months (December-January and June-July) and make sure to give a booster vaccination three weeks after the first vaccination. During disease outbreak, no new animal should be purchased and one should avoid going to the place or farm where the disease is present.
- Dairy farm should be washed twice a day with 4% sodium carbonate (400 g sodium carbonate in 10 liters of water) or 2 % sodium hydroxide (NaOH) for 10 days to prevent spread of disease.
- There should be a footbath at the door of the dairy farm in which disinfectant solution or potassium permanganate should be added. Quarantine rules (segregation of new animals for 21 days) should be followed while bringing in new animals.
- Lime or bleaching powder should be sprinkled (3 to 4 inches thick) around the boundary of the diseased village.
- Dead animals should be properly buried with lime.
- In case of disease outbreak, the Veterinary Doctor of Animal Husbandry Department should be informed immediately.

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Management of honey bee colonies during winter season

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Winter season in Punjab prevails during mid-December to mid-February. The temperature usually remains very low during this period and the minimum temperature may fall below 5°C during a few nights. Frosting can also be noticed in this season during some days. Cold winds, dense fog and prolonged cloudiness further deteriorate the conditions for the honey bees. Bees get very brief period to forage under such prevailing conditions because bees start foraging late in the morning and the activity ceases early in the evening. Hence most of the time bees remain confined inside the hive. The prevailing conditions of prolonged cloudiness coupled with the cold winds further reduce the foraging period of the bees. These conditions necessitate the focus of the management practices to be shifted on increasing bees’ strength and brood rearing for serving the ultimate goal of high hive productivity.

At the start of winter season, bees usually collect nectar and pollen largely from *toria* and eucalyptus flowers. *Toria* honey must be extracted by end of the November otherwise this honey may granulate in the combs. During the later phase of winter season, nectar to the bees is available from eucalyptus and *raya* apart from rapeseed and mustard grown in *berseem* or wheat crop.

So it is recommended that suitable management practices must be initiated at the onset of the winter season so as to facilitate the honey bee colonies to withstand the winter conditions well. Important colony management practices to be followed during winter season are described below:

**Inspection of honey bee colonies: Needs, method and suitable time**

Critical inspection of the honey bee colonies before the onset of the winter season is one of the most important steps. Colonies should not be opened during early morning or late evening times because this will suddenly reduce the temperature of the bees cluster. The best time for honey bee colony inspection during winter season is during noon hours of a calm sunny day when cool breeze is not blowing. The task of inspecting honey bee colonies must be completed within a short period so that exposure of bees and brood to low temperature conditions is minimum.

This colony inspection is important for successful overwintering and higher colony productivity. Colony inspection provides beekeepers with information regarding age and performance of queen bee, bee population, disease or pest attack and food storage. The colonies having low bee population or headed by old queen bees need more attention. A weak colony may face several problems during winter season, hence, at the onset of the winter season, such colonies must be provisioned with the sealed brood without adult bees from some strong colony. This will help in gaining the strength when adult bees emerge out of the cells. Uniting the two weak colonies can be another option.

**Need and method**

Shifting the honey bee colonies to a sunny place can help in obtaining higher colony productivity because such colonies maintain the hive temperature better as compared to colonies placed under shade. Colonies must be placed in such a way so as to receive maximum sunshine at the same time; the colonies must not be exposed to cold winds. Honey bee colonies must be migrated to another place if such place is not available at the present apiary. To do this, the golden principle of ‘3 feet or 3 km must be followed. This means that if the colonies are to be shifted to the sunny place within present in the same apiary, then daily move the colonies by 3 feet towards sunny area. If the present apiary doesn’t have sunny place, then shift the honey bee colonies to sunny place 3km away from the present apiary. At the new site, place the colonies with their entrances facing South-East direction so that sunlight falls on the hive entrances for most of the time in a day and colonies may experience warmth. This will help bees in foraging for longer period in a day.

**Protection from cold winds**

In the winter season, cold winds usually blow from western to eastern direction. So prepare wind break in the apiary by planting bushes or erecting some temporary structure at one side. Cracks or gaps in the hives must be sealed either with mud or tape. To minimize the effect of cold winds, entrances of the weak colonies should be narrowed down.
Uniting the weak colonies

At the start of the winter season, very weak or queenless colonies must be united with the queen right colonies, otherwise such colonies may not withstand the winter conditions and even they survive, these colonies will not provide surplus honey. Newspaper method of uniting the colonies (Fig 1) is very efficient, easy and being followed by most of the beekeepers. In this method, small holes in the newspaper are made with the help of tip of the hive tool. Such holes must be small enough to allow the smell of the two colonies to pass but restrict the passage of bees through it. Remove the top and inner cover of the strong colony and completely cover its top bars with the newspaper with holes. The hive of the weak queenless colony without bottom board must be put on this newspaper. There should not be any gap for the bees in the upper chamber to escape. Smell of the two colonies will get mixed slowly, this time bees of both the chambers will cut the newspaper and get mixed. This process will be completed within 2-3 days. After three days, remaining parts of the newspaper must be removed from the hive. If there is space in bottom chamber, it must be filled by shifting frames from the top chamber into it. Top chamber can also be removed if all of its frames get adjusted in the bottom chamber.

Colonies must be united in the evening time when all the bees have returned to their respective colonies. It must be ensured that bees of the upper chamber may not get any passage to come out of the chamber but they must have sufficient feed for 3-4 days.

Storing drawn combs

Due to extraction of honey during November, lesser brood rearing and reduced foraging by bees, a number of combs get empty. These empty combs create problem in efficient maintenance of the hive temperature. Therefore, such empty combs must be removed before providing winter packing to the colonies. Such combs must be stored well so as to be used in the coming spring season.

Winter packing: Need and method

Honey bees are cold blooded animals and therefore, are unable to maintain constant body temperature in extreme winter conditions. So these are severely affected by temperature. Though honey bees tend to regulate their colony temperature by making cluster, still winter packing is required to facilitate the bees in better warming up of the colony. Delay in providing winter packing is one of the main causes in reducing the hive productivity during winter season. Night temperature in the winter season usually remains 10-15°C lesser than the day temperature, hence, night temperature must be taken into account while deciding when to provide winter packing. Winter packing is of two types.

Inner winter packing

Inner packing means filling the empty space inside the hive with the help of paddy or wheat straw or wooden frass or thermocol. This will help in maintaining the hive temperature. In this season, paddy straw is readily available, easy to use and cheap material. Inner winter packing must be given to all weak queenright colonies. A colony having 10 bee-frame strength does not require a winter packing. All the frames of 6-7 bee-frame strong colony must be pushed on one side and the empty space thus formed on the other side of the hive must be filled with the paddy straw after putting dummy board at the end of the frames (Fig 2). In very weak colonies, all the frames must be kept in the centre of the hive and thus the empty space on both sides of the hive be filled with paddy straw filled in polythene or newspaper (Fig 3). Take care to avoid trapping of bees in the packing material.

Outer packing

Outer packing means covering the hive from outside. Place 2 inch thick layer of paddy straw between the bottom board and hive stand. Cut and remove the extra straw on the sides. Touching the ground must also be cut so as to avoid entry of the moisture and pests into the hive. Hive from all the sides may be wrapped with polythene sheet, leaving only the entrance open. Ensure that each colony has about 4-5 kg of feed before packing.

Provisioning feed

Bees during winter season under Punjab conditions do collect nectar and pollen, if available in that area. However, ensure that bees have sufficient feed to withstand winters. Colonies having very less stored food, may be provisioned with 1-2 sealed honey combs taken from the colonies having surplus food. Concentrated sugar solution (2:1, w/v sugar: water) filled in empty combs (Fig 4) may also be provisioned to honey bee colonies. If empty combs are not available, division board or plastic feeders can also be used during this season.

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A variety of vegetable cooking oils are available to Indian consumers. These include: rapeseed-mustard, groundnut, soybean, safflower, sunflower, and coconut oil as well as their blends. Local preferences and availability play a major role in determining the consumption patterns of different oils, largely outweighing scientific rationale. In the Northern, North-Eastern, and Eastern regions of India, about 67% of the population consumes mustard oil, palm oil and soybean oil. Mustard oil’s distinct pungency makes it preferred oil for enhancing food flavors. The mustard oil is now slated to dominate edible oil market due to its widespread consumption and beneficial health properties. To address these concerns, canola, a type of rapeseed-mustard with modified fatty acid composition and reduced level of meal Glucosinolates, was developed. The term “Canola” was coined for the first time in Canada, the country where canola was first developed. It stands for “Canadian oil with low acid.” Canola oil must have less than 2% erucic acid in its oil, while the residual meal after oil extraction should contain less than 30 μmoles of Glucosinolates per gram. The term “canola” now encompasses all rapeseed-mustard cultivars that meet the specified criteria for erucic acid content in oil and Glucosinolates in meal. These are also referred to as double low “00” varieties.

The fatty acid composition of canola oil is arguably close to ideal. This oil usually contains <7% saturated fatty acids (SFAs) [Palmitic acid (16:0) + Stearic acid (18:0)], 60% monounsaturated fatty acids (MUFA) [Oleic acid (18:1)], 30% polyunsaturated fatty acids (PUFAs) [20% Linoleic acid (18:2, Omega 6) and 10% Linolenic acid (18:3, Omega 3)], and <2% Erucic acid (22:1) (Table 1). Compared to non-canola rapeseed-mustard cultivars, canola cultivars’ oils contain significantly more oleic acid, which increases their thermostability and makes them better for frying and storage. Canola Gobhi Sarson oil possesses a higher percentage of oleic acid (62-65%), in comparison to current canola mustard/ raya genotypes (41-42%), (Table 1). Current research at Punjab Agricultural University, Ludhiana is focussed on creating Indian mustard with high Oleic acid content (70%). Canola oil is rich in two PUFAs, Linoleic acid (Omega 6) and Linolenic acid (Omega 3), both of which are good for human health since they balance out the blood cholesterol levels and lower the risk of developing heart-related ailments. Canola oil is the most healthful edible oil due to its low levels of SFAs (palmitic and stearic), high levels of MUFA’s (oleic acid), and intermediate levels of PUFA (linoleic acid and linolenic acid), as well as an acceptable omega 6: omega 3 ratio (2:1) that is more close to the recommended

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Canola hybrid/variety</th>
<th>Fatty acid profile (%)</th>
<th>Glucosinolates (μmoles/g defatted meal)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>SFA</td>
<td>MUFA</td>
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<tr>
<td></td>
<td></td>
<td>Palmitic (16:0)</td>
<td>Stearic (18:0)</td>
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<td>Mustard</td>
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<tr>
<td>1.</td>
<td>RCH 1 (Hybrid)</td>
<td>4.2</td>
<td>2.6</td>
</tr>
<tr>
<td>2.</td>
<td>RLC 3 (Variety)</td>
<td>4.3</td>
<td>1.7</td>
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<tr>
<td>Gobhi Sarson</td>
<td></td>
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</tr>
<tr>
<td>1.</td>
<td>GSH1707 (Hybrid)</td>
<td>5.0</td>
<td>2.3</td>
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<tr>
<td>2.</td>
<td>GSC 7 (Variety)</td>
<td>5.1</td>
<td>2.7</td>
</tr>
<tr>
<td>3.</td>
<td>GSC 6 (Variety)</td>
<td>5.4</td>
<td>2.8</td>
</tr>
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</table>
range. Canola oil’s high smoke point (220–255.67 °C) makes it ideal for high temperature Indian cooking because it produces little unhealthy transfats when food is deep-fried, baked or grilled.

The meal that remains as a byproduct following oil extraction from rapeseed and mustard seeds is another important product. It is mostly incorporated into the feed for cattle, pigs, poultry and farmed fish due to its high concentration of minerals, vitamins and high-quality proteins (35–40%). Despite being nutrient-dense, the meal from conventional rapeseed-mustard types is considered of lower quality due to its high Glucosinolates content, as their consumption is known to impact iodine metabolism of the animals and cause thyroid and other goitrogenic conditions. The meal Glucosinolates content has been significantly reduced from 45–130 μmoles to less than 30 μmoles per gram of defatted seed meal in the canola grade rapeseed–mustard cultivars. This reduction in Glucosinolates content is a stand out attribute as it ensures that the meal’s nutritional advantages can be efficiently utilized by livestock and poultry without the risk of potential thyroid-related issues that are known to be associated with higher Glucosinolate levels.

The Punjab Agricultural University in Ludhiana has been working to develop canola quality varieties in order to meet the growing demand for canola oil. Several canola or “00” quality cultivars have been developed. These include RLC3 (variety) and RCH1 (hybrid) of raya; and GSC6, GSC7 (varieties), GSH 1707 (hybrid) of Gobhi Sarson (Table 1). The oil quality produced from the aforementioned varieties and hybrids is similar to the canola oil imported from advanced countries like Canada. Hence, farmers are encouraged to use canola quality raya and Gobhi Sarson for cooking oil and high quality feed for animals.

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TASTE BUDS: Sweets for the festivities

**PRERNA KAPILA AND GURUPDESH KAUR**

**Skill Development Center**

**Black Carrot Burfi**

Black carrot burfi is a delicious sweet made with black carrots, khoya (reduced milk), sugar and ghee.

**Ingredients:** 2 cups grated black carrots, 1 cup khoya (mawa), 1 cup sugar, 1/4 cup ghee, 1/2 teaspoon cardamom powder, A pinch of saffron strands (optional), Chopped nuts for garnishing (almonds and pistachios)

**Method:** Peel and grate the black carrots. Heat 2 tablespoons of ghee in a pan. Add the grated black carrots and sauté them on medium heat until they become soft and the raw smell disappears. This may take about 10–15 minutes. Once the carrots are cooked, add the khoya to the pan. Stir well to combine. Add sugar to the mixture and continue to cook on medium heat. The sugar will melt. Keep stirring the mixture on medium to low heat until it thickens and starts to leave the sides of the pan. Add cardamom powder and saffron strands to enhance the flavor. Mix well. Grease a tray or plate with ghee and set it aside. Once the mixture reaches a thick consistency, transfer it to the greased tray and spread it evenly. Garnish with chopped nuts (almonds, pistachios) on top and press them gently into the burfi. Allow the burfi to cool completely. Once it is set, cut it into desired shapes - squares or diamonds and serve.

**Peanut Burfi**

Peanut burfi is a delicious and easy-to-make Indian sweet made from roasted peanuts, sugar, and ghee. Peanuts are a good source of protein, healthy fats, dietary fiber, and various vitamins and minerals including folate, vitamin E, magnesium, and potassium. The use of jaggery instead of refined sugar reduces the glycemic index of the burfi. Jaggery also contains antioxidants that help combat free radicals in the body, potentially reducing oxidative stress and inflammation. Jaggery is a good source of iron and known for its digestive properties. The combination of peanuts and jaggery provides a quick source of energy due to the presence of carbohydrates and healthy fats. Here’s a simple recipe for peanut burfi:

**Ingredients:** 1 cup roasted peanuts (unsalted), 1 grated jaggery, 2 tablespoons ghee, 1/4 cup water, 1/4 teaspoon cardamom powder, Chopped pistachios or almonds for garnish

**Method**

Dry roast the peanuts in a pan until they turn golden brown. Remove the skins from the peanuts. Grind the roasted peanuts in a food processor or a blender until they turn into a fine powder. In a heavy-bottomed pan, add the grated jaggery and 1/4 cup of water. Heat it over medium-low heat, stirring continuously until the jaggery forms syrup. Strain the syrup. Cook the strained jaggery syrup till it reaches soft ball stage. Add the ground peanut powder and cardamom powder to a separate bowl. Mix them together. Once the jaggery syrup reaches the soft ball stage, add the peanut mixture to the syrup and mix well to combine. Reduce the heat to low. Add the ghee to the mixture and stir continuously. The mixture will thicken and leave the sides of the pan. Grease a plate with a little ghee and transfer the peanut mixture onto it. Flatten and smoothen it using a greased spatula or the back of a spoon. Allow the peanut burfi to cool for a while, but while it’s still warm, cut it into squares or diamond shapes using a sharp knife. Allow the peanut burfi to cool completely before removing the pieces. Once cooled, store them in an airtight container. The homemade peanut burfi is ready to be enjoyed. It’s a delightful and nutty sweet treat that’s perfect for festivals and special occasions.

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WHEAT
1. Apply second irrigation to December sown wheat.
2. Wheat plants affected with flag smut should be rouged out and burnt. Special attention should be given in Ropar and Hoshiarpur areas.
3. Observe the wheat fields for appearance of yellow rust. As soon as the disease appears, spray the crop with Taqat @ 300 g or Caviet @ 200 g or Nativo @ 120 g or Impact xtra or Opera or Tilt or Shine or Bumper or Stilt or Compass or Markzole @ 200 ml in 200 litres of water per acre. Repeat the spray at 15 days interval.
4. Observe the fields for appearance of aphids, if the population reaches the economic threshold level (ETL) i.e. 5 aphids/earhead, give two sprays of 2 litre PAU Homemade neem extract at weekly interval or single spray of 20 g Actara/Taiyo 25 WG (thiamethoxam) in 80-100 litres of water per acre.

OILSEED CROPS
1. Lentil may be irrigated for getting better returns.
2. Gram caterpillar feeds on leaves, flowers and pods, and grains in the pods of gram crop. If a total of 16 or more larvae of gram caterpillar are observed from 100 plants, spray 800 g Bacillus thuringiensis var kurstaki 0.5 WP (DOR Bt-1) or 200 ml Helicop 2% AS (HaNPV) or 50 ml Coragen 18.5 SC (chlorantraniliprole) or 80 g Proclaim 5 SG (emamectin benzoate) or 160 ml Rimon 10 EC (novaluron) in 80-100 litres of water per acre. Prefer to use biopesticides as first spray for younger larvae and repeat the spray after a week, if necessary. Ensure a waiting period of three days for consuming leaves and green grains, after spray of Coragen 18.5 SC.
3. To check powdery mildew on peas, spray the crop with Sulfex @ 600 g in 100 litres of water per acre. Repeat the spray at 10 days interval.

SUGARCANE
1. Start sowing of sugarcane from second fortnight of this month and use recommended varieties i.e. CoPB 95, CoPB 96, Co15023, CoPB 92, Co118, CoJ 85, CoJ 64 (early maturing), CoPB 94, CoPB 93, CoPB 98, CoPB 91, Co
238, CoJ 88 for mid-season and late maturing.
2. The sets selected for planting should be free from diseases like red rot, wilt, ratoon-stunting and grassy shoot.
3. To avoid the attack of termites, apply well rotten farmyard manure and remove stubbles and debris of previous crop from the field. For the control of termites, apply 200 ml Coragen 18.5 SC (chlorantraniliprole) using 400 litres of water over seed sets in furrows before covering them with soil or spray 45 ml Imidagold 17.8 SL (imidacloprid) dissolved in 400 litres of water per acre with sprinkler along the rows 45 days after planting. Earth up slightly and follow with light irrigation.

4. For early shoot borer, apply 10 kg granules of Regent/Mortel/Rippen 0.3G (fipronil) before the sets are covered with soil by planking or apply 10 kg Regent/Mortel/Rippen 0.3G mixed in 20 kg moist sand/soil or 150 g Takumi Regent/Mortel/Rippen 0.3G to control of annual grasses and broadleaf weeds. In the second fortnight of this month, nurseries of muskmelon, watermelon, bottle gourd, pumpkin, etc. should be transplanted on recommended spacings of each crop. Before transplanting, apply 35 kg urea and earth up the crop.

Vegetables

Cucurbits
1. As soon as the risk of frost is over, remove “Sarkanda” or plastic cover from the crop sown in November-December and irrigate the field. Apply remaining half dose of nitrogen in channels, earth up and train vines towards the bed. Thereafter, apply light irrigation once a week in sandy soil and after 10 days interval in heavy textured soil regularly.
2. Draw bed marks East to West at the recommended spacing for each crop. Apply 35 kg urea, 155 kg single superphosphate and 40 kg Muriate of Potash per acre in a band at 15 cm on Southern side of each bed mark and prepare channels and irrigate. Sow the seed of different cucurbits on the moist edge of beds.
3. In the second fortnight of this month, nurseries of muskmelon, watermelon, bottle gourd, pumpkin, etc. should be transplanted on recommended spacings of the respective crop. Before transplanting, cut and remove plastic bags.

Fodders
1. Irrigate Berseem and Lucerne at 15-20 days interval depending on the weather conditions and soil type. Have regular cuttings of Berseem. Avoid delay for next cutting.
2. Make silage of oats in late February to early March when the crop is at milk stage if the fodder is surplus.

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2. Draw bed marks East to West at the recommended spacing for each crop. Apply 35 kg urea, 155 kg single superphosphate and 40 kg Muriate of Potash per acre in a band at 15 cm on Southern side of each bed mark and prepare channels and irrigate. Sow the seed of different cucurbits on the moist edge of beds.
3. In the second fortnight of this month, nurseries of muskmelon, watermelon, bottle gourd, pumpkin, etc. should be transplanted on recommended spacings of the respective crop. Before transplanting, cut and remove plastic bags.

Fodders
1. Irrigate Berseem and Lucerne at 15-20 days interval depending on the weather conditions and soil type. Have regular cuttings of Berseem. Avoid delay for next cutting.
2. Make silage of oats in late February to early March when the crop is at milk stage if the fodder is surplus.

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**HORTICULTURAL OPERATIONS**

1. It’s an appropriate time for the application of inorganic fertilizers to majority of fruit plants as per recommendations. Apply the fertilizers under the canopies of trees and mix in the soil gently.

2. To control citrus psylla, spray 200 ml Crocodile/Confidor 17.8 SL (imidacloprid) or 160 g Actara 25 WG (thiamethoxam) in 500 litres of water per acre basis on spring flush before opening of the flowers or 10 litres of Soybean oil/cottonseed oil + 1.25 kg detergent powder (surfactant) in 500 litres of water per acre.

3. The planning, layout as well as pit digging and filling for new plantation of evergreen fruit plants like citrus, mango, guava, loquat, ber, etc. can be done in late February when the weather warms up. However, the period of July-September is more suitable for planting of this category of fruit plants.

4. Citrus orchards should be irrigated before the commencement of new growth in February. Loquat trees which have already set their fruits will need 1-2 irrigations. Ber trees should also be irrigated for proper development of fruits. In grapes, one irrigation should also be given after pruning in the first fortnight of February.

5. The protective covers erected to protect the plants against possible frost injury should preferably be kept intact and remove it slowly with rising temperature up to the end of this month.

6. Give a spray of 50 g Streptocycline+25 g copper sulphate in 500 litres of water for the control of citrus canker. Bordeaux mixture (2:2:250) or copper oxychloride (0.3%) are the other alternatives.

7. To check foot rot of citrus (gummosis), drench the affected trees with 25 g Curzate M-8 in 10 litres of water per tree. Application of sodium hypochlorite (5%) @ 50 ml per tree in 10 litres of water can be done on the main trunk and on the soil surface under the canopy of trees.

8. To check powdery mildew, give one spray of 1 g Karathane or 2.5 g Wettable Sulphur or 1.0 ml Contaf per liter of water before flowering in mango.

9. For the management of mango hopper, spray 200 ml Confidor 17.8 SL (imidacloprid) in 500 liters of water per acre basis on spring flush before opening of the flowers.

**ORNAMENTALS**

1. The deciduous ornamental plants (such as Sawani, Mehandi, Nirgundi, Jatropha, etc.) can be transplanted bare rooted before sprouting of buds.

2. Off type plants in the field and flower beds of winter annuals should be removed to ensure true to type plants for seed production.

3. The summer flowering bulbous ornamentals can be planted in well drained soils rich in organic matter.

4. Seed sowing of summer annuals like kochia, zinnia, gomphrena, etc. can be done over raised nursery beds in the last week.

5. The layout for new plantation of ornamental trees and shrubs should be done after undertaking the site survey and site measurements.

6. Suckers of Chrysanthemum are planted in the field over raised beds to grow these as mother stock.

7. Layout and field preparation for establishment of lawn should be done.

8. Potting and repotting of potted ornamentals can be done during end of this month.

**FORESTRY**

**Poplar**

1. **Nursery raising**: Plant the cuttings of poplar at 50 cm x 50 cm or 60 cm x 60 cm apart during the first fortnight of February. Cuttings of 2 - 3 cm diameter and 20 - 25 cm length should be prepared from one year old plants. Soak the cuttings in fresh water for 24 hours before planting. Plant the cutting in the beds prepared after adding 8-12 tons FYM per acre. Apply 40-80 kg single super phosphate and 20-40 kg Muriate of Potash per acre depending on the soil type. Uniform spread of paddy straw mulch @ 4 t/acre immediately after planting of cutting provides the effective weed control.

2. **Field planting**: Transplant bare-rooted plants of poplar before the end of February in channels. In block plantations, plant the poplars at 5 m x 4 m or 8 m x 2.5 m apart and in single line on boundary at 3 m apart in North-South direction. Clones PL-1, PL-2, PL-3, PL-4, PL-5, L-47/88 and L-48/89 should be planted in Central Plain Region and Clones PL-3, PL-6, PL-7 and L-48/89 are suitable in semi-arid regions of Punjab. Dig the pits of 15-20 cm diameter with the help of an auger. The depth of pit should be 75 cm in heavy soils and 100 cm in light soils. Soak the plants for about 48 hours in running fresh water before planting. After planting, the pits should be filled with top soil and FYM (1:1) mixed with 110 g urea and 315 g single super phosphate.

3. Sugarcane can be planted from mid-February in poplar plantations of less than three years age.

**Eucalyptus**

1. Sow the seeds on raised in lines 10 cm apart at the rate of 20 g/m² size. Cover the beds with a thatch and sprinkle water frequently to keep the upper soil layer moist. When seedling attains 3-4 leaves, transplant them in polybags of 9”x6” filled with soil and FYM in 1:1 ratio. Keep on irrigating the seedlings as and when required till they become saleable, and shifting polybags containing seedling every month to avoid the root going deep in the soil.

**BEE KEEPING**

The weather generally starts warming in February. During this month, abundant pollen and nectar rewarding important bee flora such as Brassica (sarson/raha/gobhi sarson) and Eucalyptus are on bloom. Peach, pear and citrus are also on bloom. This is thus a favourable period for colony growth, and thus also ideal for starting beekeeping. With the onset of spring, remove the winter packing from honey bee colonies and clean the bottom board. Thoroughly examine the colonies at noon time on some calm and sunny day for availability of food stores, bee strength, brood rearing and performance of the queen bee. Unite the weak colonies, and thus also ideal for starting beekeeping. With the onset of spring, remove the winter packing from honey bee colonies and clean the bottom board. Thoroughly examine the colonies at noon time on some calm and sunny day for availability of food stores, bee strength, brood rearing and performance of the queen bee. Unite the weak colonies, and thus also ideal for starting beekeeping. With the onset of spring, remove the winter packing from honey bee colonies and clean the bottom board. Thoroughly examine the colonies at noon time on some calm and sunny day for availability of food stores, bee strength, brood rearing and performance of the queen bee. Unite the weak colonies, and thus also ideal for starting beekeeping. With the onset of spring, remove the winter packing from honey bee colonies and clean the bottom board. Thoroughly examine the colonies at noon time on some calm and sunny day for availability of food stores, bee strength, brood rearing and performance of the queen bee. Unite the weak colonies, and thus also ideal for starting beekeeping.
Progressive Farming

Else, provide it in division-board feeders. Depending on the strength of the colonies, provide already raised worker bee combs/frames with comb foundations. Depending on the need, super chambers can be added, wherein to enhance bees’ activity on new frames with comb foundations, raised combs with honey should be provided as bait. Equalize the colonies the maximum possible for food reserves, brood and bee strength following standard techniques. Infestation of ectoparasitic mites (Tropilaelaps clareae and Varroa destructor) and brood diseases may be noticed in the honey bee colonies. Dust sulphur powder on the top bars of bee combs @ 1.0 g per comb against the Tropilaelaps mite – must use inner cover for the effectiveness of this treatment. Alternatively, fumigation with formic acid (85%) @ 5 ml daily for two weeks may be applied which, however, should be avoided during nectar flow. The latter treatment will also take care of Varroa mite. In the case of infestation by Varroa, non-chemical measures such as the destruction of sealed drone brood comb part, Varroa trapping on drone brood and then its destruction, dusting of icing sugar powder on bees during late evening and use of sticky papers with Varroa bottom board can be followed. Oxalic acid (4.2 % in 60 % sugar solution) spray @ 5 ml per comb or trickling in between every two combs late in the evening once every week for three weeks can also be used. Keep vigil on the brood diseases and on suspicion, immediately consult experts and take appropriate control measures; non-chemical methods should be preferred. Use of antibiotics should be avoided. Colonies may also be prepared towards end of February for mass queen bee rearing for requeening for at least two months. Then green fodder can also be started little bit along with feed.

**DAIRY FARMING**

1. Protect all the dairy animals from direct cold winds during the winter months by using palli during night.
2. Crack/sore/chapped/injured teat(s) should be treated with teat dips (Glycerin: Povidine/ Betadine 1:3) or filmadin preparation. It should be used after every milking.
3. New born calves need special care during winter months. They are susceptible to Pneumonia and a large number of them die due to this disease. Keep them warm by providing clean and dry bedding.
4. Start colostrums feeding as early as possible after birth to increase immunity of calves and feed colostrums 1/3rd of body weight in morning and evening. Do not feed green fodder or wheat straw to calves till two months of age as rumen is not developed.
5. Deworming should be done every month upto six months age and thereafter at three months interval by using different combination of drugs to avoid drug resistance. Calves should be reared on calf starter ration instead of whole milk for at least two months. Then green fodder can also be started little bit along with feed.
6. Get your animals examined after three months of artificial insemination for pregnancy diagnosis.
7. Do not feed green, sprouted, soiled or rotten potatoes to dairy animals. These can cause serious and fatal poisoning.
8. Add grains upto 40% in the concentrate and oil cakes upto 25% as leguminous fodders in winter season for these contain 19-21% protein.
9. Make hay during last week of February from surplus leguminous fodders to replace concentrates which can be used in scarce period. It is highly beneficial for growing calves.
10. Follow vaccination schedule as per advice of veterinarian of your area.
11. Use mats in tying system to prevent hoof deformity.

**POULTRY FARMING**

1. February month is the best time for starting the broiler rearing as the day temperature starts rising. Get egg type chicks booked well in advance with a hatchery of repute in the adjoining area.
2. Purchase the day-old chicks duly vaccinated against Marek’s disease from reputed hatchery. It is essential to clean and disinfect the poultry sheds before putting the chicks. Lukewarm 5% solution of jaggery (Gur) or sugar for three days of arrival before starter feed.
3. Provide proper temperature under the brooder i.e. 95º F and decrease it by 5º F every week until it reaches to 70º F. Switch on the brooder 24 hours before arrival of chicks.
4. Spread old newspapers on bedding and put maize dalia on them as day old chicks cannot locate feeders.
5. Provide balanced ration to birds according to their requirements.
6. De-worm the chicks regularly.
7. Cull all the uneconomical layers regularly because they are increasing your feed costs.
8. Do not allow visitors to enter inside the poultry house. Put shoe covers before entering poultry farms.
9. Do not disturb poultry birds frequently as it will result in reduced growth as well as production.

**MUSHROOM GROWING**

1. The cropping of white button mushroom continues during this month.
2. Harvesting of matured mushrooms (closed form) should be done on time by gentle twisting of buttons.
3. Spray water once or twice a day on compost bags to maintain 65-70% moisture and open the growing rooms for 4-6 hours for ventilation.
4. Dhingri mushroom should also be harvested on time by seeing the margins of mushroom which start rolling inward. Picking should be done by holding the upper portion of the fruiting body and harvest the mushrooms by gentle twisting.

**Complied by:** Amarjit Singh

**Information supplied by:** KS Suri, Amit Kaul, Arsh Alam Singh Gill, Jaswinder Singh Brar, Navneet Kaur, Simrat Singh, Ruma Devi, Tejveer Singh and Shivani Sharma.
# Training Programmes in February

**KVK, AMRITSAR (98723-54170)**

February 01-09 : Beekeeping as subsidiary occupation
February 05 : New cultivation technologies of vegetable crops
February 08 : Crop intensification with summer pulses for higher productivity
February 09 : Soilless model for rooftop vegetable kitchen garden in peri urban areas
February 12-20 : Goat Farming
February 13-21 : Preservation of winter fruits and vegetables
February 15 : Identification and management of insect pests and diseases of deciduous fruits

**KVK, BATHINDA (0164-2215619)**

February 01-02 : Care and maintenance of woolen and silk garments
February 05-09 : Beekeeping, honey processing and marketing
February 06 : Preparation of vermicompost
February 08 : Formation of farmer groups (SHG, FPO, CIG)
February 12-16 : Mushroom cultivation and processing
February 15 : Soilless model for vegetable kitchen garden
February 19-27 : Poultry Farming
February 21 : New cultivation technologies of vegetable crops
February 22-23 : Food safety and techniques to check food adulteration

**KVK, FARIDKOT (01639-253142)**

February 01 : Micro irrigation, fertigation and weed management practices in orchards
February 02 : Off season management of Pink bollworm
February 05-09 : Beekeeping, honey processing and marketing
February 06 : Organic Farming
February 07 : Feed formulation for different categories of pigs
February 08 : Cultivation of summer moong for increasing productivity and soil fertility
February 09 : Organic manures production
February 14-29 : Dairy Farming
February 21 : Personal hygiene and sanitation
February 22 : Processing of milk at domestic level
February 23 : Value addition to pulses and oil seeds

**KVK, FATEHGAHRI SAHIB (01763-221217)**

February 01 : Storage of woolen and silk clothes
February 02 : Maintenance of agricultural machinery
February 05 : Production technology of summer vegetables
February 06 : Prevention and control of endo, ecto and zoonotic diseases in dairy animals
February 07 : Nutritional security through Integrated Nutrition Garden
February 08 : Pest management in gram and lentil
February 09 : Production technology of marigold cultivation
February 12-16 : Beekeeping, honey processing and marketing
February 21 : Management of insect pests and diseases of major Rabi crops
February 22 : Fish Farming and processing of fish products

**KVK, FEROZEPU (MALLEWAL) (01632-279517)**

February 02 : Preparation of low-cost nutritious dishes using millets (Jowar, Ragi, Kodra etc)
February 06 : Integrated Pest and Disease Management in pulses and oilseed crops
February 08 : Seasonal flower production
February 09 : Care and management of newly born calves and pet animals
February 19-27 : Bee Keeping, honey processing and marketing

**KVK, GURDASPUR (01874-220743)**

February 05-09 : Value addition to agriculture produce
February 06 : Cultivation of cucurbits and seasonal flowers
February 07 : Micro-irrigation systems for higher water use efficiency in horticultural crops
February 15 : Safe and judicious use of pesticides
February 05-09 : Poultry Farming
February 12-16 : Beekeeping - a lucrative subsidiary occupation
February 19-23 : Nutritious recipes for young children and pregnant/ lactating women
February 21 : Prevention and control of infectious diseases in farm animals
February 22 : Integrated Pest and Disease Management in seed crop of Berseem

**KVK, HOSHIARPUR (BAHOWAL) (98157-51900)**

February 05-09 : Preparation of bakery and confectionary products
February 09 : Cultivation of summer season vegetables
February 12-16 : Mushroom cultivation and processing
February 13-19 : Goat Farming
February 16 : Pest management in gram and lentil
February 19-23 : Beekeeping-a lucrative subsidiary occupation

**KVK, JALANDHAR (NURMAHAL) (01826-292053)**

February 02 : Care and maintenance of woolen and silk garments
February 05-13 : Fish-livestock Integrated Farming System
February 08 : Cultivation of summer pulses for diversification
February 12-16 : Beekeeping, honey processing and marketing
February 13 : Production technology of summer vegetables
February 15 : Seed production of berseem
February 19 : Farming and marketing of broilers
February 21 : Biofertilizers and organic manures
February 29 : Organic farming of vegetable crops

**KVK, KAPURTHALA (01822-233050)**

February 05-09 : Value addition to horticultural produce
February 06 : Establishment of nutrition garden in urban and peri-urban areas
February 08 : Management of insect-pests and diseases of oilseed crops
February 09 : Processing of milk at domestic level
February 12-16 : Beekeeping, honey processing and marketing
February 13 : Cultivation of summer pulses for crop diversification
February 23 : Production technology of summer season vegetables
February 08 : Vermicomposting
February 09 : Care and maintenance of woolen and silk garments
February 12-16 : Beekeeping, honey processing and marketing
February 19-23 : New techniques in stitching of garments

February 01 : Production technology of summer vegetables
February 02 : Integrated Pest Management in kharif crops
February 08 : Care and maintenance of woolen and silk garments
February 09 : Establishment of nutrition garden in urban and peri-urban areas
February 14 : Prevention of zoonotic diseases and vaccination schedule in dairy animals
February 15 : Processing of pulses
February 19-23 : Value addition of horticultural crops
February 21 : Construction and maintenance of biogas plant

February 05-09 : Value addition of horticultural crops
February 07 : Soilless model for vegetable cultivation
February 12 : Personal hygiene and nutrition for adolescent girls
February 16 : Feed management in Pig Farming
February 19 : Preparation of vermicompost
February 28 : Cultivation practices for kharif onion

February 01 : Improved cultivation of fruit crops
February 05-09 : Artifical flower making
February 07 : Micro-irrigation systems for higher water use efficiency in orchards
February 12-16 : Value addition of turmeric and ginger
February 19-23 : Poultry Farming
February 20 : New cultivation technologies of vegetable crops
February 26 : Cultivation of summer pulses for crop diversification
February 27 : Preparation of vermicompost and FYM and importance of green manuring

February 05-09 : Processing of seasonal fruits and vegetables
February 07 : Nutritional and psycho-social care in old age
February 08 : Integrated Pest Management in maize and sugarcane
February 09 : Recommended practices for clean milk production
February 12-16 : Delicious and nutritious cooking
February 16 : Processing of meat
February 19-23 : Entrepreneurship development programme in Beekeeping and queen bee rearing
February 21-27 : Entrepreneurship development programme in Poultry Farming

February 01 : Cultivation of fruits and vegetable crops
February 02 : Preparation of low cost nutritious recipes from seasonal fruits and vegetables
February 12-16 : Beekeeping- a lucrative subsidiary occupation
February 16-23 : Poultry Farming

February 02 : New cultivation techniques in vegetable crops
February 08 : Maintenance, upkeep and safe use of agricultural machinery
February 12-16 : Establishment of agro processing complexes and gur/shakkar making unit
February 13 : Establishment of nutrition garden in urban and peri-urban area including soilless model
February 14 : Pest management in rabi oilseeds and pulses
February 23 : Bulb set raising techniques of kharif onion

February 02 : Production technology of summer vegetables
February 05-09 : Value addition of horticultural crops
February 08 : Fruit thinning in peach
February 12-16 : Beekeeping, honey processing and marketing
February 15-16 : Personal hygiene and nutrition for adolescent girls
February 20-21 : Care and maintenance of woolen and silk garments
February 23 : Bulb set raising techniques of kharif onion

February 02 : Improved production technologies of sugarcane production
February 06-15 : Goat Farming
February 07-15 : Mushroom cultivation and processing
February 08 : Cultivation of vegetable crops
February 09 : Fish Farming
February 12-16 : Preparation of eco-friendly cleaning agents
February 15-23 : Beekeeping-a lucrative subsidiary occupation
February 16 : Formation of farmer groups (SHG, FPO, CIG)
February 21 : Water conservation techniques
February 22 : Low cost nutritious recipes using seasonal ingredients
February 23 : Green fodder production round the year

February 06 : Cultivation of summer moong and mash for high profitability
February 12-16 : Basic training course on Beekeeping
February 19-23 : Organic Farming (Vermi-compost and use of biofertilizers for enhancing crop yield and soil fertility)
February 28-29 : Preparation of value added milk products (flavoured milk, dahi, lassi, kulfi, khoya, desserts and puddings)

Compiled by: Dr Inderpreet Kaur Boparai and Dr Manoj Sharma
Wishing you all a very Happy New Year

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