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Dear Farmers and Farm Women

Warm greetings and heartfelt wishes for a happy, prosperous, and inspiring New Year, 2026! The dawn of a New Year provides us an opportunity to renew our commitment to agriculture and to prepare ourselves for the challenges and opportunities that lie ahead. As the backbone of our nation, farmers play a pivotal role in ensuring food security, rural livelihoods, and sustainable development.

Punjab has proudly remained the food bowl of India, owing to the hard work, resilience, and progressive spirit of its farming community. While conventional agriculture has delivered remarkable achievements, emerging concerns such as declining natural resources, changing food habits, and increasing market competition call for diversification, innovation, and sustainability-driven growth.

Horticulture has emerged as a strong pillar of agricultural diversification, offering higher income potential along with nutritional and ecological benefits. The cultivation of fruits, vegetables, flowers, spices, and medicinal crops is steadily gaining momentum in Punjab, covering about 4.2 lakh hectares. This reflects the willingness of our farmers to adopt new enterprises and strengthen farm profitability.

The State Department of Horticulture and the Punjab Agro Industries Corporation are actively supporting this transformation through subsidies, infrastructure development, and initiatives such as the Mega Food Park at Ludhiana. These efforts promote value addition, food processing, and export opportunities, thereby creating multiple income avenues for farmers. In the present scenario of shrinking water and soil resources, the adoption of sustainable practices such as micro-irrigation, integrated pest management, and protected cultivation is essential. Scientific and technology-driven farming will help conserve resources, reduce production costs, and ensure long-term sustainability.

As we move into 2026, let us resolve to strengthen our bond with science, protect our natural resources, and ensure a prosperous future for coming generations. On behalf of Punjab Agricultural University, I extend my sincere New Year wishes to all farmers, farm women, and readers. May the year 2026 be the harbinger of good health, success, and abundant harvests to every household.

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Optimal Timing for Planting of Deciduous Fruit Plants

Anirudh Thakur, Mandeep Singh Gill and Kirandeep Kaur
Department of Fruit Science

The planting season for deciduous fruit crops is coming and the demand for these fruit plants in Punjab remains very high. Many growers rely on private nurseries to purchase fruit plants, as these nurseries are often more easily accessible. However, sustainable fruit production is possible only when we use genuine, healthy and good quality planting material of recommended varieties. Sometimes, growers bring planting material of non recommended varieties of apple, pear, peach, guava, fig and dragon fruit from other states. Such plants may carry soil borne diseases and nematodes, which makes buying from unauthorized sources risky. Punjab has around 85 registered fruit nurseries, including 50 in the private sector, 26 operated by the Punjab Government and 9 run by PAU Ludhiana. PAU nurseries supply high quality planting material of recommended varieties, ensuring safer plantations, better survival and higher productivity. Farmers should buy plants only from registered nurseries so that their orchards remain healthy and they can earn significant profits in future.

Commercial methods of propagation in deciduous fruit crops

Crop	Main method of propagation	Best time of propagation	Average budsticks/ cuttings per mother plant
Pear	Tongue grafting	December-January	600
Peach	T-Budding	May-June	300
	Tongue grafting	December-January	
Plum	Stenting for Satluj Purple	December-January	1000
	Hardwood cuttings for Kala Amritsari		
Apple	Tongue grafting	December-January	300
Grapes	Hardwood cuttings	January-February	200
Fig	Hardwood cuttings	January	200

Fruit crop	Recommended varieties	Standard/Recommended Rootstock
Pear	Hard pear: Punjab Nakh, Patharnakh, Semi soft pear: Punjab Beauty, Punjab Nectar, Punjab Gold Soft pear: Nijisseiki and Punjab Soft	Kainth
Peach	Yellow Fleshed: Partap, Florda Prince, Earli Grande, Shan-i-Punjab White Fleshed: Prabhat and Sharbati Nectarine: Punjab Nectarine	Sharbati and Flordaguard
Plum	Satluj Purple and Kala Amritsari	Kala Amritsari or Kabul Green Gage (used as rootstocks for Satluj Purple)
Apple	Anna and Dorsett Golden	Crab apple
Grapes	Superior Seedless, Punjab MACS Purple, Flame Seedless, Beauty Seedless, Perlette	-
Fig	Black Fig I and Brown Turkey	-

Planting season: The best time to plant deciduous fruit crops is during winter, when the plants are in dormant condition. Pear should be planted from January to mid-February. Peach comes out of dormancy earlier, so it should be planted from late December to the end of January while the plants are still dormant. Plum should be planted in the first half of January so that trees can settle before spring. Apple is planted from late December to January. Grapes and fig, which are propagated from rooted hardwood cuttings, are best planted from January to February. Planting these crops during the cool, leafless period helps reduce transplant shock and ensures better establishment before the initiation of spring growth.

Mother and rootstock block: Farmers must verify whether the fruit nursery is maintaining healthy mother plants and rootstock blocks. The number of mother plants should match the production capacity of the nursery. Fruit plants must be propagated only through the recommended propagation methods to ensure quality and true-to-type planting material.

Handling and transportation of nursery plants: Nursery plants of deciduous fruit crops such as pear, peach, plum, apple, grapes and fig should be uprooted and transported only during the dormant season, usually from December to February, depending on the crop. While lifting and moving the plants, care should be taken to keep the roots moist so that they do not dry out. After planting them in the field, irrigation should be given immediately to help the soil settle around the roots and to prevent the plants from drying or wilting.

Planting and care of saplings: After the plants are delivered, create a suitable sized hole in the centre of each pit using a planting board. The sapling must be placed carefully so that the bud union stays around 8–9 inches above the ground. The soil around the plant should be pressed gently with the feet so it becomes firm. A light irrigation helps the soil to settle well around the roots, and if the plant tends to lean, staking can be done when the soil reaches the suitable moisture level (vattar). Young plants need protection from termites, so chlorpyriphos at 0.5 litres per acre may be applied, followed by light irrigation. Regular removal of root suckers and unwanted sprouts is important. Proper staking should begin in the first year to train a strong, straight main leader.

Use of recommended rootstock: The fruit plants of the recommended varieties of deciduous fruit crops should be grafted/budded on the standard / recommended rootstocks as given in table.

Important points for fruit growers

- Since fruit crops are perennial, always purchase plants from recognized and approved nurseries.
- Consult experts from PAU, Ludhiana, or State Horticulture Department regarding the recommended varieties and suitable rootstocks for your area.
- Plants supplied by approved nurseries belong to recommended varieties, are propagated through standard methods and generally perform better in the field.
- Farmers need to remain alert about costly saplings sold by private individuals or company agents in the name of "contract farming." Technical guidance from PAU, Ludhiana, or the Punjab Horticulture Department can prevent such mistakes.
- Most approved nurseries provide fruit plants at reasonable and fixed rates. Buying plants at very high prices from hawkers or unverified floriculture nurseries should be avoided.

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Improve Productivity of Pear Orchards Through Good Agricultural Practices

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Department of Fruit Science

In Punjab, pear is fourth leading fruit occupying an area of 5186 ha. Although pear is mostly concentrated to districts of Tarn Taran and Amritsar it can be cultivated throughout the state. Pear plant produces fruit on spurs and it takes about 5-6 years for full spur development. Afterwards, continues to produce fruit for several years provided the plants are properly trained at initial stages and other cultural practices like suitable intercrops, nutrition of plants and irrigation are taken care of.

Training and pruning

Pear trees have long juvenile period of nearly 6-8 years. One year old pear plants grafted on *Kainth* rootstock are planted during the dormant season, preferably in January. Immediately after planting, the plant should be cut at the height of 90 cm from the ground level to encourage lateral buds to sprout. Four to five properly oriented scaffold branches growing vertically around the main trunk are selected in dormant season after one year of plantation. These shoots should have wider crotch angle and arrange in a spiral fashion. Pear plants are trained by modified leader system. The growth of upper branches can be regulated by changing the direction of natural growth of lower branches by bending the upper branch directly above the lower branches.

After attaining the age of 30 years or more, spurs borne on lower canopy become unproductive due poor to penetration of sunlight and intermingling of branches. Fruiting area shifts to the periphery of tree canopy which is responsible for the reduction of fruit quality and yield. Tall pear trees produce higher proportion of undersize fruit. In addition, pest management is more difficult in tall trees due to poor spray coverage. Similarly, the fruits borne on upper canopy are prone to damaged by birds and also difficult to harvest. Under local conditions, these fruits are usually harvested with long bamboo sticks and *dhangis*. This practice severely damages the spurs which ultimately reduce bearing in the following years. The productivity of old and unproductive pear plants can be restored by severe heading back the 3-4 scaffold branches. The main scaffolds are headed back to length of 15 cm with the help of sharp pruning saw during dormant season i.e. December January. During spring season, new shoots will emerge from stubs. In May or January, retain one to two outgrowing shoots per stub and thin out the rest of growing shoots. These shoots act as main scaffolds of rejuvenated plants. The rejuvenated plants come into bearing after 3 years and commercially after 5 years.

		Fertilizer dose (g/tree)		
Age (Years)	FYM (Kg)	Urea (46 % N)	Superphosphate (16% P_2O_5)	Muriate of potash (60% K_2O)
1-3	10-20	100-300	200-600	140-450
4-6	25-35	400-600	800-1200	600-900
7-9	40-50	700-900	1400-1800	1050-1350
10 and above	50	1000	2000	1500

Nutrition

In Punjab, pear trees are applied with full dose of farm yard manure, phosphate and potash fertilizers in December, while half dose of N is added in February and other half dose in April after fruit set. T Punjab Beauty pear cultivar shows sudden nitrogen hunger and its deficiency principally lead to poor development of reproductive spurs. Vegetative growth in the plant is primarily dependents on the accumulation of carbohydrates and application of nitrogen fertilizers. The supplemental urea application (500g/tree) during September month considerably improves fruit yield and quality in semi-soft pear cv. Punjab Beauty. Three foliar sprays of KNO_3 @ 1.5% after 15, 30 and 45 days from full bloom substantially improved fruit size and yield in pear. Manure and fertilizers to pear trees should be applied according to their age as table.

Generally, 50 to 60 leaves of 4-6 month's old age are collected at shoulder height from middle of the current season's growth i.e. July to September to estimate the nutrition status of an orchard. These leaf samples may be got analysed from Leaf Analysis Laboratories established by PAU and Department of Horticulture (Punjab). In Punjab, soil pH of pear growing area ranges from 7.6 to 8.3 which cause deficiencies of zinc and iron in pear leaf. The symptoms of zinc deficiency appear on young leaves as irregular interveinal chlorosis, reduction in leaf size and upward leaf edge curling. It can be corrected with the foliar spray of 3.0 kg $ZnSO_4$ + 1.5 kg unslaked lime

in 500 litres of water. Likewise, iron deficiency appears during hot summer months on apical leaves as dark green veins on a pale green background and this is corrected with the foliar application of 0.3 per cent $FeSO_4$ solution.

Intercropping

Pear tree has long juvenile period and growers are advised to grow intercrops in young pear orchards but should avoid to cultivate high water requiring inter crops like potato, barseem, bajra etc during winter. Deep ploughing with disc harrow cultivators, tillers etc. for the preparation of potato seed beds and sowing of intercrops considerably damage root system and causes root rot, sap wood rot diseases etc. Uproot plum, peach and guava grown as filler plants when pear orchard comes into commercial bearing after 7-9 years from planting. In young and non bearing pear orchards, moong, mash, toria, peas, gram and senji can be grown as intercrops. Legume field crops should be preferred as these improve the soil fertility and productivity. *Phalsa* fruit plant is used as filler and these should be trained as a bush by regular annual pruning during January-February. Arrangements should be made for separate fertilization; intercultural practices etc. on the basis of given recommendations for growing intercrops/ fillers in young orchards.

Irrigation

Proper moisture in soil is required in pear orchards especially during fruit setting and fruit development period. The feeder roots of pear plants are concentrated in top 60-90 cm of the soil. One irrigation should be given after addition of fertilizer doses in January. During period of flowering upto harvesting irrigation should be given at 7-10 days intervals depending upon soil conditions. After harvest irrigation should be given at 3-4 week interval depending upon requirement. Separate water channels should be provided for intercrops grown in between the plant rows.

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Efficient Marketing of Kinnow

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Department of Economics & Sociology

Kinnow is an important fruit crop of Punjab. During 2023-24, the total area under fruits in the state was 1.03 lakh hectares and the production was 23.06 lakh tonnes, of which kinnow occupied top position as about 48 per cent area (49 thousand hectares) and 57 per cent production (1316.6 thousand tonnes) of fruits was from kinnow alone. Marketing of kinnow is a complex problem due to its short post-harvest life. Most of the kinnow growers market its produce on contract basis. There are very few farmers who go to the market and sell their produce themselves. The farmers can multiply their current profits by adopting the scientific tips given by the Punjab Agricultural University to improve the quality of kinnow in the field and selling it higher prices domestic or distant markets.

Marketing problems of kinnow

- There is a lack of cold storage facilities in the state.
- The lack of processing facilities to add in the post-harvest value of kinnow fruit is another problem.
- Lack of market infrastructure which result in high post-harvest losses.
- There is virtually no separate marketing structure for kinnow due to which the post-harvest losses are high.
- Lack of unity and organization skill among the farming community, which proves a major impediment in the formation of cluster groups and co-operatives especially for the small and medium farmers to avail the better prices of distant markets.
- Pre-ponderance of intermediaries in the marketing channel results in unfair and exploitative practices in marketing of fresh produce which erodes the farmer's profit.
- Improper pre- and post-harvest handling without any sound packaging leads to heavy losses of the produce at the time when its reaches the final destination.

Tips for profitable marketing

- The quality of the fruit must be maintained during production by timely training, pruning, light irrigation by drip system, fertigation, minimum interculture of the kinnow field and plant protection.
- The post-harvest practices to improve the quality of kinnow includes soft harvesting to minimise mechanical injury to fruit, cleaning, washing, drying, waxing, grading and final packing in corrugated fibre board boxes specially designed for this purpose.
- The kinnow graders and kinnow wax plants being run by the state government can be used to add to the post-harvest value of kinnow fruit.
- Regular market vigilant check to get accurate information about domestic and distant market prices.
- Farmers can also get help from the government by forming small self-help groups or cooperative marketing organizations for selling fruits in distant markets.
- Export of fruits can also be facilitated by creating the groups/cooperatives than trying alone.

Further, setting up of kinnow grading and waxing plants in the producing areas would enhance the shelf-life of the produce and would help the farmers to take their produce to the distant markets for better prices without incurring any heavy cost.

The Punjab government may fix minimum support price (MSP) for kinnow as has been fixed by the Government of Himachal Pradesh for apple to assure the comparable margins from kinnow fruit as its cultivation has been identified as one of the best alternatives to the existing paddy-wheat cropping system.

Thus, with little efforts during production, processing and marketing, kinnow cultivation can be transformed into a profitable enterprise for the farmers.

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Cultivation of Vegetable Crops for Diversification in Agriculture

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Department of Vegetable Science

Punjab agriculture is facing problems due to mono-culturing of rice-wheat crop rotation on the same piece of land over the years which resulted into depletion of water table, deterioration of soil health, deficiency of micronutrients, problem of emerging weeds, insects-pests and diseases and injudicious use of chemical fertilizers and pesticides. Despite the hardship being faced for nearly a decade, marginal farmers have been tilling the land with the hope of good days ahead. Obviously, need of the hour is to find out other alternative ventures to the farming community which is practically feasible, economically viable and ecologically sustainable. In this direction, vegetable crops offer better opportunities for its substitution for diversification with cereals in the agri-business system as it provide food and nutritional security for ever-growing population of the country. Besides nutritional security, vegetables produce higher yield per unit area and time and provides basic needs of food, employment and income. Vegetables as diversified crop does not mean that farmers blindly shift from paddy-wheat rotation to complete vegetable production, as it will result glut of produce in the market which ultimately lowers down the price.

In Punjab, area under different vegetables has increased steadily from 32000 hectares in 1960-61 to 3.56 lakh hectares in 2023-24. Consequently, production has jumped from 4.97 lakh tons to 71.72 lakh tons during the corresponding period in the state. Though, vegetable production has increased but availability of vegetables per capita is approximately 125 g which is well short of the recommended per capita requirement i.e. 280g. To bridge the gap between production and requirement, there is a need to enhance the vegetable production. There are different ways by which we can increase the area and production of vegetables in the state

For better returns, farmers can partially or completely replace paddy-wheat rotation with following vegetables.

(A) The following vegetable(s) may be practiced in place of wheat /paddy:

1. Chilli (Transplant in April-end) –-- Wheat (October-November)
2. Radish (April cv. Pusa Chetki)--Bottle gourd / Bitter gourd /Ash gourd /Sponge gourd / Cucumber/ Okra (June-July) --- Wheat (October-November)
3. Early Cauliflower (Transplant in June-July) --- Wheat (October-November)
4. Potato (October) --- Late Cauliflower (Transplant in December) --- Paddy (June)
5. Potato (October) --- Okra/Muskmelon (February - March) --- Paddy (June)
6. Capsicum under low tunnels (Transplant in November) --- Paddy (June)
7. Early Pea (End September - October) --- Rabi Onion (Transplant in 1st fortnight of January) --- Paddy (June)
8. Carrot (September)—Carrot seed (December)—Paddy (June)

(B)The following complete vegetable crop rotations may be practiced:

1. Pea/carrot (September-October)-- Chilli (Transplant in February- March)
2. Potato/carrot (September –October)

--- Rabi Onion (Transplant in 1st fortnight of January) ---Okra/Green manuring (June)

3. Potato (October) ---- Late Cauliflower (Transplant in December) --- Chilli (Transplant in March)
4. Potato (October) --- Carrot/Radish (Seed) (Transplant stecklings in January)--- Okra (Seed) (June)
5. Potato (September) --- Muskmelon (February)--- Radish (June)
6. Capsicum/cucumber under low tunnels (November-December)--- Bottle gourd/ sponge gourd (June-July)
7. Cauliflower (September)—Tomato (December)—Okra (June)

Protected cultivation of vegetables

Poly-net house cultivation proved to play a significantly better role in improving productivity, advancing maturity, increasing fruiting span and is a feasible option to produce vegetables with minimum use of pesticides. Vegetable cultivation under poly-net houses is gaining momentum in Punjab, as a result area under these structures has reached more than 400 acres. PAU has recommended cultivation of parthenocarpic cucumber, sweet pepper, tomato, French bean and brinjal for cultivation in poly-net house. PAU has recommended parthenocarpic cucumber variety 'Punjab Kheera-1' and hybrid 'PKH-11'; three tomato varieties 'Punjab Gaurav, Punjab Sartaj and Punjab Swarna', three cherry tomato varieties 'Punjab Red Cherry, Punjab Sona Cherry and Punjab Kesar Cherry'; one capsicum variety 'PSM-1' and two French bean varieties Punjab Rangat' and 'Punjab Anand' for cultivation in poly-net houses.The handsome profit earned by cucumber growers in some areas of the state has enthused the farmers to adopt this technology on a large scale. Center of excellence on protected cultivation of vegetable crops has been established at Kartarpur, Punjab by National Horticulture Mission to promote vegetable cultivation under protected conditions. This center has been demonstrating high-tech cultivation of vegetable crops and provides trainings to farmers for capacity strengthening and skill enhancement. Moreover capsicum and cucumber are successfully grown under plastic low tunnels to get early and higher yield. This technology is economical for small and marginal farmers to capture the high prices in the market early in the season.

Precision farming

Precision farming includes water management (Sprinkler or drip irrigation), fertilizer management (Fertigation), vertical planting, soil leveling with laser leveler, disease and pest management, abiotic stress management, intercropping, mulching etc. The cultivated area is shrinking every year as a result, there is a need to focus on maximize production per unit area and time with the help of intercropping and vertical planting. During the recent past, drip irrigation system has been designed which is highly economical for irrigation and fertigation of vegetable crops. Government is providing subsidy on this system so that it is adopted by the farmers. The laser leveling minimizes the wastage of water and ensures its uniform availability to vegetable crops.

Nursery raising

Nursery rising of vegetables is one of lucrative occupation. In the present scenario, demand of healthy nursery of good varieties/hybrids is very high. The nursery of some vegetables is first prepared and then seedlings are transplanted in the main field e.g. tomato, brinjal, chilli, sweet pepper, cabbage, cauliflower, onion. It is essential to have disease free nursery because it is the main source of insect-pests and diseases in the field and it is easy and economical to manage diseases and insect-pests in the small area of nursery. Nursery raising of vegetables is quite beneficial even for the marginal farmers. About 100 farmers in state are engaged in nursery production business and taking handsome profits.

Seed production

Seeds are the most important input in vegetable production. The quality seed of vegetables is of prime need to the farmers. There is a great demand of hybrid seeds in the country especially of tomato, brinjal, capsicum, chilli, muskmelon, watermelon, cucumber, bitter gourd, bottle gourd, cauliflower etc. In many cases, the cost of hybrid seeds is very high which is beyond the purchasing power of the farmers and sometime hybrid seeds are not available. PAU is providing hands-on training to the farmers for production of seeds of hybrids and open pollinated varieties of vegetables.

Vegetable nutrition garden

Most of the vegetable reaching the market contains high amount of pesticides residues that might lead to serious health hazards. Under such circumstances, one should grow vegetables in nutrition garden for year around consumption without the use of pesticides and such vegetables are more nutritious. Vegetable nutrition garden model having 500m2 for rural area and 36m^2 for urban and peri-urban areas is recommended to meet the nutritional requirement of family. About 10,93,000 farming families are engaged in agriculture in Punjab. If each family grows vegetables in 500m^2, then additional 1.36 lakh acres can be covered under vegetables, which can play a major role in diversification in addition to improving the nutritional status of the family and saving of money for purchasing of vegetables from the market.

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Pruning of Kinnow Trees

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Water shoots

Rootstock suckers

Bordeaux paste application on cut ends

Criss-cross branches

Kinnow is the number one fruit of Punjab state. The bearing span, yield and quality of kinnow fruits depends on several orchard management practices. Among these, pruning is of great significance. Pruning involves the removal of tree wood (branches/ limbs). Pruning is essential for: maintaining annual fruit bearing wood, obtaining good fruit quality and managing plant health. This is essentially done after harvest to regulate yield and quality of the next crop. Sometimes, the contractual labour either over-prune or do not remove the undesirable branches, which negates the advantages of this very important operation. The harvesting season is approaching closer. Thus, understanding the right way of pruning can help fetch handsome returns in the next year crop as well as can reduce the expenditure on plant health management.

Need of Pruning

Kinnow trees produce two main vegetative flushes- spring flush (February-March) and summer or rainy season flush (July-August). If the temperature remains moderate, the number of flushes can go even upto four. In un-pruned trees, tree size goes on increasing, and overcrowding of the branches occurs, leading to poor light and air access to the inner canopy. Gradually, inner canopy becomes barren and fruiting gets restricted to outer peripheral canopy, eventually lowering fruit yield. The sunlight is not only required for good flowering and fruit set, but also impacts fruit quality. Colour development of the inner canopy fruits gets delayed if they receive low light. The south-western districts of Punjab experience windstorms during summers. In these storms, the peripheral fruits are always vulnerable to the mechanical injuries caused by sand particles, thorns or striking branches. The inner canopy fruits on the other hand remain protected. The unmanaged crowded trees provide congenial environment for development and spread of insect pest (psylla) and diseases (sooty mould). Further, through pruning, dead and diseased branches are also removed, which provides an opportunity to shed off the spore load of various pathogens mainly responsible for causing fruit drop in Kinnow. This also reduces the expenditure for plant health management.

Pruning time

Kinnow is an evergreen tree. It can be pruned round the year except at the time of high heat (peak summers) or rains. However, the best time of pruning the bearing trees is when the plants are metabolically less active. This time is January *i.e.* after the harvest of the fruits and before the initiation of the new flush.

What to prune?

1. Rootstock suckers and water shoots should be removed regularly. Kinnow plants are raised on rough lemon rootstock. It has tendency to produce suckers in initial years until the kinnow canopy becomes a stronger sink for water and nutrients supplied by it. The suckers grow at the cost of kinnow. Similarly, the water shoots show upright growth and grow at the expense of horizontal fruiting wood. These shoots bears large thorns and also cause mechanical injuries to the fruits. In the initial years, however, if the water shoot is one of the main

scaffold, it can be retained.

2. Mispositioned branches should be removed. These include criss-cross branches, branches which cause shade to the lower branches, parallely placed branches, low hanging branches below the height of 50 cm or shoots going downward.
3. Four problematic *D's*- Diseased, Dead, Dry and Damaged shoots should be removed every year. These should not be left in the orchard and should be immediately burnt. Removal of diseased twigs and branches is a great step in managing the load of pathogens like *Diplodia, Colletotrichum, Alternaria* and *Phytophthora,* which serves as an inoculum for next year fruit drop.

How much to prune?

The pruning intensity depends on factors like tree age, plant health, spacing of plants and previous year crop loads. However, citrus mainly bears on spring season wood and to a limited extent on the wood produced through summer flush. This should be kept in mind that excessive pruning of one year old wood may adversely impact the next year fruit yield. In excessively pruned trees, the fruits may also show sunburn injuries.

Plant age: In young plants, the focus should be on developing a framework for future fruiting years. For the first few years, young plants do not require excessive pruning except for regular removal of rootstock suckers. The suckers; if not removed, overgrow the kinnow tree and consume the valuable canopy development time of Kinnow. When the tree is three or four years old, depending on its growth, branches that are too closely spaced, may be removed. If there are not sufficient upward growing lateral, then the downward growing shoots should be headed back. It will encourage growth of a number of laterals, of which the upward growing lateral can be trained as one of the main branch. In plants of 5-10 years age, the pruning aim should be to remove dys functional and mis-positional branches. In trees of age above 10 years, light pruning (10-15% removal of one year wood) should be done for better light and air penetration for fruit development in the inner canopy. In trees of age above 20-25 years age, removal of a light obstructing branch from sun facing side can help in restore their optimum fruiting potential.

Plant Health: On healthy trees, do regular light pruning. For trees showing stunted growth, the excessive pruning should be done to encourage new vegetative growth for producing fruiting wood in future years.

Plant spacing: PAU has recommended plant spacing of 20' x 20' for regular planting and 20' x 10' for high density planting. In addition to it, growers in south-western districts have also customized their own plant spacings like 20' x 15', 20' x 16' *etc*. As a thumb rule, plants start intermingling after 10 and 15 years in 20' x 10' and 20' x 15'. For normally spaced plants (20' x 20'), annual maintenance pruning (10-15% pruning) is sufficient. When the closely spaced plants start merging, hedging of side shoots at 1.0-1.5' length of every alternate tree can be done to open up the trees for optimum fruiting and managing insect pests and diseases. But, the hedging will promote excessive vegetative growth from cut ends next year. After keeping the well-directed shoots, the other shoots should be thinned out. Alternately few selected branches can also be removed to open up the tree to obtain regular fruiting.

Crop load: The heavy fruiting in one year causes poor flowering in the succeeding year. This tendency is due to overutilization of carbohydrate reserves which are required to support next year flowering. In order to maintain regular fruiting, a slight increase in the intensity of pruning in a light year can induce optimum fruiting next year.

How to prune?

As like pruning techniques, use of right pruning tools is equally important. Pruning tools include secateurs, loppers, pruning saw, *etc*. Pruning secateurs are useful for pruning twigs of less than ½ inch thickness while loppers are used to cut branches of 2 inches or more thickness. Pruning saw are used for cutting larger branches. Pruning of high-density orchards can be performed by tractor mounted mechanical pruners available on custom-hiring basis from *Citrus Estates* of different districts in Punjab.

What to care?

- Avoid pruning if rain is in the immediate forecast, it can stir up fungal infection.
- Direction of pruning should be from top to bottom in bearing trees and from bottom to top in young trees.
- Unhealthy or diseased plants should be marked and pruned at the last.
- The pruning tools should be sanitized before and after pruning each tree. Use alcohol or mercuric chloride for sanitizing the tools.
- Make all cuts clean and smooth for rapid healing of wounds. Avoid tearing the bark when removing large branches.
- Immediately after pruning, spray Bordeaux mixture (2:2:250) or Blitox (3g/l) to avoid fungal infection through the pruning cuts. Large cut should be covered with Bordeaux paste.

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Floral Gulal: A Value-Added Product from Surplus Production and Used Flowers

Shalini Jhanji and Kiranjeet Kaur Dhatt

Department of Floriculture and Landscaping

Every day, a large number of flowers are wasted and survey reports reveal that almost 40% of flowers remain unsold of total flower production. Therefore, there is a need for proper and eco-friendly processing of floral waste to value-added products like Holi colours, rose water essence, natural dyes, incense sticks, handmade paper etc that could add to economic benefits.

Floral Gulal is a value-added product prepared from both fresh and used flowers to replace these colours. It is cost-effective and ecofriendly as no chemical is used.

Types of flowers

Different flowers can be used for preparation of floral gulal such as Marigold, Rose, Gomphrena, Celosia, Tecoma, Hibiscus, Dhak etc. Depending upon the type of flower, different coloured floral gulal can be prepared. Marigold yield orange to yellow colour, rose gives pink to purple colour, gomphrena mauve colour, celosia magenta, tecoma yellow, hibiscus pink to red and dhak gave orange coloured gulal. These flowers are available in different seasons of the year, so we can prepare floral gulal throughtout year depending upon demand and availability of flower. In Punjab, marigold and desi gulab (rose) are two commercially cultivated loose flower crops and during glut farmers earn has to sell them at very low prices. The production of floral gulal from surplus produce during peak flowering season could enable them to earn remunerative prices of their produce with very low inputs.

Methodology

The fully opened flowers of marigold, rose and other ornamentals should be collected. The petals should be separated and cut/smashed/crushed into small pieces. 1 kg of crushed petals should be dipped in approx. 1.0-1.2 litre of warm water (50˚C to 70˚C) with 2g of citric acid. The mixture should be kept for 1 hour to facilitate extraction of colour and then squeezed to have decoction around 800-900 ml of optimum colour intensity. The decoction thus prepared is sieved. The flower decoction (700ml) is added to 500 g of arrow root to make gulal of fine and smooth consistency. The mixture is then shade-dried, finely ground and sieved. Drying was done till the powder did not stick to the fingers. The dried powder is floral gulal that could be kept even for a year when properly packed and stored.

Precautions

- Coloured petals should be separated from green coloured sepals properly
- Water should be luke warm but not hot
- Squeezing of petals should be proper to have good intense decoction
- Avoid sun drying to prevent colour fading
- Drying should be proper as high moisture content could lead to fungal growth

Benefits

- The price of loose flowers especially marigold and rose vary from Rs 30 to 150/ kg depending upon season but the cost of floral gulal ranges from 700-1500/ kg. The inputs' cost in production of 1kg gulal {arrow root (Rs 20-30/ kg), citric acid (Re 0.15/ kg)} is very low as compared to output.
- This innovation holds promising for farmers and florists, offering them an avenue to transform surplus or discarded flowers into a value-added product (floral gulal).
- It presents an opportunity for entrepreneurs and unemployed individuals to generate income from limited resources, thereby fostering economic empowerment.

Preparation of floral gulal

↓

Crushed petals of flower (1 kg)

↓

Dip in 1-1.2 litre of warm water + 2g citric acid for 1 hour

↓

Flower decoction (600-700 ml)

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Add 500 g of arrow root and shade dry for 3-4 days

↓

Floral gulal (lump free and fine textured)

• ***Shalini Jhanji: 98729-72526***

Bordeaux Mixture: A Boon for Disease Management in Fruit Crops

Amrinder Kaur and Anita Arora
Department of Fruit Science

Bordeaux is an outstanding protective fungicide and bactericide that has been used for decades to manage wide spectrum of diseases of fruit crops. It has long persistence on the host surface, so it reduces the need of more number of sprays. The application of Bordeaux mixture has been recommended for management of various fungal and bacterial diseases such as leaf spots, blight, anthracnose, downy mildew and cankers etc.

Disease management with Bordeaux mixture

Prune and destroy all the diseased and dead twigs of the plants to reduce the primary source of inoculum and thereafter give one spray of Bordeaux mixture to avoid further spread of the disease from the cut ends/wounds. Proper time of spray of Bordeaux mixture for management of important diseases of fruit crops is given hereunder for the benefit of the orchardists:

How to prepare Bordeaux mixture

Bordeaux mixture can be easily prepared by mixing copper sulphate solution and quick lime suspension in a fixed ratio (2:2:250) i.e. copper sulphate (2 Kg), quick (unslaked) lime (2 Kg) and water (250 litres). The raw material should be of good quality. Copper sulphate (98 per cent purity) and freshly burnt lime stone (quick lime) should be used. For preparing 2:2:250 Bordeaux mixture, dissolve 2 kg of copper sulphate in 125 litres of water. Copper sulphate dissolves very slowly in cold water. Hence, in winter it is better to use hot water or suspend copper sulphate in gunny sac into a non-metallic vessel (wooden barrel or an earthen pitcher), so that the material gets dissolved in, if any, are left out. Slake 2 kg of quick lime in another vessel and add water slowly to the lime to make a paste to which water should be poured slowly, to make the volume to 125 litres. Stir vigoro usly to make a lime suspension. Then mix the two solutions either by pouring the copper sulphate solution into the lime solution slowly or the two solutions together into a third vessel. Pour the lime solution through a strainer to keep back all lumps. Stir the mixture with a wooden stick while pouring. Stir and strain the mixture again when pouring into the sprayers.

Time of spray of Bordeaux mixture for disease management of fruit crops

Fruit crop	Name of the disease	Time of spray
Citrus	Foot rot (Gummosis)	February-March and July-August
	Canker	October, December and February
	Scab	June to August at 20 days interval
	Anthracnose/die-back	March, July and September
Mango	Anthracnose/die-back	After pruning
	Stem canker	After pruning
	Black tip	After fruit set
Pear	Shoot/fruit blight and bark canker	January, March and June
Ber	Leaf mould and leaf spot	3-4 sprays starting from first week of November at 15 days interval
Grape	Anthracnose/die-back and Cercospora leaf spot	January-February, end March, end May, mid August and mid September
	Downy mildew	
Pomegranate	Bacterial blight	May, June and July

How to test Bordeaux mixture before use:

i) Litmus test: Bordeaux mixture as prepared above, is alkaline in reaction containing, as it contains more proportion of lime. It should, therefore, turn the red litmus paper blue. An excess of copper compound in the mixture may be dangerous to foliage of many plants and is indicated by the solution turning the blue litmus paper red.

ii) Copper deposition test: Another way of determining whether the mixture contains excess of copper is to immerse a bright iron surface such as knife, blade or a nail in the upper layer of the liquid for a few minutes. A brick red or bright pink coppery deposit on the metal surface indicates the presence of excess copper and as such the solution is unsafe for use.

iii) Reagent test: A more precise chemical test may be performed by using the reagent, potassium ferrocyanide. Add a few drops of the Bordeaux mixture to little ferrocyanide in a small saucer. If no change occurs, the mixture is safe but if it becomes reddish brown, too much copper is present.

More lime solution must be added, if the tests indicate that copper is present in excess.

Some do's and don'ts:

- Use the Bordeaux mixture soon after preparation. It should not be stored for further use.
- Do not use metallic containers for preparing copper sulphate solution and lime suspension. Use a wooden stick for stirring to get a homogenous mixture. Never use a metallic stick.
- Do not use the Bordeaux mixture in combination with any other chemical or pesticide.
- To avoid choking of the nozzle, it is advisable to strain the Bordeaux mixture through a cloth or a sieve before putting it into the spray tank.
- The Bordeaux mixture tends to sediment easily. Therefore, it's stirring while using is desirable.
- Bordeaux mixture should not be sprayed, when it is raining or on exceptionally hot days when the plants are showing sign of temporary wilting.
- After carrying out spray operations the appliances should be thoroughly washed with plenty of water to remove any copper deposits.
- The left over Bordeaux mixture should not be dumped in the field as this may prove toxic to the subsequent sowings.

Other formulations of Bordeaux mixture

Bordeaux paste

Pruning is a regular horticultural operation for removing dead wood, diseased plant parts and to give shape to the tree. The cut ends created during pruning need to be protected against infection by different pathogens, by sealing with suitable fungicide pastes. The Bordeaux paste is the most effective wound dressing material for this purpose.

Preparation of Bordeaux paste

Dissolve 2 kg of copper sulphate in 15 litres of water. Slake slowly 3 kg of quick lime in a small amount of water. When slaked, add enough water to make the volume up to 15 litres. Thoroughly mix the two concentrated solutions. This ready-to-use paste is suitable for application to the cut ends with brush.

Bordeaux paint

Bordeaux paint is applied for curing the deep and deformed wounds caused by cankers, gummosis, root rots. Bordeaux paint makes the covered surface impervious to water. It is very useful in places subject to abundant rains and protects the wounds from the wood rotting fungi.

Preparation of Bordeaux paint

To prepare the Bordeaux paint use monohydrated copper sulphate (1kg), hydrated lime dust (2 kg) and boiled linseed oil (3 litres). Monohydrated copper sulphate can be easily made by heating the copper sulphate crystals on an iron sheet or in a frying pan (tawi) till they crumble into a white amorphous powder. Lime dust and copper sulphate powder are then mixed thoroughly and homogenized with 3 litres of boiled but cooled linseed oil to make a thick paste. Bordeaux paint is now ready for application. Apply it with a brush. It may be stored in a glass jar or other suitable non-metallic vessel for future use or made fresh, when needed.

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Ready-to-Use *Kanji* Mix: An Innovative technology

Preetinder Kaur, Tarsem Singh Dhillon and Gulab Pandove

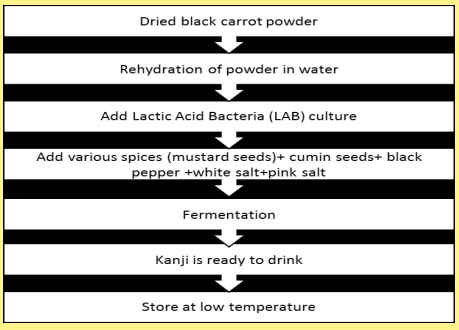
Department of Processing and Food Engineering

Black carrots are a rich source of bioactive compounds; however, their utilization remains limited due to their seasonal availability and perishable nature. Traditionally, black carrots are used for the preparation of *Kanji*, a naturally fermented, non-dairy beverage produced by lactic acid bacteria in the presence of selected spices.

The PAU-developed black carrot variety 'Punjab Black Beauty' possesses superior nutraceutical and quality attributes. Keeping all this in view, Punjab Agricultural University has developed a ready-to-use *Kanji* mix using lactic acid bacterial (LAB) culture and refractance window dried (RWD) black carrot powder of 'Punjab Black Beauty' for controlled fermentation to enhance the year-round availability of *kanji* beverage and ensure its microbiological safety. The refractance window drying technique has proven highly effective for drying heat-sensitive materials such as liquids and purees into powders, flakes, or sheets. Compared to conventional drying methods, RWD offers advantages such as reduced processing time and energy consumption, and superior retention of nutritional and sensory quality.

Lactic acid bacteria further enhance sthe bioavailability of minerals and trace elements, thereby improving the nutritional value of the final product. The dried *Kanji* mix can be easily reconstituted into a naturally fermented probiotic beverage with a distinctive flavour and aroma, while ensuring microbiological safety and improved commercial feasibility. The physicochemical and microbiological quality attributes of *Kanji* prepared using the ready-to-use mix, comprising LAB culture, RWD black carrot powder, and standardized spices, were evaluated and found to be superior to those of traditionally fermented *Kanji*.

The standardized method involves reconstitution of the RWD black carrot powder in potable water of defined quality,



Flowchart for preparation of Kanji from Kanji mix

followed by the addition of a recommended dose of spices such as crushed mustard seeds, black salt, white salt, red chilli powder, and a defined LAB inoculum. This ready-to-use mix serves as an excellent alternative with enhanced shelf life, enabling consumers to obtain the functional and probiotic benefits of *Kanji* throughout the year.

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Machinery for Horticulture Crops

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Wheat-paddy crop rotation is predominant in Punjab. The area under wheat crop is approximately 35 lakh ha, and the area under paddy is approximately 31.5 lakh ha. The water requirement of the paddy crop is very high, due to which the water table is declining continuously. There is a great need to reduce the area under wheat-paddy rotation and diversify the area under some other alternative crops. During 2023-24, the area under horticultural crops was 4.59 lakh ha. To improve working in horticulture cultivation and to reduce labour, horticulture mechanisation is being emphasized. Financial aid for new machines is also being given under the National Horticulture Mission. The information about machines, which are being developed and popularized by Punjab Agricultural University are given below.

1) Laser Land Leveller

Laser land levelling is a technology which helps in using water efficiently, reduces irrigation time and enhances productivity per unit input not only of water but also of other farm inputs. Laser leveller is trailed type equipment used for achieving precise levelling with desired grade. This 2-meter-wide automatic leveling operation can be successfully carried with 50 hp or above tractor. It saves water to the tune of 25-30 %, enhances efficacy of chemicals and fertilizers and improves productivity. After leveling of field the number of ridges is reduced in the field due to which 2-3 % area in flat fields and 6-8 % area in ridge fields is increased under crops. With this machine we can also give slope to the field. If there is difference of 3-4 inch in the field then it takes 1.25-1.50 h/acre for completely leveling the field. In case of vegetables if the fields are leveled then uniform irrigation can be applied and also due to no water clogging in field there will be increase in yield of vegetables.

2) Sub Soiler

It requires a tractor above 45 HP. It breaks hard pan beneath the soil surface and increases infiltration as well as aeration in the soil. It can penetrate the soil to a depth of more than 40 cm. The excess rainwater can also drain more easily into fruit plants and vegetable crops.

3)Tractor Operated Post Hole Digger

This equipment is used for digging pits of sizes ranging from 15 to 75 cm in diameter and up to 90 cm in depth. Under average conditions, it is capable of digging 60-70 pits/h of 90 cm depth.

4) Offset rotavator

This rotavator can be used for tillage as well as it can also be operated between plant rows at the same time. In this rotavator, a hydraulic side shift system, along with a sensor, is provided. As this sensor touches the tree/plant stem, the hydraulic system brings the rotavator behind the tractor and, after crossing it again, operates in the plant row. Its effective width is 178 cm, and it can go offset up to 54 cm.

5) Tractor Operated Bed Maker and Plastic Mulcher Machine

This machine performs four operations simultaneously, i.e. making beds, laying of drip line, laying of plastic sheet as mulch and punching holes in the sheet at required spacing. It requires a tractor of 45-50 HP for its operation, and its capacity is 0.6 acre/h. It saves 92 % labour as compared to the manual method

6) Subsurface Drip Laying Machine

This machine is used for laying drip pipes under the surface, and the depth varies from 15-30 cm. It requires a tractor of 45 HP for its operation, and its capacity is 0.2-0.28 acre/h.

7) Carrot Planter

Mechanical planting of vegetable seeds on beds is done to maintain proper depth and spacing for enhancing yield and quality of roots, along with lesser cost and labour requirement. Tractor-operated bed planting machine with a total width of 230 cm and having an inclined plate type metering mechanism

for planting of small seeds like carrot, onion etc.

8) Manually Operated Multicrop Planter

It is useful for sowing garlic and other bold seeds. In this machine, the planting mechanism has been mounted over the existing wheel hand hoe, which is used for inter-culture purposes and is already commercialised. The planting mechanism consists of a vertical plate with spoons. The capacity of the hopper is about 3.0 kg and two persons operate the machine. Plant spacing can be varied by varying the number of spoons on the periphery of the vertical plate. Planting spoons are also available for sowing different crops like peas, sunflowers, cotton, okra, maize, and soybeans. It can plant 0.75 to 1.0 acres/day. There is a saving of 80 % labour and 75 % cost with this machine.

9) Self- Propelled Rotary Power Weeder

It is a self-propelled engine-operated power weeder for inter-culture operation in horticulture and wider row crops. The depth of operation ranged from 4-7 cm. The weeding efficiency of the machine varies from 80-94 % depending upon the type of crop. The field capacity ranged from 1.5-2.5 acres/day.

10) Orchard Sprayer

Mostly farmers are using foot operated and power operated sprayers in Punjab. With this sprayer, in addition to saving in labour and time, timely spraying is done. The sprayer is to be trailed by the tractor and blower is operated by the P.T.O shaft. With the help of blower, the insecticide is sprayed on both sides. The tank capacity is 1000 litre. The sprayer can give uniform and effective spraying on orchard trees up to height of 6 m. The field capacity of the sprayer is 2.0-3.0 acres/h.

11) Pick Positioner

Pick positioner is used for harvesting fruits from orchards and is also used for pruning operations. Pick positioner is a tractor-mounted machine. Pick positioner has a base height of 25 feet and a standing platform height of 30-31 feet. There is a saving of 90 % labour in tree pruning and 75 % labour saving in fruit harvesting by using this machine. It reduces the fruit losses during harvesting, and fruits at the ends can be easily harvested by using this machine. It saves labour to the tune of 25%.

12) Root Crop Harvester

This machine is used for digging various root crops like carrots, potatoes, garlic and onions. It consists of a digger blade made from carbon wear-resistant steel. The field capacity of the machine is 0.5 acres/h with harvesting efficiency ranging between 96-99 %. Labour saving is about 60-70 %.

13) Paddy Straw Bale Shredder cum Mulcher

The functional requirement of the machine was to shred paddy straw using a suitable shredding mechanism and spread this shredded straw in the field in a strip approximately one meter wide. This machine can be used for mulching in vegetable crops. The machine is operated by 35 or above hp tractor. Manual spreading of loose straw is highly labour-intensive for mulching. This machine reduces dependence on labour and also reduces straw size, which helps in better control of weeds. The weed count found was 3-4 times less than where no mulch was used. Weed counts were three to four times less in fields where a shredder was used. No plant damage was observed due to machine operation in the field. The average field capacity of the machine was 0.63 acres/h. The average fuel consumption during machine operation was 4.61 l/h. The yield of garlic was increased by 9-10%. The economics of mulch application through a shredder have been calculated, and found that the application of straw mulch in garlic through a shredder increased the returns by Rs. 20650/-

14) Vegetable Seed Extraction Machine

This machine is used for extracting seeds from different vegetables and fruits like tomato, brinjal, chilli, watermelon, summer squash, cucumber, tinda etc. The fruits or vegetables are cut into small pieces in the primary chamber. Thereafter, these are further crushed by means of axially arranged blades attached to a rotor shaft. The shaft rotates at a speed of 250-300 rpm. Different concave screens for separating different seed sizes are used.

For the mechanisation of various operations involved in horticultural crops, machines are being developed and popularised by Punjab Agricultural University, Ludhiana. Farmers can save labour as well as time by using these machines. Farmers can get information about these machines from the Krishi Vigyan Kendra of their District or the Department of Farm Machinery and Power Engineering, Punjab Agricultural University, Ludhiana. For subsidy-related information on these machines, farmers can contact the Horticultural Development Officer of their district.

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Successful Cultivation of *Rabi* Onion

Jiffinvir Singh and Madhu Sharma
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Selection of varieties/hybrid

Farmers often face problems such as excessive bolting and poor storage quality, mainly due to sowing the nursery earlier than the recommended period. Early sowing promotes bolting, which ultimately reduces yield. Therefore, it is advised to sow the onion nursery between mid-October and mid-November. In addition, farmers should select hybrids or varieties recommended by State Agricultural Universities (SAUs) or research institutes for cultivation in their region. Since onion seed remains viable for only one year, ensuring the use of fresh seed is equally important. Therefore, nursery seedlings should be purchased only from authentic and reliable sources to ensure varietal purity.

Nursery raising of *Rabi* Onion

Sow 4 to 5 kg seed to raise seedlings for transplanting in an acre. Prepare 15 to 20 cm high beds in 8 marlas (200 sq. m). Mix 125 kg well rotten farmyard manure per marla and irrigate at least 10 days before sowing to allow complete germination of weeds. Sow seed thinly at one to two centimeter depth in 5 cm apart lines. Transplant the seedlings in a wattar field soon after uprooting from the nursery beds. The varieties/hybrids recommended for *rabi* season are as under:

Varieties/ Hybrids	Bulb Characters
Red coloured varieties/hybrids	
POH-1 (F_1)	Large, round and light red bulbs, tolerant to bolting and long shelf life
PRO-7	Medium-large, round and red bulbs with thin tight neck, tolerant to bolting and long shelf life
PRO-6	Medium to large, deep red bulbs with thin tight neck, tolerant to bolting and long shelf life
Punjab Naroya	Medium to large, red and round bulbs, tolerant to bolting and long shelf life
Yellow coloured varieties	
PYO-1	Large, yellow and globular bulbs with tight neck, tolerant to bolting and long shelf life
White coloured varieties	
PWO-2	Medium large, white and round bulbs with tight neck, tolerant to bolting and long shelf life

Manures and fertilizers during transplanting *Rabi* onion

Manures and fertilizers can be incorporated based on soil test for better results. Onions are highly responsive to application of farmyard manure (FYM). So, incorporate 20 tonnes of FYM along with 45 Kg of Urea, 125 Kg of single super phosphate (SSP) and 35 Kg of Muriate of Potash (MOP) per acre before transplanting the onion. It is also advisable to use 4 Kg of microbial consortium per acre for better yields of onion. When seedlings attained the height of 10-15 cm, transplant them at row to row spacing of 15 cm and plant to plant spacing of 7.5 cm. Transplanting can be done on beds (if soil is heavy) or on flat (if soil is light in texture). Watering should be done immediately after transplanting for proper establishment. Apply forty-five Kg of Urea to the crop after 4-6 weeks of transplanting.

Weed control

Weed control is the major problem in *rabi* onion. Majority of the labour work in onion is involved in transplanting and weeding as being closely planted crop, it requires 3-4 hoeings for proper weed control. Apply Goal 23.5 EC (oxyfluorfen) within 7 days after transplanting @380 ml/ acre using 200 litres of water. Then hand weeding can be done after 90-100 days for effective weed control.

Important tips in *Rabi* onion crop

Tips	Benefits
Timely transplanting of healthy seedlings	Higher production
Selection of varieties as per market needs	Better prices
Soil test mandatory for providing better nutrition	Better bulb size and quality of onion
Provide proper and timely Irrigation	Better establishment of seedlings and storage
Select weed free fields	Minimize labour costs
Knowledge of insect-pest and diseases	Better yields and more benefit: cost ratio

Not recommended	Losses
Never sow nursery before mid-October	More bolting and less storage
Use of seeds/ seedlings from un-recommended sources	Poor production due to more bolters, non-uniform crop, hence low prices
Irregular irrigation	Affect crop growth and production, affects shelf life
Transplanting onion in fields with history of weeds	More labour costs in terms of weeding

Harvesting and storage

Drying and falling of tops of onion indicates that crop is ready for harvesting. Curing is the next step after harvesting where bulbs are dried under shade. Onions should be stored in a well-ventilated and dry place. There is need to turn the bulbs once in a fortnight for enhancing storage capacity and farmers have to keep sorting out and discarding injured onions to preserve better lot for long period of time.

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Control of Rodents in Wheat Crop

BK Babbar, Rajwinder Singh and Tejdeep Kaur Kler

Department of Zoology

Rodent control without poison

- Old bunds, pavement and water channels around crop fields having burrows should be built periodically after sometime.
- Height and width of bunds in crop fields should be less.
- Do proper weed management in and around crop fields manually or by using chemicals as rodents get food and shelter from weeds.
- Rodent control operations must be carried out in waste land along roads, canals, railway lines, uncultivated areas and forests strips which serve as a reservoir of rodents.
- During irrigation the rodents coming out of flooded burrows can be killed using spades/sticks.
- Rodents can be caught by using multi-catch traps @ 16 traps/acre placed at different spots covering runways, damage and activity sites of rodents. Trapping can be enhanced by doing pre-baiting by placing 10-15 g of cracked wheat grains containing 2% sugar and 2% vegetable oil on a piece of paper in each trap for 2-3 days and leaving the back door of the trap open. After pre-baiting, close the back door of the traps by placing 10-15 g of plain bait on a piece of paper in the trap tunnel.
- We should protect dogs, owls, kites, falcons, eagles, snakes, cats and mongoose which are natural predator of rodents.

Rodent control with poison

Two rodenticides zinc phosphide (2%) and bromadiolone (0.005%) are recommended by PAU for the preparation of poison bait to control rodents. It is important to do pre-baiting with plain bait material for 2-3 days to lure rats before using poison bait. Do not use zinc phosphide in repeated baiting before 60 days to reduce bait shyness. Bromodiolone is anticoagulant which prevents coagulation of blood and its effect begins 2-3 days after ingestion of poison bait, so, it can be used repeatedly.

Preparation of poison bait

For one kg of poison bait, we need 940 g broken grains of bajra wheat, maize or their mixture. Add 20 g of any edible vegetable oil in it and mix it thoroughly and afterwards add 20 g powered sugar and 25 g zinc phosphide or 20 g bromodiolone and mix it thoroughly. Always prepare poison bait a fresh when needed.

Placement of poison baits

On a small piece of paper put 10 g poison bait and make a small paper boat. Put this paper boat 5-6 inches deep inside open burrow with the help of stick and cover it by soil using spade/*khurpa*. To reduce detrimental effect on environment and make judicious use of rodenticide, cover all the open burrows with soil one day before and treat re-opened burrows next day @1 paper boat/burrow. On crop having good vegetative growth, randomly select 40 points in the field and put 10 g poison bait on a piece of paper at each selected point @ 400g/acre. Use crop baiting at specific growth stage of crop when needed.

Critical timings of bait placement in wheat crop

For wheat crop sown with conventional tillage method, do crop baiting @ 400g/acre throughout field with zinc phosphide/bromodiolone in mid-February to early March (before milky grain stage). For wheat crop sown with zero tillage method, do burrow baiting with zinc phosphide before crop sowing and second crop baiting @ 400g/acre throughout field with zinc phosphide/bromodiolone in mid-February to early March (before milky grain stage). For wheat crop sown with Happy Seeder, do burrow baiting twice with zinc phosphide/bromodiolone at an interval of 10-15 days after sowing of wheat crop. Do crop baiting @ 400g/acre throughout field with zinc phosphide/bromodiolone in mid-February to early March (before milky grain stage).

Safety measures during preparation of poison bait

- Always keep rodenticides and poison bait away from the reach of children and pet animals.
- Do not drink, eat or smoke while applying poison baits and wear gloves while preparing poison bait.
- Dead rats, empty pouch es/packets of rodenticides and remaining poison bait should be buried deep in soil to reduce secondary toxicity.
- Always wash your hands thoroughly after handling rodenticide.

Message to farmers

No single method is 100% effective in controlling rodents. Therefore, adapt an integrated approach by using different methods at different stages of the crop. Migration of rodents from surrounding fields results in ineffectiveness of management in small areas. Therefore, for better results village level anti-rat campaigns should be organized with an integrated approach using different methods at different stages of the crops. By using these techniques judiciously in sequence or in combination with other methods as an integrated pest management, rodent damage in crops can be reduced and farm income can be increased.

• ***BK Babbar: 99156-36711***

Tips for Successful Wheat Seed Production

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Seed production is a specialized activity that differs significantly from ordinary grain production. While grain production mainly aims at obtaining higher yields, seed production focuses on maintaining varietal purity, high germination percentage, vigor, freedom from diseases, and uniformity. Scientific seed production involves strict adherence to field standards, careful crop management, timely rouging, proper isolation, systematic record keeping, and meticulous post-harvest handling. Any negligence at any stage may result in deterioration of seed quality or rejection during certification. Hence, farmers interested in wheat seed production must understand and follow recommended practices.

In India, there are three generally recognized classes of seed, namely Breeder Seed, Foundation Seed, and Certified Seed. Breeder seed is produced under the direct supervision of plant breeders and forms the basic source of all other seed classes. Foundation seed is produced from breeder seed and maintains high genetic purity. Certified seed is produced from foundation seed and is made available to farmers for commercial cultivation. Punjab Agricultural University (PAU), Ludhiana, has repeatedly emphasized the importance of quality seed and has encouraged progressive farmers to produce seed either individually or in groups and exchange improved varieties among themselves. This approach not only reduces dependence on external seed sources but also ensures timely availability of quality seed at the village level.

The success of wheat seed production begins with proper field selection. The selected field should be fertile, well levelled, and well drained, as waterlogging adversely affects crop growth and seed quality.

Isolation is another critical requirement in wheat seed production to maintain varietal purity. Although wheat is a self-pollinated crop, a small amount of natural cross-pollination may occur. Therefore, seed fields must be isolated from other wheat varieties by maintaining the prescribed isolation distance. For certified seed production, a minimum isolation distance of about three meters should be maintained, while for breeder and foundation seed production, the isolation distance should be at least five meters.

The use of appropriate seed rate and quality planting material is equally important. For seed production plots, only breeder or foundation seed should be used. The recommended seed rate for normal sowing is about 40 kg per acre, which ensures proper plant population, better tillering, and uniform crop stand.

Time of sowing plays a vital role in determining both yield and seed quality. From a seed production point of view, the first fortnight of November is considered ideal for sowing wheat in Punjab.

Balanced nutrient management is essential for producing healthy and vigorous seed. The recommended fertilizer dose for wheat seed production is 50 kg nitrogen, 25 kg phosphorus, and 12 kg potassium per acre. Nitrogen should be applied in split doses to match crop demand. Phosphorus and potassium should be applied at sowing to promote strong root development. Micronutrients such as zinc, iron, or manganese should be applied if deficiency symptoms appear, as nutrient imbalances can adversely affect seed development and viability.

Roguing, which refers to the removal of off-type and undesirable plants, is the most important and distinctive operation in seed production. Off-type plants differ from the main variety in height, leaf colour, ear characteristics, or maturity. Diseased plants affected by rusts, smuts, or blights, as well as weedy grasses resembling wheat, must also be removed promptly. Roguing should be carried out at least three times: before heading, at flowering, and at maturity. Timely and thorough roguing ensures high genetic purity and helps the seed crop meet certification standards.

Effective disease and pest management is essential for producing disease-free seed. Farmers should always use healthy and treated seed for sowing and monitor the crop regularly for the appearance of diseases and insect pests.

Harvesting and post-harvest handling require special attention in seed production. The crop should be harvested when the grains are fully mature, hard, and have attained a golden colour. Mechanical mixtures must be strictly avoided during harvesting, threshing, and transportation. Separate and thoroughly cleaned threshers should be used for each variety, and seed of different varieties should never be mixed. Proper sun drying of seed is essential to reduce the moisture content to about 12 per cent before storage, as higher moisture may lead to fungal growth and loss of viability.

Seed processing is the final but equally important step in quality seed

production. The harvested seed should be properly cleaned to remove dust, chaff, weed seeds, and other inert matter. Grading should be done using appropriate sieves or mechanical graders to eliminate broken, undersized, or shrivelled grains. Seed treatment with recommended fungicides before packing helps protect the seed from storage fungi and soil-borne diseases. Depending on prevailing humidity conditions, seed should be packed in gunny bags, cloth bags, or airtight containers. Each bag must be properly labelled with details such as variety name, class of seed, lot number, and year of production, and proper identification should be maintained throughout handling and storage.

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Integrated Practices for the Management of Stripe/Yellow Rust in Wheat

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Wheat is an important rabi crop in Punjab. Every year, stripe/yellow rust affects the crop from time to time, causing reductions in both yield and quality. The severity of losses increases when susceptible varieties are grown, weather conditions become favourable for disease development, and timely management measures are not taken. Therefore, farmers need timely information regarding the appearance of the disease, how to correctly identify it, and management practices to be followed. Here, we will discuss various integrated practices for the management of stripe /yellow rust and also cover the time of occurrence and accurate diagnosis of the disease.

Stripe/yellow rust is caused by the fungus *Puccinia striiformis* and is a big threat to wheat, especially in the sub-mountainous areas of Punjab like Ropar (Rupnagar), Shaheed Bhagat Singh (SBS) Nagar (Nawanshahr), Hoshiarpur, Fatehgarh Sahib, Pathankot, and Gurdaspur during December and January and can cause huge yield losses if not checked on timely. Spores of yellow rust will survive during the offseason on wheat in the adjoining hilly areas of Himachal Pradesh. The uredia spores of the fungus travel down the hills with air currents (katabatic winds) and land on wheat crop in sub-mountainous regions of the state. The spread of the disease from these areas to others occurs through the airborne spores which are produced on the diseased plants as yellow powder/pustules in linear stripes. The color of the powder looks like turmeric and sticks to the hands or clothes when touched or cross the infected plants or fields, respectively. During favourable conditions, if susceptible varieties are grown, the disease can appear at any stage of the crop, i.e., starting from the first leaf stage till the plant remains green.

The secondary spread and development of the disease in other areas also depend on the prevailing weather conditions and the extent of area under susceptible varieties. For this, minimum temperature in the range of 7-13 ˚C coupled with 85-100% relative humidity during the night and maximum temperature in the range of 15-24 ˚C during the day are congenial for infection, development and spread of disease.

If the disease appears early in the season on a susceptible variety and is not timely managed, it can lead to severe losses in the affected fields. Farmers are advised to adopt integrated management of stripe/yellow rust. Grow yellow rust resistant wheat varieties (PBW Zinc 2, PBW RS1, PBW 725, *Unnat* PBW 550 and and PBW 660), especially in disease prone sub mountainous areas of the state and also avoid sowing in October because it leads to an early and prolonged period of disease development.

Farmers should start monitoring the crop from December onward and keep an eye on the crop, especially after irrigation or rain, to identify the earliest infection. If the disease, appears in the field the spray the crop with 300 g Taqat 75 WP (captan + hexaconazole) or Caviet 25 WG (tebuconazole) or 120 g Nativo 75 WG (trifloxystrobin + tebuconazole) or 200 ml Ampact Extra 25.5 SC (azoxystrobin + cyproconazole) or 200ml Opera 18.3 SE (pyraclostrobin + epoxiconazole) or 200 ml Custodia 320 SC (azoxystrobin + tebuconazole) or 200 ml Tilt 25 EC/Shine 25EC/Bumper 25 EC/ Stilt 25 EC/Compass 25 EC/Markzole 25 EC (propiconazole) in 200 litres of water per acre. Initially, only spot application surrounding the infected area should be done. Regularly monitor the crop and repeat the fungicidal application as needed. Repeated use of a single fungicide should be avoided as it may lead to the development of fungicide resistance. In the last few years, the area under organic farming in Punjab has expanded, with wheat being one of the major crops cultivated in this system. However, yellow rust has become a significant challenge, particularly in organic production where fungicide use is strictly prohibited. For the effective management of yellow rust under organic conditions, Punjab Agricultural University recommends four sprays of fermented buttermilk at 20% concentration (for one acre, dissolve 40 litres of fermented buttermilk in 200 litres of water). First prophylactic spray one month after sowing, followed by 3 more sprays after the appearance of the disease at an interval of 10 days on moderately resistant varieties.

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Grow Til "The Queen of Oils": Small Seeds with Big Nutrition

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Sesame commonly known as '*Til*' is one of the oldest crops traditionally used in Punjab. Its oil has long been known as the "Queen of oils" because of excellent stability, rich taste, and tremendous health benefits, which gives it special importance. Last year, this crop was cultivated on more than 4.0 thousand hectares with a production of 6000 quintals. Although *Til* occupies a relatively small area in the state, it is a crop of immense value because of its rich nutritional qualities and medicinal benefits. It is a short-duration, low-cost, and profitable crop.

Sesame seeds are an excellent source of energy and nutrition. These tiny seed contains 40–53% high-quality oil, which makes sesame one of the richest oil-bearing crops. About 65% of the harvested seeds are used for oil extraction, while the remaining seeds are used for direct consumption. Due to their delicious nutty flavor, sesame seeds are widely used in bakery items, confectionery and other food specialties. Apart from oil, sesame seeds contain 18–25% protein and around 15% carbohydrates, making them a balanced source of energy and nutrition. They are also packed with essential minerals such as calcium, iron, zinc, magnesium, phosphorus, and copper. *Til* contains nearly three times more calcium than milk or nuts, making it an excellent food for children, women, and elderly. Along with these minerals, sesame seeds also contain fibre, vitamins (especially vitamin E and vitamin B1), and a variety of antioxidants, all contributing to better health.

One of the unique benefits of sesame oil is its natural medicinal properties, as it is rich in antioxidative compounds such as vitamin E, lignans *viz.,* sesamin (0.4-1.1%), sesamolin (0.3-0.6%), and traces of sesamol. These compounds not only protect the oil from oxidation but also support human health by strengthening immunity and reducing cell damage. Sesame oil is also preferred over other vegetable oils because it constitutes more than 80% of oleic (mono-unsaturated fatty acid, MUFA) and linoleic acid (omega6) (polyunsaturated fatty acid, PUFA) and less than 20% of saturated fatty acid (SFA). Omega 6 plays a crucial role in brain function, regulating body metabolism, maintaining the reproductive health and stimulating skin and hair growth. The richness of PUFA in sesame oil makes it a quality oil to be used as nutraceutical and functional food. In addition to PUFA, the presence of tocopherols, phytosterols, lignans (sesamin, sesamolin, sesamol), and other natural antioxidants in sesame oil helps protect body from various diseases.

Apart from the above-mentioned qualities, sesame seeds also possess highly important medicinal properties. The oil has been used for healing wounds for thousands of years. Due to the presence of lignan compounds, sesame seeds exhibit anti-inflammatory, antiviral, anti-bacterial and anti-fungal properties. Lignans are also active ingredients of various antiseptics, bactericides, vermicides, disinfectants, moth repellants etc. They also have been found to protect the liver from oxidative damage and have cholesterol-lowering effects, which makes it extremely beneficial for heart health. Sesame seeds are also known for their high phytosterol content (400-413mg/100 g) which is believed to reduce blood cholesterol levels and boost immunity.

India imports large quantities of edible oils every year because domestic oilseed production is unable to meet the rising demand. Sesame can help reduce this dependency, as it can be cultivated at low cost using less water and on marginal lands. To promote sesame cultivation in the state, Punjab Agricultural University has released an improved variety, Punjab Til No. 2. This variety yields 2.8 quintals per acre. It has profuse branching, dense pod setting, and long non-hairy pods filled with bold, soft, white seeds containing 49% oil content. This variety matures in about 90 days and shows tolerance to phyllody and *Cercospora* leaf blight diseases.

In addition to oil, sesame defatted meal (*khal*), is an excellent protein-rich feed for livestock. It contains valuable amino acids such as methionine and tryptophan, which are often limited in many other plant-based protein sources like soybean meal. Therefore, given the numerous benefits of sesame, we should incorporate it in our daily diet. Sesame can be consumed not only as seeds but also in the form of *laddoos*, chutney, or sesame oil.

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Agronomic Practices for Successful Mentha Cultivation in Punjab

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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. Mentha can also play an important role as a diversification crop to prevailing rice-wheat cropping system. 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 Unnati, CIM Kranti and Kosi are recommended for commercial cultivation in Punjab. The detail description of varieties is as below.

CIM Unnati: It is high yielding variety of menthol mint (*Mentha arvensis* L.) with high oil content (0.81-0.83 %) in herb and suitable for planting from end of January to mid of February. Its average herb yield is 113 quintals per acre. It produces the highest herb and oil yield when harvested 145 day after planting.

CIM Kranti: It is high yielding variety of menthol mint suitable for planting from end of January to mid of February. It contains oil in herb which ranged 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, CIM Kranti and CIM Unnati 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 in the end of January.

Fertilizer application

Mentha respond 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 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. 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 0.83% 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.

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GNSS-based Auto-Steering System for Tractors

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Efficient and precise operation of agricultural machinery is crucial for reducing input costs, enhancing productivity & human comfort, and ensuring sustainability in farming practices. Also, there is a shortage of agricultural workers as farming is less appealing to younger generations than other occupations, resulting in rising labour expenses. Automated machinery can be used to aid human operators in simplifying agricultural tasks. Manual steering often leads to inaccuracies, including overlapping, missing, and inconsistent parallel operation, as well as row spacing issues, particularly in large fields or during extended working hours. These results in wastage of resources, reduced crop yield, and increased operator fatigue. An auto-steering system for tractors can effectively address such challenges.

Auto-steering system is a GNSS-based guidance technology to maintain precise steering control, thereby reducing errors caused by manual steering. This system helps in operating tractor-mounted implements along a predefined path with enhanced accuracy, reducing missed areas, overlaps, and the number of passes required during field operations. The system comprises a multi-constellation GNSS receiver, a responsive touchscreen console with ISOBUS-compliant software, a wheel angle sensor, and a motorized steering. The original steering wheel of the tractor is removed and a motorized steering is installed using an adopter. The major dimensions of the tractor and implements were entered into the system beforehand. Also, the coordinates outlining the boundary of the field are pre-defined. For this, the tractor is taken around the field boundary and four corners of the field are marked as A, B, C and D. The system configures the area by itself and calculates the number of turns as per implement and tractor geometry. GNSS receiver delivers precise location data that guides the vehicle along pre-planned paths. The sensor communicates with the controller of the auto-steering system by detecting the rotation of the steering wheel. The software capabilities include auto-steer, automatic headland turns (with variable headland width), headland turn patterns (alternating/ infill/ single direction infill), skip row (zero, 1, 2, 3) etc. A switch is provided on the tractor that allows the driver to activate or deactivate the auto-steering mechanism. When this switch is turned on, the auto-steering system takes over the steering of the tractor whereas when the switch is disengaged, the operator regains manual steering control. The tractor's 12-volt battery is used as a power source to run different components of the system.

Field trials showed that the average overlapped area (in lines), when the tractor is operated with manual steering is generally observed to be 3-12% for different tillage and seeding machines, whereas with auto-steering system, the average overlapped area is about 1%. Similarly, manual steering control, while operating these machines, generally results in missed area (in lines) of 2.0-7.0%, whereas the missed area is less than 1% when the auto-steering system is used to operate these machines. The adjacent pass-to-pass accuracy with auto-steering system in up to ± 3 cm. The system assists tractor operators to perform field work precisely, which can lead to minimal wastage of input resources, enhanced working hours, and improved productivity. The operator's fatigue also reduces, allowing him to focus more on implement management. Further, parallel sowing lines facilitate subsequent mechanical intercultural and harvesting operations.

The Secrets of Crystallized Honey

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Honey, the golden sweet stuff our bees work so hard to make, has been used and loved for generations—not just for its taste, but for its health benefits. But when winter comes, many of us notice something different: the honey starts to "sugar up" and turn thick or grainy. This is called crystallization or granulation, and it simply means the honey is changing from a liquid to a semi-solid form. A lot of people think this sugared honey is spoiled or mixed with sugar etc., but that's not true at all. It's completely natural. When we understand why honey crystallizes, we can enjoy it without worry and even appreciate nature's way of protecting this sweet gift.

When honey turns thick and granulates evenly during the winter, it's actually a good sign. Uniform granulation usually means the honey is pure and hasn't been mixed with anything. In fact, this smooth, evenly sugared honey is often called "cream honey." However, the honey produced from different floral sources doesn't granulate in the same way because the following factors play a role in the crystallization/ granulation of honey:

1. High glucose content in some types of honey: Honey is primarily a mixture of two types of sugars *viz.* glucose and fructose. When the ratio of glucose to water is high in certain types of honey (i.e. more than 2.1), it promotes crystallization. In other words, the honey which contains higher glucose content will crystallize more. On the other hand, when this ratio of glucose to water is lower than 1.8, then that honey remains in the liquid state. Low water content in certain types of honey also promotes crystallization, probably because there is less moisture available in that honey to keep its sugars in solution form. As the honey ages, its water content may decrease, which in turn promotes crystallization in the aging honey.

2. Presence of pollen or other particles in honey: The pollen or other particles such as propolis & beeswax which naturally get mixed in honey in the bee hives, act as nuclei during the granulation/ crystallization of honey. The sugar molecules present in the honey get attached with these nuclei to initiate the granulation process. But these pollen particles etc. which are present in the honey also impart it with medicinal/ nutritional properties. Therefore, the honey which contains more number of pollen particles is more prone to crystallization, but is more beneficial to our health at the same time.

3. Temperature: The changes in temperature at which honey is stored may increase or decrease its chances of crystallization. Low temperature (less than 14°C) may increase the crystallization/ granulation of honey, whereas high temperature may decrease it, thus enabling the honey to remain in its liquid form. Therefore, storing honey in a cooler environment like in a refrigerator may accelerate its crystallization, while storing it in a warmer place can delay the process.

4. Type of floral source of honey: The species/ type of flowers whose nectar is collected by the honey bees to prepare honey also influence the tendency of its crystallization. The nectar of certain floral sources such as rapeseed-mustard (*sarson*) naturally contains a higher concentration of glucose than fructose, thus making their honey more prone to crystallization. Different compositions of nectar contribute to different rates of crystallization among different types of honey.

All of these factors indicate that crystallization or granulation is a natural characteristic of honey. It is not due to any type of adulteration, and is instead an indicator of its purity. It does not have any degrading effect on the nutritional value of the honey, rather the presence of pollen particles in it make it more beneficial for our health. A majority of consumers in the western countries prefer the granulated/ crystallized honey known as "cream honey", as it is easier to spread on toasts etc. and the chances of adulteration in it are also miniscule. We should also become aware regarding the qualities and characteristics of honey and should make it a part of our regular diet.

Punjab Agricultural University, Ludhiana, its Krishi Vigyan Kendras and the Progressive Beekeepers' Association, Punjab are also making their all-out efforts to spread this awareness among the common people during their various mass contact programmes like *kisan melas*, *goshtis* etc. through lectures, published literature and free tasting of "cream honey". Consumers are also giving a good response to such efforts and the sale of crystallized honey is increasing due to these efforts. Even then, if any consumer likes liquid honey only then the crystallized/ granulated honey can be again changed to liquid form by keeping the bottle of honey in warm water or sunshine.

In the end we can conclude that, just as different varieties of honey have unique flavours, colours and aromas, crystallization adds another dimension to the diversity of this remarkable food product. Whether we like liquid honey or crystallized granular honey, both of them provide us with the same nutritional benefits. So, the next time you encounter crystallized honey, savour its unique texture and enjoy its exquisite flavour with confidence.

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Scientific Cultivation of Poplar

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Punjab, with over 80% of its cultivated area under wheat and paddy and only 6.5% forest cover, faces soil degradation, water depletion, and ecological imbalance due to continuous rice-wheat cropping and excessive chemical use. Poplar (*Populus deltoides*), with its fast growth, straight trunk, short rotation, and versatile timber, has become a profitable and sustainable alternative. Its cultivation is relatively low-risk, making it particularly attractive to large farmers and absentee landowners. Widely adopted across Punjab and its adjoining states, poplar-based agroforestry enhances farm income, supports intercropping with short-duration crops, and improves soil fertility and water efficiency. Successful cultivation requires quality planting material, proper planting and spacing, pruning, irrigation, nutrient management and integrated pest and disease control to ensure long-term productivity and profitability.

Climate and Soils: Poplar thrives in subtropical climates where temperature extremes are moderate. It tolerates cool winters and warm summers but is sensitive to severe frost and extreme heat. The tree prefers deep, fertile, well-drained sandy loam soils with 20-30% clay content and a pH of 6.5-8.5. Growth is poor in heavy clay, saline-alkaline, or waterlogged soils.

Planting time: Planting is ideally done from mid-January to end of February.

Recommended clones: Choosing region-appropriate clones ensures better survival, growth, and resistance to pests and diseases.

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: The success of poplar cultivation heavily depends on high-quality planting material, which is a long-term investment. Nurseries are raised from one-year-old stem cuttings (20-25 cm long, 2-3 cm diameter). Cuttings should be soaked in fresh water for 48 hours before planting. Beds are prepared with well-decomposed FYM (8-12 tons/acre), and cuttings are planted at 50 × 50 cm or 60 × 60 cm spacing. Holes are made using a planting rod, leaving one bud above the soil surface. After the first irrigation, rice straw (4 tons/acre) is spread to control weeds. Fertilizers for one acre include 50 kg nitrogen (in two splits), 70 kg phosphorus, and 30 kg potassium. Light irrigation at 7-10 day intervals, along with regular hoeing, weeding, and debudding, is essential. Saplings are ready for transplanting after one year.

Spacing: Poplar can be planted along field boundaries or in block plantations. Marginal farmers generally prefer boundary plantations in north-south rows spaced 3 m apart to reduce shading on adjacent crops. Block plantations use 5 × 4 m spacing (~200 plants/acre), or 8 m row spacing with 2.5 m intra-row spacing to accommodate intercropping while maintaining planting density.

Field planting: Pits should be prepared using an auger or boki with a diameter of 15-25 cm and depth of about 100 cm. One-year-old saplings (ETPs) are planted in January-February, keeping bare roots in running water for 48 hours

to promote root bud development. After planting, pits are filled with topsoil mixed with SSP (150 g/pit in loam soil; 200 g/pit in sandy soil) or DAP (50-70 g/pit) to promote root growth. Soil should be compacted gently without filling the pit to the top to retain water, and immediate irrigation is necessary.

Pruning: Pruning is crucial for producing high-quality, knot-free timber. In the first year, debudding is performed post-monsoon for the lower one-third of the plant. From the second year onwards, winter pruning removes thick or vertical branches that compete with the main stem. Over-pruning should be avoided as it may reduce growth. Cut ends should be treated with Bordeaux paste (2 kg CuSO□ + 3 kg lime + 25 L water) to prevent infection by pathogens.

Intercropping: Poplar plantations support intercropping of crops that tolerate partial shade. Selection of suitable varieties, sowing time, and optimal seed rate are critical for successful intercrops. Frequent irrigation and balanced nutrient management using nitrogen, phosphorus, and potassium enhance tree growth, especially during the first 2-3 years.

Irrigation: Poplar being a fast-growing tree requires abundant water, particularly during the active growing season from April to October. In the first year, weekly irrigation is necessary, while in subsequent years irrigation is done at 7-10 day intervals during March-June and fortnightly from October-February. Independent irrigation channels for each tree row are recommended to prevent water stress, particularly during wheat harvesting, and allow intercrops to grow in between.

Nutrient Management: Nitrogen is essential for poplar growth, applied in split doses (May, July, and September) with amounts increasing from 80 g/plant in the first year to 280 g/plant by the sixth year. Fertilizer doses should be adjusted based on soil nitrogen content. Phosphorus is generally not required annually, as residual P from intercrops suffices. Zinc deficiency is common in Punjab, causing interveinal chlorosis, stunted leaves, and reduced growth. In nurseries, zinc can be corrected by applying 40 kg/acre zinc sulphate heptahydrate (21%) or 25 kg/acre zinc sulphate monohydrate (33%) at the time of sowing, with a repeat dose after two years if the site is reused. In plantations, zinc doses should be applied as 100, 200, and 300 g/plant heptahydrate (or equivalent monohydrate) in the 1st, 3rd, and 5th years, respectively, in circular bands around the tree after harvesting the rabi intercrop.

Weed management: Weed control is essential for maximizing growth of both poplar and intercrops, particularly during the first 2-3 years. Manual or mechanical removal and tractor-drawn intercultural operations are effective, while herbicides may also be used for annual grass and broadleaf weeds. Pre-emergent herbicides can prevent weed establishment, and post-emergent herbicides should be applied carefully on actively growing small weeds, following label instructions.

Insect pest management

- **Leaf Defoliators,** *Clostera restitura* and *C. fulgurita* are major pests with peak activity from July to November. Larvae emerging from overwintering pupae feed on leaves; early instars skeletonize foliage, while later instars consume entire leaves. Its management includes early detection, manual removal of larvae and egg masses, deep ploughing in December, and planting resistant clones.
- **Leaf webber,** *Asphadastis cryphomycha* webs 2-3 leaves and feeds on them, causing desiccation and scorched appearance. Management includes destroying larvae and eggs, winter ploughing, and resistant clones such as L 47/88 and L 48/89.
- **Poplar stem borer,** *Apriona cinerea* bores into saplings and mature trunks, forming galleries and hollowing timber. Its management involves pruning infected branches, mechanically destroying larvae with iron wires, chemical treatment of exit holes with paradichlorobenzene in kerosene, and avoiding collateral host plants.
- **Bark-Eating caterpillar,** *Indarbela quadrinotata* tunnels into branches and trunks, forming L-shaped galleries. Severe attacks can kill trees over 2-3 years. Management includes burning infested bark, maintaining spacing (8-10 feet), summer irrigation, light traps for adults, and mechanical or chemical control of larvae.

Disease management: Leaf spot caused by *Myrothecium roridum, Cercospora populina, Phaeoisariopsis spp., Drechslera maydis,* and *Alternaria spp.* occur mainly during monsoon (July-September), causing lesions, defoliation, and reduced photosynthesis. Control involves Bordeaux mixture (0.8%) sprays, destroying infected leaves, and maintaining field hygiene.

Cutting rot caused by *Botryodiplodia spp.* affects young cuttings under high temperature, leading to bark pycnidia, tissue decay, and death. Management requires disease-free material, pre-treatment with Bavistin (0.5%), Bordeaux mixture drenching, and avoiding waterlogged areas.

Harvesting: Poplar trees are ready for harvest when they reach a girth of around 80 cm. Trees grown along farm boundaries typically attains this girth earlier than those in block plantations. Standing trees are usually sold on a weight basis, which is the preferred method for maximizing income.

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Feed Management of Dairy Animals during Winter Season

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For dairy animals, the ideal temperature ranges from 15°C to 25°C, and humidity should be around 70%. However, in winter, the temperature usually remains between 13°C and 24°C, and at the beginning of the year, it drops even further. At lower temperatures, especially when humidity exceeds 80%, dairy animals experience a lot of stress. To cope with such conditions, the dairy animals make several physiological adjustments. Therefore, it is important to keep a few things in mind:

1. To maintain their body temperature, animals increase their metabolism and always seek for dry and warm places to sit. If it's sunny outside, they prefer to go out and drink less water. The shed should always be in east to west direction, while the north side should be covered and the south side should keep open. Doing this helps protect the animals from the cold because sunlight enters directly from the south, keeping the shed warm and dry. Each animal should have 4 feet of space in the shed; that means for 10 animals, the shed should be 40 feet long.
2. Inside the shed, there should be a proper arrangement for clean drinking water, because during winter, the water intake of animals decreases by about 50%. Usually, after milking, cows prefer to drink water — so avoid crowding near the water trough. For ten animals, a water trough 8 feet long and 3 feet wide is sufficient. Fresh water should be available every 2–3 hours otherwise, animals may refuse to drink icy cold water.
3. During winter months, trim unnecessary branches of shade trees so that animals can soak proper sunlight to make them more comfortable.
4. The nutritional quality of green fodder depends on stage of harvesting If it is cut on early stage, the fodder contains high moisture content in winter which increases risk of fungal attack. On later stage, it becomes more fibrous, and animals avoid eating due to complex nature of mature fibrous material. Nowadays, berseem, oats, lucerne, and ryegrass are commonly sown — these have higher protein and calcium content compared to summer fodders. Initially, they slightly increase milk production, but due to higher protein content which increase in urea levels in the blood after its metabolism that may cause health problems. Similarly, when calcium intake is too high, it further cause imbalance between calcium and phosphorus. To cope up with phosphorus deficiency, animals start drinking their own urine. Therefore, it is important to use area specific mineral mixtures properly. During winter, you should adjust the animal feed by keeping green fodder as the main source but reducing it slightly and increase amount of grains. Farmers who use silage should also limit the amount to 10–12 kg per animal per day, and provide fresh leguminous fodder to maintain animal health and productivity while keeping the feed cost-effective.
5. In winter, the importance of balanced feed (ration) increases further because animals need various micronutrients to maintain health and productivity. Each farmer has their own feeding practices — some use commercial feeds (pellets). When feed companies manufacture their feeds, they do not make them according to any specific farmer but according to government feed regulations. Therefore, results can vary — some farmers may get good results, others may not. Many dairy farmers use commercial feeds along with homegrown grains, pulses, and oilcakes. Some farmers also get custom feed made from local feed mills, but it's important that the formula matches your animal's requirement, and you should know the ingredients and their proportions. The quality of grains, oilcakes, and polishing material added to the feed should meet your own standards, because the feed mill is not responsible for feed quality. They usually stock 2–3 types of maize, 2–3 types of mustard cakes, and different kinds of cottonseed cakes (raw or processed). It's the farmer's responsibility to

prioritize ingredient quality and selection, since the feed mill only charges for grinding and mixing.

6. The maize grains should be large, shiny, and free from fungus or insects. Oil cakes should be dark brown in color. When you place a piece of cake (papri) between your fingers and press it with your thumb, it should break easily. Oil cakes that are free from oil should not contain sand or husk impurities. Similarly, bran (churi) should also be free from husk or shell particles. If you break a binola (cottonseed) cake, it should break easily, and fibers should be visible inside. Polish (rice polish) should not contain cracks, and when pressed in your palm, it should leave a slight oily mark on your fingers.
7. It should also be ensured that the ingredients listed in the feed formula are actually available at the feed mill. Many mills do not have all ingredients, such as full-fat soya, de-oiled cottonseed cake, DDGS, bypass protein, or bran. Similarly, some micro-ingredients like enzymes, chelated minerals, toxin binders, yeast, mold inhibitors, vitamins, etc., may also not be available at every mill. If you make changes to the feed formula, it can negatively affect the results. Nowadays, the market has many types of mineral mixtures, chelated minerals, trace minerals, bypass fats, and buffers available. Before using any of these, read their composition carefully, check quality and dosage, or take expert advice. If possible, use authorized mineral mixtures only, so that your animals stay healthy naturally and you don't need to depend on antibiotics or injections.
8. Under normal conditions, a buffalo giving 15 litres of milk per day can consume about 7 kg of concentrate feed daily. However, during winter, this should be increased to 8–8.5 kg, though many farmers don't make this adjustment. You can reduce protein slightly, and therefore lower the proportion of oil cakes, but the overall feed amount must be increased. That's why feed is cheaper in winter because animals need more nutrition. Most farmers continue to give the same amount of feed, and as a result, milk production decreases, because animals use more energy to maintain body temperature, and extra protein leads to higher internal urea levels. Remember — the nutritional balance of feed is more important than the ingredients themselves. Currently, maize is quite expensive, but if you can use good quality maize then it must be prioritised. Bajra (pearl millet) is also available and can make the feed cheaper. Rice kani or wheat are also nutritious options. Molasses (sira) is inexpensive and contains potassium, which helps increase milk yield. Mustard cake is available in two forms — papri (pressed) and de-oiled. Some farmers avoid mustard cake due to bitterness but actually, it can be beneficial if fed properly (not in excess) as it helps maintain milk production. Cottonseed cake (binola) and cottonseeds (vadeve) are often used in higher quantities because they are good sources of bypass protein, but they are costly and sometimes adulterated. If your animals are already accustomed to guar meal, it can be used as a very economical source of bypass protein.
9. Whenever we want to make something tasty, we usually use ghee (clarified butter) — similarly, to improve feed quality, rice polish can be used. Nowadays, good-quality rice polish is available, and about 6–8 kg per quintal of feed can be added. For oil or fat supplementation, full-fat soya, mustard cake, or bypass fat can also be used. However, the responsibility of checking the quality of bypass fat lies with the farmer. Many farmers focus only on the price, but the energy value of bypass fat depends on its processing method and ingredients. Bypass fat can be used in quantities ranging from 0.5 kg to 2 kg per quintal of feed. It should not be moistened, as animals may refuse to eat it if it becomes wet. In winter, due to increased feed intake, animals can suffer from acidosis (indigestion), which reduces rumination (chewing of cud) and decreases fat content in milk. To prevent this, buffers should be used in the feed. Buffers contain sodium bicarbonate and magnesium oxide, which help control acidity in the rumen. In winter, using yeast in feed helps to improves appetite, increases milk fat, and enhances milk yield. Yeast products are available in different types, such as live yeast, metabolite yeast, and enzyme-based yeast. It's the farmer's responsibility to check the quantity and composition of the yeast supplement before use. Although green fodder is abundant in winter but due to frost and less sunlight, animals may suffer from vitamin deficiencies. Therefore, vitamins should be supplemented to make the animals healthier and reproductive problems are significantly reduced.
10. During winter, green fodder retains more moisture which makes the dung more watery or chances of diarrhoea are higher. Therefore, more dry fodder or straw should be mixed with greens before feeding to animals. However, more dry fodder or straw (like paddy straw) use, increases the risk of fungal contamination. Hence, it's important to use toxin binders in the feed to prevent harm.

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Managing Diseases and Insect-Pests of Rapeseed-Mustard

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Mustard aphid

Rapeseed-mustard occupies an important place among the *rabi* season oilseed crops. Mustard oil is not only a part of daily cuisine but also holds cultural and medicinal value. To ensure a good and profitable harvest, it is important that farmers protect their crop during the critical months of January to March, when environmental conditions become favourable for the development of different diseases and insect-pests. During this period, low temperatures, foggy mornings, and longer dew retention on foliage create a microclimate that helps disease-causing fungi to infect leaves, stems and pods. Similarly, moderate temperatures and tender plant tissues support the build-up of sap-sucking and leaf-feeding insects.

If farmers monitor their fields regularly and carefully from the beginning of January, most crop losses can be avoided with timely and economic interventions, rather than resorting to late, repeated or unnecessary sprays. Regular field scouting, correct pest and disease identification, and decisions based on threshold levels rather than fear are the foundation of effective and economical crop protection. In this article we have discussed in details about different insect-pests and diseases that appear on rapeseed-mustard and their management.

Alternaria blight (Black spots)

It is one of the most widespread and damaging among all the diseases of rapeseed-mustard, particularly in seasons with intermittent showers or prolonged cloudy weather. The disease appears early, often in late December and January, when tiny brown or black spots appear on the lower leaves. These spots gradually enlarge and develop distinct concentric rings just like target boards. As the disease progresses in January and February, these lesions expand upwards and cover the entire canopy. As the spots cover almost entire leaf surface, the foliage looks yellowish, blightened and start falling down prematurely which leads to overall reduction in photosynthetic activity of the plant. When pods are infected, dark necrotic lesions develop and the seeds inside them become undersized, discoloured and shrivelled. This directly affects both the yield and oil quality.

The pathogen survives on crop residues and on volunteer host weeds. It helps in carryover of the diseases between seasons. Hence, adoption of clean cultivation, destruction or deep burial of infected plant debris after harvest, and timely sowing are critical for preventing severe outbreaks. Excessive application of nitrogenous fertilizers results in succulent plant tissues that are more prone to infection. Therefore, it is very important to apply balanced fertilizers as per the PAU recommendations. Maintaining proper spacing by thinning at around 25 days after sowing helps in improving the airflow and reducing the humidity within the crop canopy. These conditions are less favourable for disease spread. Avoiding heavy irrigation during humid weather also helps in effectively reducing crop susceptibility and plants less exposed to the disease.

Cabbage caterpillar

White rust

It is another important disease, which appears only on raya (Indian mustard) and not on gobhi sarson (oilseed rape), toria (mustard rape) and African mustard. Early symptoms of this disease start as small (1-2 mm) creamy-white pustules on the lower leaf surfaces which appear as light yellow green spots on the upper surface of leaf. Infection generally starts during mid December or early January. By the time it is noticed by farmers in late January or February, most of the damage has already been done due to systemic nature of the pathogen. As the disease advances, these pustules may spread to stem and pods. A characteristic symptom of severe attack is the formation of 'stag-heads', where the developing floral structures become swollen, deformed and fail to form pods, causing direct yield loss.

The white rust fungus can survive in the soil, crop residues and even on contaminated seed. Disease onset coincides with cool, moist conditions in December and January. To effectively manage this disease, spray the crop twice, first at around 60 days and then at 80

days after sowing, using Metalaxyl M 4% + Mancozeb 64% (Ridomil Gold) @ 250 g per acre in 100 litres of water. This also provides some protection from Alternaria blight as well. Destruction of crop residue after harvest is crucial to prevent carryover of the pathogen to next year. Canola *raya* variety RLC-3 is resistant to this disease.

Stem rot

Stem rot, caused by the fungus *Sclerotinia sclerotiorum*, is another important disease that often becomes evident only towards the end of January or early February. Plants show water-soaked lesions on the stems or leaves, which soon get covered with cottony white mycelial growth. Infected stems become weak, and the plants start wilting, drying and dying prematurely. On splitting the stems, one can observe hard, grayish black, irregular fungal bodies known as sclerotia. These sclerotia can remain viable in soil for up to 10 years, making stem rot particularly difficult to eradicate once it becomes established in the field.

The disease spreads readily through harvesting machinery, irrigation flow, and seed mixing. Therefore, as soon as diseased plants are observed, they should be cut at ground level and buried deeply so that sclerotia do not fall on the ground. Avoiding the dense sowing, restricting excessive irrigation, and refraining from heavy applications of nitrogen reduce disease intensity. Avoiding irrigating the field between 25 December and 15 January helps reduction in germination of Sclerotia. This practice year by year decreases inoculum in the soil and thus decreases the chances of infection. Crop rotation with wheat, barley or maize (non-host crops) is a long-term preventive strategy.

Mustard aphid (*tela/chepa*)

Among the different insect-pests, mustard aphid is the most destructive which needs close monitoring as it has high damage potential. Damage by this pest has been reported to range from as low as 6 per cent to as high as 96 per cent. The infestation of this pest usually begins in January, but it becomes particularly damaging during February and March with warming weather. Aphids congregate in large numbers on the top tender twigs, flower buds, inflorescence and pods and suck plant sap continuously. Due to sucking of large quantity of sap, plant develops symptoms such as yellowing, stunted growth, curling of leaves, poor flower development and shrivelled seeds. In the neglected fields, aphid attack can lead to complete crop failure.

For effective management of this pest, farmers are advised to regularly monitor their field from the first week of January at weekly intervals. Decision on pest management intervention should be based on the Economic Threshold Level (ETL). For determination of economic threshold level, divide the field into four quarters and from each quarter randomly select 3-4 plants (12-16 plants from one acre) and count the number of aphids from top 10 cm central twig. If the average count reaches 50 to 60 aphids per plant or more than that, only then control measures should be applied. If the population is lower than that then there is no need to apply any control measure. The crop must be left unsprayed to conserve natural predators like ladybird beetles, syrphid fly larvae and green lacewings, which naturally suppress aphid population.

Since aphids are small in size, sometimes farmers find it difficult to count the population. In that case, if the top 0.5 to 1.0 cm central twig of the plant is completely covered with aphids, then decision to apply control measures should be made. Alternately, farmers can also decide to apply control interventions if 40-50% of plants are infested with aphids regardless of the level of population. When spraying becomes absolutely necessary, apply Actara 25 WG (thiamethoxam) 40 g or Rogor 30 EC (dimethoate) 400 ml or Dursban/Coroban 20 EC (chlorpyriphos) 600 ml per acre, mixed in 100 litres of water. If needed, repeat the spray after two weeks. For the subsequent spray, insecticide should be used in rotation and spray of same insecticide should be avoided to prevent development of insecticide resistant in the pest. Spraying should always be done in the afternoon, when honeybees and other pollinators are less active.

Cabbage caterpillar

The cabbage caterpillar is another pest that appears in end January and February. The caterpillar is pale to light green with distinct black spots, and it feeds voraciously on leaves, green stems and pods. Adults are white butterflies with black spots in the middle of forewings. The female lays eggs in masses on the underside of leaves, and young larvae feed gregariously, consuming entire leaf areas and leaving only the veins. If timely control measures are not taken up then the larvae may devour all the above ground plant parts leaving only twigs.

Early detection is very important. Since the pest multiplies rapidly, young gregarious larvae or egg masses should be hand-collected and destroyed by immersing them in kerosenized water, or buried deep in the soil. This simple physical removal practice is extremely effective in preventing the pest from spreading throughout the field.

Early detection of diseases and insect-pests is very important. The pests and diseases that appear during this month, if left unchecked, intensify during February and March, leading to severe loss in both seed quantity and oil quality. However, by practicing field scouting, making decisions based on threshold levels, avoiding unnecessary chemical sprays, adopting balanced fertilization, and managing irrigation intelligently, farmers can protect their crop effectively and economically. The key lies not in how many sprays are applied, but when and why they are applied. Timely awareness today ensures a healthier crop and a profitable harvest tomorrow.

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Farm Operations in February

WHEAT

- Apply second irrigation to December sown wheat.
- Wheat plants affected with flag smut should be rouged out and burnt. Special attention should be given in Ropar and Hoshiarpur areas.
- Observe the wheat fields for appearance of yellow rust. As soon as the disease appears, spray the crop with Taqat @ 300g or Caviet @ 200g or Nativo @ 120g or Impact xtra or Opera or Custodia 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.
- Observe the fields for appearance of aphids, if the population reach 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 20g Actara/Taiyo 25 WG (thiamethoxam) in 80-100 liter of water per acre.

SPRING MAIZE

- Sow P-1844, PMH-10, DKC-9108, PMH-8, PMH-7 and PMH-1 upto 15 February on southern side of 60 cm spaced East-West ridges or 67.5 cm spaced beds keeping plant to plant spacing of 20 cm for ridges and 18 cm for bed planting by using 10 kg seed per acre.
- For the control of maize shoot fly, treat the seed with 6 ml Gaucho 600 FS (imidacloprid) per kg seed. If seed treatment is not done, then apply 5 kg Furadan 3 G (carbofuran) per acre in the furrows at the time of sowing.
- For controlling weeds, apply Atrataf 50 WP (atrazine) @ 500 g / acre in lights soils and 800 g per acre on medium to heavy soils within two days of sowing in 200 litres of water.

OILSEED CROPS

- To save the oilseed crops from frost damage, irrigation may be applied.
- In case mustard aphid population reach the economic threshold level (ETL), spray the crop with 40 g Actara 25 WG (thiamethoxam) or 400 ml Rogor 30 EC (dimethoate) or 600 ml of Dursban/ Coroban 20 EC (chlorpyriphos) in 80-125 litres of water per acre. The spray must be carried out in the after-noon when the pollinators are less active.

SUNFLOWER

- Sowing of sunflower should be completed in the first week of Ferruary and preference should be given to the early maturing hybrids such as PSH 2080, PSH 1962, PSH 996 and PSH 569. Under late-sown conditions in February transplanting one month old seedlings of sunflower hybrids give better yield than direct seeded crop. Direct seeded crop matures late causing delay in the sowing of the succeeding crops while transplanted crop matures early. Sow the crop in rows 60 cm apart with plant to plant spacing of 30 cm. The sunflower performs better when planted on Southern side of East-West ridges. Place the seed about 6-8 cm below the ridge top. Apply irrigation to ridge sown crop 2-3 days after sowing and water level in the ridges should remain well below the seed placement line.
- Treat the seed with Tegran 35 WS @ 6g/ kg seed before sowing. Two kg seed is sufficient for sowing one acre.
- Apply 50 kg urea and 75 kg single superphosphate/acre at the time of sowing. In coarse textured soils, apply 50 kg urea/ acre in two equal splits, half at sowing and remaining half one month after sowing. Sunflower grown after potato receiving 20 tonnes FYM requires only 25 kg urea/ acre. Also drill 20 kg muriate of potash/ acre on soils testing low in potassium. In Hoshiarpur and Shahid Bhagat Singh Nagar districts, apply 40 kg muriate of potash/acre.

PULSES

- Lentil may be irrigated for getting better returns.
- 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 3 days for consuming leaves and green grains, after spray of Coragen 18.5 SC.
- To check powdery mildew on peas, spray the crop with Sulfex @ 600g in 100 litres of water per acre**.** Repeat spray at 10 days interval.

SUGARCANE

- 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.
- The sets selected for planting should be free from diseases like red rot, wilt, ratoon-stunting and grassy shoot.
- 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 setts 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.
- 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 (fipronil) mixed in 20 kg moist sand/soil or 150 g Takumi 20 WG (flubendiamide) or 150 ml Coragen/Citigen 18.5 SC or 2 litre Durmet/Classic/Dursban/Markpyriphos 20 EC (chlorpyriphos) in 400 litres of water per acre at post germination stage (about 45 days after planting).
- Application of Atrataf 50 WP/Sencor 70 WP/Karmex 80 WP/Klass 80 WP (diuron) @ 800 g/acre or Authority NXT 58 WP @ 1000 g/acre as pre-emergence application provides effective control of annual grasses and broadleaf weeds.
- Apply 8 tones FYM/press mud per acre 15 days before sowing and mix it thoroughly. In case FYM/press mud is applied, apply 40 kg N/acre, otherwise apply 60 kg N/acre. Apply half N (65 kg urea) at sowing. However, on coarse textured soil, if FYM is applied, do not reduce the dose of nitrogen fertilizer. Apply phosphate fertilizer on soil test basis at sowing. Apply *Azotobactor* biofertilizer @ 4 kg/acre at sowing.

FODDERS

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

VEGETABLES

Cucurbits

- As soon as the risk of frost is over, remove "*Sarkanda*" or plastic cover from the crops 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.
- 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.
- In the second fortnight of this month, nurseries of muskmelon, water-melon, bottle-gourd, pumpkin etc. should be transplanted on recommended spacings of the respective crop. Before transplanting cut & remove plastic bags.
- Most ideal varieties are Punjab Barkat and Punjab Bahar of bottle-gourd; Chappan Kaddu No. 1 of Summer Squash; MH-27, MH-51, Punjab Amrit, Punjab Sarda, and Hara Madhu of muskmelon; Punjab Mithas of watermelon; Punjab Tinda -1 of Tinda; Punjab Jhar Karela-1, Punjab Karela-15, Punjab-14 and Punjab Kareli No.1 of bitter gourd; Punjab Nikhar of sponge gourd, PPH-1, Punjab Nawab and Punjab Magaz Kaddu-1of Pumpkin, Punjab Naveen of cucumber.

Caution: Do not sow cucurbits in those fields where Atrazine herbicide has been used for weed control in potato.

Chilli and capsicum

- Remove "Sarkanda" or plastic cover from the fields of chilli and capsicum in the afternoon when the risk of frost is over and irrigate the fields. After a week, apply 90 kg urea per acre in channels and earth up near the base of plants.
- Transplant the nurseries of chilli and capsicum raised under protection on the ridges at the recommended spacings. Before transplanting, apply 35 kg Urea, 175 kg superphosphate and 20 kg muriate of potash per acre in capsicum and 30 kg Urea, 75 kg superphosphate and 20 kg muriate of potash in chilli. Dose of nitrogen can be increased for chilli hybrids. Irrigate the field after transplanting of seedlings and repeat the irrigation once in 7 to 10 days depending on upon soil and climate. Fill the gaps after 7-10 days to ensure complete plant population of the crop.

Brinjal

- After the frost period is over, remove "Sarkanda" or plastic sheet in the afternoon and irrigate the field as and when required. After a week, apply 55 kg urea and earth up the crop.
- Transplant nursery of hybrids i.e. BH-2, PBH-3, PBH-4, PBH-5, PBH-6, PBHR-41, PBHR-42; and varieties i.e. Punjab Raunak, Punjab Himmat, Punjab Bharpoor. Apply 10 tonnes of well rotton FYM, 55 kg urea, 155 kg superphosphate and 20 kg muriate of potash per acre by broadcast. After a week, fill the gaps and irrigate again.

Okra

- Prepare the field and apply 40 kg urea per acre in bands kept 45 cm apart from East to West. Prepare ridges and apply irrigation. Dibble seeds on ridges at a spacing of 45 x 15 cm. Sowing on ridges ensure quick germination and better stand of the crop. Varieties recommended for sowing in this season are Punjab Lalima and Punjab Suhawani. Use 15-18 kg seed per acre, since germination is low in this period.

Tomato

- When frost period is over, remove "*Sarkanda*" or plastic bags/sheets from the fields and irrigate the crop. After a week, apply 55 kg urea per acre in channels. Repeat watering after 7 to 10 days.
- Spray the crop in the middle of February with Indofil M-45 @ 600 g per acre in 200 litres of water at 7 days intervals to control late blight.

Onion

- For the control of purple blotch, spray

the crop with 300g of Caviet or 600g of Indofil M-45 mixed with 200 ml of Triton or linseed oil in 200 litres of water per acre as soon as first symptom of purple blotch appears in the crop. The spray should be repeated at 10 days interval.

HORTICULTURAL OPERATIONS

- The planning, layout as well as pit digging and filling for new plantation of evergreen fruit plants likecitrus, mango, guava, loquat, *ber* etc. can be done in late February when the weather warms up, however, the period ofJuly-September is more suitable for planting of this category of fruit plants.
- 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.
- 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.
- Citrus orchardsshould 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, oneirrigation should also be given after pruning in the first fortnight of February.
- To control citrus psylla, spray 200 ml Crocodile/Confidor 17.8 SL (imidacloprid) or 160g Actara 25 WG (thiamethoxam) in 500 litres of water per acre basis on spring flush before emergence of the flowers.
- 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.
- 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 soil surface under the canopy of trees.
- For management of mango hopper, spray two times, one in end February and second in end March with 800 ml Malathion 50 EC in 500 liters of water per acre. OR spray twice at weekly intervals, PAU Homemade Neem or PAU Homemade Dhrek ectract @ 5 litres/acre.
- To check powdery mildew, give one spray of 1 g Karathane or 2.5 gWettableSulphur or 1.0 ml Contaf per liter of water before flowering in mango.

ORNAMENTALS

- The deciduous ornamental plants (such as *Sawani, Mehandi, Nirgundi, Jatropha* etc.) can be transplanted bare rooted in prepared pits before sprouting of buds.
- Off type plants and weeds in the flower bedsof winter annuals should be removed to ensure true to type plants for seed production.
- The summer flowering bulbous ornamentals such as tuberose can be planted in well drained soils rich in organic matter.
- Seed sowing of summer annuals like *kochia, zinnia, gomphrena, portulaca, cosmos* etc. can be done over raised nursery beds in the last week. The nursery beds should be under partial shade and protect tender seedlings from afternoon sun.
- The layout for new plantation of ornamental trees and shrubs should be done after undertaking the site survey and site measurements.
- Suckers of Chrysanthemum are planted in the field over raised beds to grow these as mother stock.
- Layout and field preparation for establishment of lawn should be done.
- Potting and repotting of potted ornamentals can be during end of this month

FORESTRY

Poplar

- **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 upon the soil type. Uniform spread of paddy straw mulch @ 4 t/acre immediately after planting of cutting provides the effective weed control.

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

Eucalyptus

- Sow the seeds on raised in lines 10 cm apart at the rate of 20 g/m^2 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 of 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/raya/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 queenless colonies with queen-right ones.

Provide stimulative sugar syrup (sugar: water = 1:2) feeding if needed. Prefer to provide this feed in empty drawn combs. Else, provide it in division-board feeders. Depending upon the strength of the colonies, provide already raised worker brood combs/frames with comb foundations. Depending upon 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 & 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 to manage *Varroa* mite. Keep vigil on the brood diseases, and on suspicion, immediately consult experts and appropriate/ advised control measures should be undertaken; non-chemical methods should be preferred. Use of antibiotics should be avoided. Colonies may also be prepared towards end February for mass queen bee rearing for requeening or for stock multiplication or for selling the bee colonies. For queens production, follow modified Doolittle Mass Queen Bee Rearing Technique using larvae for grafting from the best performing selected 'breeder' colonies. Beekeepers can also use cup-kit system for mass queen bee rearing for its distinct advantage of, particularly non-requirement of manual grafting. The beekeepers, who have already migrated their apiaries to *sarson/raya* belts, can extract ripe (sealed) *Brassica* honey. Follow recommended measures to prevent swarming of the colonies. During the second fortnight of the month, the colonies may be prepared for migration to *Eucalyptus* plantation.

DAIRY FARMING

- Protect all the dairy animals from direct cold winds during the winter months by using palli during night.
- 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.
- New born calves need special care during winter months. They are susceptible to Pneumonia and large number of them dies due to this. Keep them warm by providing clean and dry bedding of paddy straw.
- Start colostrums feeding at early as possible after birth to increase immunity of calves and fed colostrums 1/10th of body weight in morning and evening. Do not fed green fodder and wheat straw to calves till two months of age as rumen is not developed.
- Calves should be reared on calf starter ration from 4th day of age instead of whole milk for at least 2 months. Then green fodder can also be started little bit along with feed from 20th day.
- De-worming should be done at 15th day then at 22nd day after that on 30th day of age thereafter it can be done every month up to six months of age and then at three months of interval by using different combination of drugs to avoid drug resistance. Get your animals examined after 3 months of artificial insemination for pregnancy diagnosis.
- Do not feed green, sprouted, soiled or rotten potatoes to dairy animals. These can cause serious and fatal poisoning.
- Add grains upto 40% in the concentrate and oil cakes upto 25% as leguminous fodders in winter season contain 19-21% proteins..
- 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.
- Follow vaccination schedule as per advice of veterinarian of your area.
- Use mats in tying system to prevent hoof deformity.

POULTRY FARMING

- 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.
- 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. Luke warm 5% solution of jaggery (Gur) or sugar for 3 days of arrival before starter feed.
- 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.
- Spread old newspapers on bedding and put maize dalia on them as day old chicks cannot locate feeders.
- Provide balanced ration to birds according to their requirements.
- De-worm the chicks regularly.
- Cull all the uneconomical layers regularly because they are increasing your feed costs.
- Do not allow visitors to enter inside the poultry house. Put shoe covers before entering poultry farms.
- Do not disturb poultry birds frequently as it will result in reduced growth as well as production.

MUSHROOM GROWING

- The cropping of white button mushroom continues during this month.
- Harvesting of matured fruiting bodies (closed form) should be done on time by gently twisting the button mushrooms.
- The water should be spray once or twice a day on compost bags to maintain 80-85% moisture and open the growing rooms 4-6 hours for cross ventilation.
- Dhingri mushroom should also be harvested when the mushroom margins start rolling inwards. Harvesting of this mushroom should be done by holding the upper portion with gentle twisting of the fruiting body.

Compiled by: Amarjit Singh

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Training Programmes in February

KVK, AMRITSAR (98723-54170)

February 03-11 : Beekeeping as subsidiary occupation
February 09-17 : Pig farming
February 10 : New cultivation technologies of vegetable crops
February 11 : Crop intensification with summer pulses for higher productivity
February 12 : Establishment of nutrition garden in urban and peri-urban areas
February 13 : Identification and management of insects Pests and diseases of deciduous fruits
February 17 : Preparation of Vermi-compost
February 16-20 : Preservation of winter fruits and vegetables
February 20 : Silage making for dairy animals during lean period

KVK, BATHINDA (0164-2215619)

February 02-03 : Care and maintenance of woolen and silk garments
February 03-07 : Beekeeping-a honey processing and marketing
February 04 : Preparation of Vermi-compost and organic farming
February 09 : Formation of farmer group (SHG, FPO,CIG)
February 11 : Soilless model for vegetable kitchen garden
February 16-20 : Mushroom cultivation and processing
February 23 : New Cultivation technologies of vegetable crops.
February 24-25 : Food safety techniques to check food adulteration

KVK, FARIDKOT (01639-253142)

February 02 : Feed formulation for different categories of pigs
February 03 : Cultivation of sugarcane
February 04 : Micro irrigation, fertigation and weed management practices in orchards
February 05 : Off-seasonal management of Pink bollworm
February 06 : How to prepare quality organic manures and vermi-compost
February 09-20 : Dairy farming
February 10-16 : Beekeeping, honey processing and marketing
February 20 : Personal hygiene and nutrition for adolescent girls
February 23 : Seasonal management of honey bees
February 25 : Awareness on social evils

KVK, FATEHGARH SAHIB (01763-221217)

February 03 : Identification and management of insect pests and diseases of major Rabi crops
February 04 : Production technology of flower cultivation
February 05 : Improved cultivation technologies of fruit crops
February 13 : Nutritional Security through integrated nutrition garden
February 16-20 : Beekeeping, honey processing and marketing
February 18 : Fish farming as subsidiary occupation
February 19 : Modern techniques of clothing
February 20 : Fertilizer management in late sown wheat
February 26 : Cultivation of summer pulses for crop diversification
February 27 : Micro-irrigation systems for higher water use efficiency in horticultural crops

KVK, FEROZEPUR (MALLEWAL) (01632-279517)

February 03 : Care and maintenance of woolen and silk garments
February 06 : Integrated pest and disease management in pulses and oilseed crops.
February 12 : Production technology of summer vegetables
February 16 : Feeding and management of poultry birds
February 17 : Dietary practices for the diabetes management
February 23-27 : Bee Keeping, honey processing and marketing.

KVK, GURDASPUR (01874-220743)

February 02-06 : Value addition to pulses and oil seeds
February 06 : Production technology of summer vegetables
February 09-13 : Poultry farming
February 11 : Micro-irrigation systems for higher water use efficiency in horticultural crops
February 16 : Seasonal management of honey bees
February 19 : Calf rearing
February 23-27 : Beekeeping - a lucrative subsidiary occupation

KVK, HOSHIARPUR (BAHOWAL) (98157-51900)

February 12 : Solar gadgets as a renewable source of energy
February 09-13 : Preparation of bakery and confectionery products
February 16-20 : Beekeeping, honey processing and marketing
February 19 : Production technology of summer vegetables
February 23-27 : Goat Farming

KVK, JALANDHAR (NURMAHAL) (01826-243288)

February 02-06 : Fish-Livestock Integrated Farming System
February 03 : Formulation of balanced feed for dairy animals
February 04 : Processing of milk at domestic level
February 06 : Nutritional recipe for pregnant/lactating women
February 09-13 : Personal grooming and personality development
February 10 : Cultivation of summer pulses for crop diversification
February 11 : Production technology of summer vegetables
February 13 : Seed Production of barseem
February 16-20 : Beekeeping training- honey processing and marketing
February 18 : Bio fertilizers and Organic Manures
February 23-27 : Seed Production and storage as an Enterprise
February 24 : Broiler farming and their marketing
February 25 : Organic farming of vegetable crops

KVK, KAPURTHALA (01822-233056)

February 05-07 : Jaggery making and preparation of value added products from it
February 06 : Establishment of nutrition garden in urban and peri-urban area
February 11 : Value addition to pulses and oil seeds
February 12 : Cultivation of summer pulses for crop diversification
February 13-19 : Beekeeping, honey processing and marketing
February 16 : Food safety and techniques to check food adulteration
February 20 : Production technology of summer vegetables

KVK, LUDHIANA (SAMRALA)

(01628-261597/ 81465-70699)

February 02-06 : Profitable cultivation of dragon fruit and marketing
February 09-13 : Preparation of millet based food products for winter season
February 10 : Vermicomposting
February 12 : Garment Enrichment through different techniques
February 13 : Improved Cultivation of fruit crops
February 18 : Production technology for growing of summer season organic vegetables by using PAU vegetable seed kit
February 23-27 : Beekeeping, honey processing and marketing
February 24 : Training and pruning of evergreen fruits plants

KVK, MANSA (01652-294843)

February 03 : Eco-friendly approaches for insect-pest and disease management of fruits and vegetables
February 04 : Production technology of summer vegetables
February 05 : Care and maintenance of woollen and silk garments
February 11 : Establishment of nutrition garden in urban and peri-urban area
February 12 : Processing of pulses and millets
February 16-20 : Value addition of horticultural crops
February 17 : Prevention of zoonotic diseases and vaccination schedule in dairy animals
February 20 : Construction and maintenance of biogas plant

KVK, MOGA (BUDH SINGH WALA) (81465-00942)

February 11 : Preparation of Vermicompost
February 12 : Personal hygiene and nutrition for adolescent Girls
February 13 : Identification and management of insect pests and diseases of fruits and vegetables
February 17 : Soilless model for vegetable cultivation
February 20 : Feeding and management of poultry birds
February 24 : Cultivation practices for summer season mushrooms

KVK, PATHANKOT (0186-2920895/98723-54170)

February 02 : Care and maintenance of woolen and silk garments
February 03 : Soilless model for vegetable kitchen garden
February 04 : New cultivation technologies of vegetable crops.
February 06 : Value addition to pulses and oil seeds
February 09-13 : Poultry Farming
February 10 : Feed formulation for different categories of pigs
February 11 : Production technology of summer vegetables
February 13 : Custom hiring of agricultural machinery
February 16-20 : Embellishment of clothes using modern and traditional techniques.
February 17 : Role of green manuring to enhance soil health
February 18 : Cultivation of summer pulses for crop diversification
February 23 : Preparation of vermicompost, FYM and importance of green manuring

KVK, PATIALA (RAUNI) (0175-2225473)

February 05 : Integrated pest management in maize and sugarcane
February 09-13 : EDP in Bakery and Confectionery
February 19 : Clean milk production and prevention of zoonotic diseases
February 20 : Processing of Honey
February 26 : Care and maintenance of woolen and silk garments

KVK, ROPAR (01881-220460)

February 04 : Preparation of low cost nutritional recipes from seasonal fruits and vegetables
February 05 : New cultivation technologies of vegetable crops
February 09-13 : Nursery raising of agro-forestry trees
February 10 : Cultivation of summer pulses for crop diversification
February 11 : Rational use of poor quality water
February 12-18 : Poultry farming
February 20-27 : Beekeeping, honey processing and marketing
February 24 : Bio fertilizers and Organic Manures
February 28 : Production technology of summer vegetable crops

KVK, SANGRUR (KHERI) (01672-245320)

February 05 : Maintenance, upkeep and safe use of agricultural machinery
February 09-16 : Establishment of agro processing complexes and *gur/ shakkar* making unit for enhancing farmers income through value addition of product
February 10 : New and improved cultivation techniques in vegetable crops
February 12-18 : Beekeeping- a lucrative subsidiary occupation
February 17 : Establishment of nutrition garden in urban and peri-urban area
February 23 : Care and maintenance of woolen and silk garments
February 27 : Cultivation of summer pulses for crop intensification

KVK, SHAHEED BHAGAT SINGH NAGAR (LANGROYA) (01823-292314)

February 03 : Production technology of summer vegetables
February 09-13 : Beekeeping, honey processing and marketing
February 10-14 : Value addition of winter horticultural crops
February 11 : New cultivation technologies of vegetable crops
February 17 : Seed production of field crops
February 20 : Personal hygiene and nutrition for adolescent girls
February 25 : Care and maintenance of woollen and silk garments

KVK., SRI MUKTSAR SAHIB (GONEANA) (94630-22203)

February 03 : Improved production technologies of sugarcane production
February 04 : Heat stress management in wheat
February 10-18 : Beekeeping-a lucrative subsidiary occupation
February 11 : Production technology of summer season annuals
February 12 : Importance of Kisan Mela for farming community
February 16-20 : Preparation of eco-friendly cleaning agent
February 17-21 : Goat Farming
February 18 : Round the year green fodder production
February 25 : Identification and management of insect pests and diseases of fruits and vegetables

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(0161-2401960 EXTENSION 261)

February 03-04 : Cultivation of Aromatic and Medicinal Plants, and Value Addition to Herbs
February 06 : Nutrition Garden Model for Rural, Urban and Peri-Urban Areas
February 16-20 : Advance Training Course on Mass Queen Bee Rearing and Production of Hive Products
February 24-25 : Cultivation of Dragon Fruit

Compiled by: Dr Ritu Raj and Dr Gurpreet Singh Makkar

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