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Baisakhi is not only a religious festival but also an occasion for farmers to celebrate the successful harvest season and express gratitude for the bounties of nature. It symbolizes unity, prosperity and the spirit of community among Sikhs and Punjabis worldwide. In Punjab, at this time, wheat crop can be seen growing and swinging everywhere. Looking at the crop, the farmers get an excitement and rejoice. On this occasion, everyone preforms folk dance, *Bhangra* and *Gidha*. After all hard work and efforts, this Earth gives crop.

Agricultural equipment plays a pivotal role in enhancing agricultural productivity by enabling farmers to cultivate more efficiently and in less time. It can include anything from tractors and harvesters to animal feed mixers or intercultural equipments. Agricultural mechanization provides more monetary gain for large and small farms and reduces the time needed to pay laborers. Crop yields are higher with machinery, thus increasing farm profits. Lastly, it adds a level of sophistication to farms-transforming them from local businesses to organizations that can compete on a global scale. The increased mechanization has added a new dimension to Punjab agriculture. Custom hiring of agricultural machinery is a good entrepreneurship adopted by many large farmers. Many farmers are making use of modern technology like combine harvester, tillage equipment and planting/sowing machinery through custom hiring.

Enhanced technology is essential for ensuring and optimizing production levels, just as efficient marketing serves as the benchmark for maximizing profits in markets. Agricultural marketing plays an important role not only in stimulating production and consumption, but also in accelerating the pace of economic development. It is the most important multiplier of agricultural development. Farmers must have complete information about the market before taking the produce to the market. Preferably, the produce should be taken to the market in the morning so that the farmers can return to their homes in the evening after disposal of their produce. The market prices fluctuate depending upon forces of demand and supply in the post-harvest period. It is, therefore, important for the farmers to be fully aware about the prices prevailing in the nearby local as well as distant markets of other states.

The present issue of Progressive Farming focuses on Agricultural Engineering and Marketing, the two very important facets of Punjab Agriculture.

Contents

Processing operations and small scale machinery for quality 3
Prevent fire incidents in wheat field 5
Repair and maintenance of drip irrigation system 6
PAU Protection Kit for stored pulses- An innovative solution to insect-.. 8
Tips for profitable marketing of flowers 9
Become turmeric processor for better returns 12
Improved production techniques of turmeric 14
Green manuring for improving soil health 15
Baby corn for crop diversification and more profit 16
Tips for the successful cultivations of cucurbits 17
Crop regulation and ecofriendly practices for improving quality of 18
Decision of cotton cultivar to grow: foundation of crop returns 19
Tips for the successful management of whitefly in cotton 21
Somatic Cell Count and its effect on milk quality 23
Nutritious and healthy salads 24
Soil and Water Testing: A key to sustainable agriculture 25
Sardar Gurpreet Singh: A successful jaggery producer 27
Sardar Surjit Singh Bimbh: Torch bearer for organic farmers 28
Farm operations in May 29
Training Programmes in May 33

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Processing operations and small scale machinery for quality management of honey

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Honey is high viscosity product of characteristic flavor and aroma, colour and texture. The principal characteristics and behaviour of honey are due to its sugars, but the minor constituents such as flavouring materials, colour, pigments, acids and minerals are largely responsible for the differences among individual honeys. Honey is a good source of carbohydrate, minerals, amino acid and vitamins. Honey is typically composed of Fructose (38.2%), Glucose (31.3%), Sucrose (1.3%), Maltose (7.1%), Water (17.2%), Higher sugars (1.5%), Ash (0.2%) and other/undetermined (3.2%). Honey is classified by its floral source, and there are also divisions according to the packaging and processing used.

The thumb rule is that the least processed honey is the best honey. However, the processing has become a necessary evil. Honey processing is termed as the indirect heating of honey at controlled temperatures and durations to facilitate its filtering, destroying all the yeast cells, thereby, preventing fermentation and delay granulation besides retaining its natural flavour, colour, aroma and other constituents. The exhaustive unit operations which may be required are pre-heating, pumping, filtration, pasteurization, anti-granulation treatment, moisture reduction, settling and packaging.

Unit Operations involved in a Modern Honey Processing Plant

Liquification: Raw and granulated honey is liquefied in a liquefier at 40°C for 30 minutes in order to reduce the viscosity and increase the flowability of honey through the system.

Preheating and straining: In the stainless steel preheating tank provided with coarse filter mesh (50-80 mesh size) to exclude coarse particles and a stirrer for uniform heating, the liquefied raw honey is heated and maintained at 45°C by circulating hot water through hot water jacket using centrifugal pump. At 45°C, bees wax does not melt.

Micro-filtration: Through gear pump, honey is pumped to special polyurethane cartridge type filter to remove suspended solids of upto 40 microns which remove practically all dust, bee particles, foreign particles and pollen grains. In place of such filters, long type cloth filters or stainless steel filters or simple filters are also being used.

Pasteurization: Honey is then passed through helical coil heat exchanger, maintained at a temperature of 60-70°C under vacuum for 15 minutes to inactivate the yeast cells. Honey is then taken to intermediate feeding tank at the same temperature of 60-70°C.

Moisture reduction: Honey is then fed to falling film type heat exchanger where temperature is maintained at 60-65°C. The falling film not only evaporates the water from a thin film of honey (up to 8-10% max.) but also pasteurizes the honey. The vapours are cooled down and collected separately. Both moisture reduction and pasteurization is carried out under vacuum so that heating time could be reduced. Reduction in heating time also considerably reduces the quantity of Hydroxy Methyl Furfural (HMF) production. The temperature and total time in heat exchangers is controlled and monitored critically, not exceeding 60-65°C and 25 minutes respectively, thus avoiding any loss of natural quality attributes of honey.

Cooling and Settling of Honey: The processed and moisture reduced honey is immediately cooled by cold water circulations when honey passes through heat exchanger. Honey collected at the bottom of heat exchanger is pumped through a special pump under vacuum to air tight storage-cum-setting tanks. Whileall bubbles and foam settle at the top, pure clean honey is taken for bottling with the help of filling machine, preventing any human and atmospheric contamination.

Packaging: The packaging/ bottling of honey in itself is problematic because of honey being too viscous. If the bottling temperature is higher, it creates numerous air bubbles but these bubbles are smaller in size and readily rise up to the surface and may result into froth. But if the temperature is low, the bubbles produced are only a few but these are larger in size and do not readily rise to the surface. So while bottling, the tip of funnel should touch the bottle and remain submerged in honey to check the air trapping or the funnel tip should touch the side wall of bottle. The vacuum packing technology may, however, totally avoid the problem of air trapping. While purchasing honey, it must be stressed upon that the honey does not have froth at its surface as it enhances it fermentation, thereby, reducing its shelf life.

Storage: There is an orthodox that the older the honey, the better it would

Model-I

Model-II

be. Scientifically, however, it is not true. Honey quality deteriorates during storage with time which is actually governed by the storage temperature, moisture content of honey, storage structure and ambient relative humidity. Honey becomes darker in colour during storage, more rapidly so at higher temperatures. Contamination with metals also darkens honey. Sugars such as glucose, sucrose and fructose also decrease during storage. The breakdown of various sugars results into increase in hydroxymethyl furfural (HMF) which is a very sensitive indicator of honey quality. Higher HMF is also an indication of heated honey. In India where temperatures are generally higher, HMF is likely to cross the limits if stored at room temperature. So, there is a strong need for appropriate storage conditions if our honey has to find market outside India.

The honey stored under refrigerated conditions does not spoil and shelf life remains quite long. However, during storage, the air-tightness of container must be ensured and the pack should immediately be closed after its use. It is so because honey being hygroscopic, may absorb moisture from environment which may trigger off some fermentation and spoilage may occur.

Anti Granulation treatment: Granulation in itself is not a problem. Every honey has its tendency to granulate sooner or later. The granulated honeys in our country do not find consumer acceptability as these are considered as adulterated honeys. The granulation depends on dextrose water (D: W) ratio of honey, the storage temperature and presence of pollen grains and impurities. The honeys with D: W ratio of more than 2.1 granulate quickly and those with less than 1.8 do not granulate. The storage temperature around 14°C favors the crystallization of dextrose. This is all because honey is a supersaturated solution of sugars and on exposure to low temperature, the dextrose separates out as crystals. This crystallization is enhanced by the presence of material such as pollen grains and other fine impurities. While heating for avoiding granulation, every effort should be made not to exceed recommended temperatures i.e. the honey should be heated up to 77°C for only 5 min and then immediately be brought to 57°C and then stored.

The Department of Processing and Food Engineering, PAU, Ludhiana has developed honey heating-cum-filtration machines

PAU Honey Heating-cum-Filtration System

Normally ripe honey needs only light heating to bring down its viscosity for straining and bottling. At the producers' level, honey heating is usually done by keeping the container with honey in a large vessel with water and heating the water. It is stirred by dry sticks. There is no control on the temperature to which honey is heated. To overcome these shortcomings, a fully mechanized low cost honey heating-cum-filtration system was designed and developed. This system being simple in working and having the optimum capacity of 50 kg/ batch will be helpful for both the entrepreneurs as well as bee keepers.

Model I- Honey Heating-cum-Filtration System without moisture reduction unit: The overall dimension of the developed honey heating-cum-filtration machine is 686 x 533.5 x 1524 mm and is electrically operated. It consists of two sections; the top heating section and the lower filtering section (Fig. 1). The operator is comfortable while working with it. One person is required for its operation. The cost of honey heating-cum-filtration machine is approximately Rs 90, 000 which can process approximately 2 qtls of honey per day. The recommended operational condition for honey processing and filtration is 50^0C with holding time of 40 minutes. This machine being simple in working, and having optimum capacity and affordable price makes it suitable for both the entrepreneurs as well as beekeepers. The machine has been licensed and commercialized.

Model II- Honey Heating-cum-Filtration System with moisture reduction unit: A moisture reduction unit (for reducing moisture content of honey to the desired level) has been developed along with some modification in the filtration system in the existing honey heating-cum-filtration system (Fig. 2). The moisture reduction unit consists of baffles, dry heater and two fans reducing the moisture of honey @ 1% moisture reduction/20 min. The processing unit consists of 3 filters, one macro and two micro filters along with honey collection and settling tank. The cost of this modified honey processing unit is around Rs 1.50 lakh.

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Prevent fire incidents in wheat fields

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In the month of April, the landscape of rural Punjab turns golden as the wheat crop is ripe and waiting for harvest. Also the *Baisakhi* festival, associated with on-set of wheat harvesting, turns the mood of farmer's delighted. But sometimes, the happiness is short-lived if dry ripe crop catches fire. Thousands of acres of wheat crop get burnt every year in Punjab due to fire accidents during harvesting and threshing season. Sometimes precious human lives are also lost. Most of the time fire accidents happen due to carelessness or other reasons which could be easily avoided.

Reasons and preventive measures of fire accidents

The fire accidents happen when the crop is dry especially during harvesting season. Reasons and preventive measures of such accidents are:

Sparking from the electric wires and transformers

Reasons: Sometimes overloaded electrical transformers and loose electric wires produce sparks that could ignite the standing wheat crop. Hanging or sagging wires may touch each other due to wind, rain or birds. Low hanging electric wires may touch harvesting machines leading to fire or even electric shock to workers.

Preventive measures: The crop surrounding the transformers or electric poles should be harvested manually and moved away immediately. If possible, area under the transformers and electric poles should be kept clean. The electric wires should be suitably staggered and fixed with a small wooden stick or a bamboo to avoid short circuit. Help of staff of electricity department must be taken for above said.

Harvesting and threshing of crop at high moisture content

Reasons: The crop with high moisture content at maturity or due to untimely showers is prone to catch fire during mechanical harvesting and threshing. If crop is moist, its straw becomes soft and flexible and may wrap round the rotating shaft of threshing cylinder and causes sparks due to friction. Such accidents are common during use of combine harvesters, threshers and straw combines.

Preventive measures: Only fully mature crop should be harvested by combine harvester. If the crop gains moisture due to rains, the farmers should dry it before harvesting or threshing. Matured and dry crop also requires less energy for harvesting and threshing.

Heat generated by tractor/ diesel engine

Reasons: Crop touching tractor/ diesel engine may catch fire due to heat generated. Heat or spark emitted by silencer of engine may also be a cause of fire accident.

Preventive measures: Direction of the *silencer* of the engine should be kept away from crop. Engines fitted with vertical silencers and spark arresters may be preferred to prevent sparks.

Burning of crop residue in adjoining field

Reasons: Some farmers burn crop residue to clear field for sowing of subsequent crop. This practice may pose danger of fire to adjoining fields.

Preventive measures: Use of fire must be prohibited nearby. Water should be sprinkled to ensure no left over fire or ambers.

Smoking in the field

Reasons: Use of match stick or cigarettes/*bidi* by farm workers in field may cause fire to dry crop.

Preventive measures: The smoking must be completely banned during harvesting and threshing season.

Hot winds and dust storms

Reasons: Hot winds, dust storms and lightening are frequent during harvesting season of wheat (April-May) causing many fire accidents. Strong winds may also carry the sparks/ambers from nearby makeshift hearths.

Preventive measures: Water should be available to control fire immediately. Water supply from the nearby tubewell should be available in case of need. Help must be called from concerned authorities.

Rural people join together and struggle a lot to control fire in field by use of various means like water buckets, sprinklers, sand, etc. Fire, once erupted, may not be easy to control and could also lead to burning injury and even death. Thus, it is necessary to take adequate measures to prevent and control damage due to such accidents.

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Repair and maintenance of drip irrigation system

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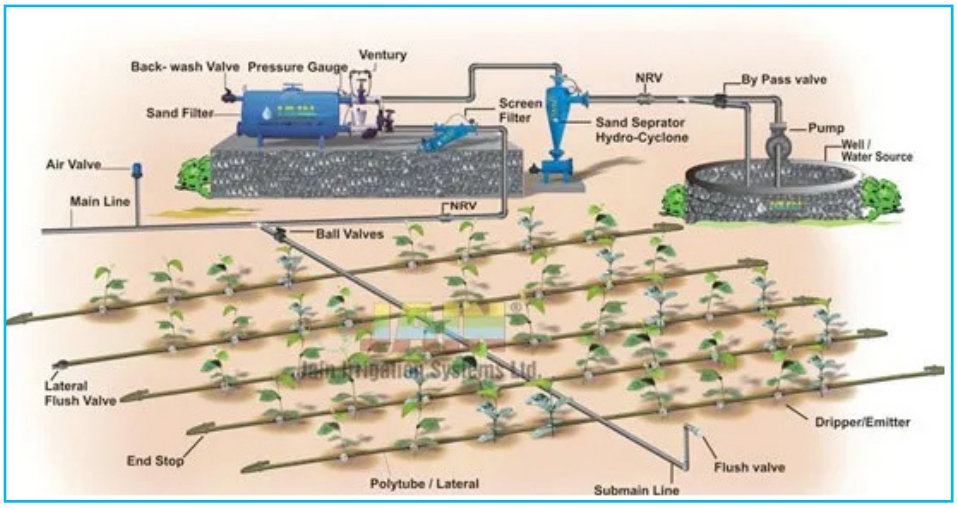

Fig 1. Layout of drip irrigation system

The maintenance of drip irrigation system plays a crucial role for smooth and efficient use of drip irrigation system. The basic information of type of soil, pH and EC of irrigation water, crop, crop spacing, field area and topography, the highest and lowest field elevation are required before installation of drip irrigation system. The selection of pump depends upon head, discharge and Hp of the pump and subsequently selection of main, sub main, lateral and dripper depends upon required flow rate. The blind lateral with online drippers is preferred when plant spacing is farther (as in orchards). The inline lateral is preferred when plant spacing is closer. The field topography is undulating then pressure compensating drippers are used for uniform distribution of water.

Care and maintenance after installation of drip set:

- The care and maintenance is of utmost importance forsmooth and efficient use of drip set. The following points should be considered for care and maintenance of drip set.
- Monitor the dripper discharge during the working mode and replace it immediately if any damage or leakage is found.
- After installation of the drip set, open the end caps of the lateral and allow free water movement for 5 to 10 minutes duration for removing entrapped impurity in the drip set.
- Check the wetting pattern of dripper for sufficient available moisture in the soil.
- Measure the uniformity of the dripper discharge by collecting water below the emitter for 5 minute duration and make sure that distribution of emitter discharge is uniform.

Maintenance of filters under drip irrigation:

Filter is heart of drip irrigation system. The selection of filter depends upon source of irrigation water and its quality. The various irrigation sources such as canal, reservoir, well and tube well are used for irrigation system. Combination of sand filter and screen filter is used when water source is water tank or reservoir. Combinations of hydro cyclone filter and disc filter is used if water source is tube well. The sand or media filter acts as a primary filter to separate biological impurity such as algae, plant residues.Screen and disc filter are used to separate fine sand impurity and acts as secondary filter. The backwashing is important to remove the entrapped impuritiesby reversing the flow of water. During backwashing precaution has to be taken to avoid loss of silica sand (0.7 mm to 1.2 mm size) and maintain 1/3rd proportion of silica sand in the sand filter.

Check inlet and outlet pressure of filter water flow. Remove entrapped impurities of sand and coarse aggregates weekly for smooth working. Weekly backwashing (reversing of water flow) of sand filter is required for smooth working. The inlet and outlet pressure difference of sand filter should not exceed 0.3 kg/cm^2. Similarly inlet and outlet pressure of screen filtershould not exceed 0.2 kg/cm^2.

Emitter clogging

Emitter is an important component in drip irrigation system for drop by drop water application at low pressure in the root zone of the crop. Emitter clogging is considered to be very serious problem in the drip irrigation system. The emitter clogging reduces the discharge rate and causes non-uniform application of water.

Care and maintenance of emitter clogging

The clogging problem periodically occurs due to deposition of impurities in the emitter particularly in rainy season due to availability of muddy water. Regularly check the operation of emitter during irrigation time. Avoid the use of transparent white pipe as its use leads to the growth of biological impurity such as algae growing in the drip system. To clean the dripper, acid and chlorine treatment is given periodically for better efficacy of the system. Chemical water treatment (chemigation), daily flushing of drip lines and drip system inspection is of utmost importance for smooth operation of drip system.

Control of algae in irrigation water source

Clogging problems due to growth of algae affect on working of drip irrigation system. The growth of algae in the reservoirs results due to exposed top water surface to the natural sunlight. The required dose of chemical (chlorine) can be calculated by considering uppermost 2 m layer of water level. The use of chemical prevents penetration of sunlight in that region. Precaution has to be taken to protect the fish or aquatic life.

Control of algae in drip system

The transparent pipes are exposed to sunlight and susceptible for algae growths. The underground buried pipeline and black polyethylene laterals should be preferred for drip system for preventing algae growths. However the algae may grow in open PVC white pipes due to frequent exposure to the sunlight. The chlorination is an effective method for removing unwanted growth of algae. Dissolved chlorine in the source water acts as powerful oxidizing agents for reducing algae growth. Subsequently chlorine helps in the removal of some easily oxidisable substances like iron, manganese etc. Care should be taken during the application of soluble fertilizer through drip system. However the chlorination and fertigation should be done at different timings, otherwise chlorine reacts with ammonia producing compounds of chloramines which may create clogging problem.

Chlorineapplication

Chlorination is an effective technique to control algae growth. The sources of chlorination can be sodium hypochlorite or calcium hypochlorite can produce desire results for controlling algae growth. The frequency of treatments depends upon the algae growth and contamination in the water.It also acts as oxidizing agent, causing the decomposition of organic matter.

- Injection of chorine at low, uniform concentration (normally at 1 to 10 ppm), thoughout the entire irrigation cycle
- Intermittent injection at higher concentration (normally over 10 ppm) for duration of approximately 20 minutes per day
- Injecting highest concentration 50 ppm, for duration of 5 minutes during irrigation cycle

Precaution's during Chlorination

- Sodium hypochlorite (liquid form) should be stored in corrosion resistant tank at cool place
- Avoid long-time storage and use of sodium hypochlorite because it goes under degradation
- Calcium hypochloride (granular/ tablet/powdery from) should be stored in dry place
- Chlorine is very poisonous and corrosive when it moist
- Preventing toxicity of chlorine fumes at the time of injecting chlorine gas
- Handling material and equipment's used for chlorination should be corrosive resistant material
- Test chlorine level by using chlorine test kit and adjust injection rate accordingly

Acid Application

The amount of acid application is based on laboratory water testing report. The concentration of acid (hydrochloric acid/sulphuric/phosphoric acid) based on desired pH of water. Lowering the pH of water prevents the precipitation of salts. Injection acid for short duration of 10 to 30 minutes is conducted for desired pH of 2. If pH of 4 found at the end of laterals application of acid continuous for 30minute is preferred.

Precaution's during acid application

- Injection of phosphoric acid can be used in standing crop and it also providesP nutrition.
- Carefully selection of injection pump must be required for acid injection
- Phosphoric acid should not be used in the presence of iron (micro nutrients)
- Use hand gloves during handling of sulphuric acid
- Handling material and equipment's used for acid should be corrosive resistant material

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PAU protection kit for stored pulses - An innovative solution to insect-pest management

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Pulses are important crops of Punjab and essential food category for humans for thousands of years. It represents one of the most important food categories that have been extensively used to cover basic protein needs of the vegetarian population. During storage, pulses are badly affected by various abiotic and biotic factors like temperature, moisture, storage time, storage conditions, insects, rodents, birds, microorganisms etc. Among biotic factors, insect-pests *viz.* pulse beetle and lesser grain borer are the major ones which affect the qualitative and quantitative parameters of stored pulses. These storage insects generally affect the produce during May-October, as the weather is congenial for their reproduction and development.

Chemical fumigant is the most commonly used practices in grain storage to manage insect-pests. But due to human consumption, safety issues as well as development of resistance in insects, chemical pesticides are not a common approach for storage of pulses. Thus, keeping in mind the hazardous effect of these chemicals, the scientists of Punjab Agricultural University (PAU), Ludhiana have developed an eco-friendly way to manage insect-pests. The development of "PAU Protection Kit for stored pulses" is an innovative solution to manage insect-pests of stored pulses in retail packets and household containers.

Use of kit to manage insect-pests: The detail of using the kit is mentioned in Fig 1.

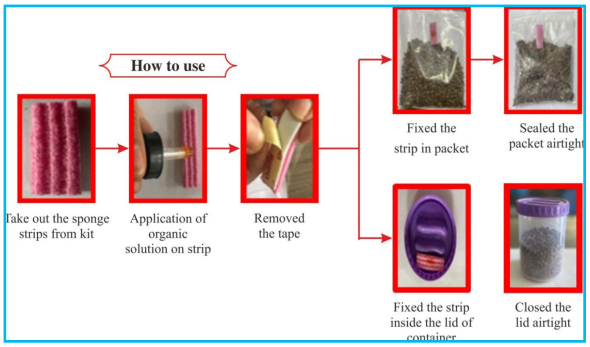

Fig. 1: Method to use PAU Protection Kit in retail packets and household containers

Untreated control (Presence of chickpea powder due to insect attack)

Lower dose (Presence of chickpea powder due to insect attack)

Recommended dose (No insect attack)

Fig 2. Quality of chickpea grains after 6 months of storage

Recommended dose of organic solution given in the kit

Capacity of storage unit	Dose
500 g	3 drops
1 kg	6 drops

Quality of chickpea grains: The effect of using the organic solution at recommended dose and its comparison with lower dose and untreated control in retail packed chickpea grains after 6 months of storage is mentioned in Fig. 2.

Contact details for PAU Protection Kit for stored pulses

This kit can be procured from room no. 11, Department of Processing and Food Engineering, PAU, Ludhiana. The cost of kit is approximately Rs 100/200 to pack 20/40 units of 500 g pulses to protect them from stored insects.

Merits and important instructions for using PAU Protection Kit for stored pulses

Merits	Important instructions
Easy to use Cost effective Safe to environment and humans Chemical free Doesn't affect the quality parameters of stored pulses	Moisture content (% wet basis) of pulses at the time of storage should be 10% if to be stored for 6-12 months. No puncturing should be done in LDPE packets to maintain airtight condition. The dose may be increased or decreased according to the capacity of storage unit. Repeat the dose as and when required.

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Tips for profitable marketing of flowers

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Floriculture is rapidly emerging as a highly competitive industry in India. Despite being the second-largest producer globally, with around 2.83 lakh hectares under flower cultivation, India's share in world trade is merely 0.6 per cent. The industry faces challenges in production, marketing, and export, despite its annual growth rate exceeding 20 per cent. India boasts rich biodiversity and varied agro-climatic regions which are ideal for floriculture. In recent years, despite climate change challenges, the industry's importance has grown significantly, driven by advancements in technology and scientific practices. Punjab state floriculture sector occupying 2.32 thousand hectares holds 16th place at the national level with a production of 14.45 thousand MT.

Floriculture has become a vital commercial activity for farmers, offering profitable opportunities and potential for self-employment. However, it still lacks the precedence it deserves in the nation's agricultural landscape. Cooperative societies can help eliminate middlemen, while the cosmetic industry's demand for floricultural products offers an additional revenue streams. High demand exists for rose varieties, followed by carnations and chrysanthemums. Though with favorable weather conditions and lower production costs, we are well-positioned for floriculture expansion, yet inadequate infrastructure and transportation facilities lead to delays, damages, and increased costs during the transportation of perishable floriculture products. Improving infrastructure, such as cold storage facilities and efficient transportation networks, is essential for maintaining product quality and reducing post-harvest losses. Access to accurate market information and intelligence is crucial for making informed decisions regarding production levels, pricing strategies, and market expansion opportunities. Lack of reliable market data can lead to inefficiencies and missed opportunities for producers and exporters.

The floriculture industry requires skilled labour throughout various stages, from planting to transportation. The floriculture industry faces significant challenges in marketing its produce, which directly impacts the calculation of net profit. These challenges occur at various stages of the marketing process, including assembling, grading, packaging, and transportation. Additionally, there are diverse marketing channels from producers to consumers, which help supply the produce to the ultimate consumer. To fetch better prices for their produce, the farmer should consider the below-mentioned points.

Selection of flower: Based on the demand for some specific flower in the local and adjoining markets, a farmer should select that kind of flower crop.

Variety selection: The variety of flowers selected plays an important role in the successful marketing of the product. Floral varieties are available for different purposes like fresh flowers for domestic use, storage, and commercial use like in marriages, parties, etc. Some varieties are preferred in a particular area due to their peculiar colour, size, or shape. For example, during February, red roses are in huge demand while in some areas, white Jasmine (mogra) for hair decoration is highly preferred. Thus, while selecting a variety due consideration should be given to high yield, disease resistance, insect-pest resistance, end purpose, and consumer preference.

Picking of flowers: The picking of flowers should be done by skilled labour so that the flowers may not get damaged during picking and their quality remains intact.

Grading/Sorting: The grading of flowers is an important practice that ensures better prices in the market. Grading can be done by preferred standards based on the shape, size, and colour of the flower. Sorting of infested, immature, undersized, and oversized flowers should also be done before marketing.

Packaging: In the general scenario, farmers tend to avoid packaging to reduce production costs. Flowers are commonly filled in tractor trolleys during transportation and this leads to crushing and damage of flowers, ultimately leading to loss of quality. Therefore, packaging in a proper manner is necessary to fetch a higher price.

Attractive presentation: With an increasingly competitive market, floriculture producers must diversify their product offerings and differentiate their offerings from competitors. This requires innovation in terms of new flower varieties, unique arrangements, and specialized packaging to attract consumers.

Maintain consistent quality standards: Innovation is also essential for staying ahead in the market, whether through new cultivation techniques, sustainable practices, or novel marketing strategies. Maintaining consistent quality standards is critical for success in the floriculture

industry. Fluctuations in quality can lead to loss of consumer trust and market share.

Exporters face various challenges related to accessing international markets, including strict quality parameters, trade barriers, and intense competition from other exporting countries.

Marketing challenges faced by flower growers

The challenges faced by floriculturists are diverse and significantly impact their profitability and market access. Many floriculturists struggle to find consistent and accessible markets for their produce. Limited market access can lead to reduced sales opportunities and lower profitability for growers. Further, flowers being highly perishable require efficient and timely transportation to maintain their quality. However, inadequate transportation infrastructure and logistical challenges can result in damage or spoilage of the produce during transit, leading to financial losses for growers. Floriculturists often face delays in receiving payments for their sold flowers, which can disrupt cash flow and create financial instability for growers. Delayed payments can also impact growers' ability to reinvest in their operations or expand their businesses. The lack of proper grading and storage facilities can affect the quality and shelf life of flowers, reducing their market value. Without adequate facilities, growers may struggle to maintain product quality and command higher prices in the market. The share of producers in the final retail price of flowers varies widely across different regions and cultivation methods. In many cases, growers receive only a fraction of the consumer price, leading to lower profitability and economic challenges for growers. The imposition of various local taxes by the government on the transportation of floriculture produce presents a significant challenge for growers in India. These taxes increase the operational costs associated with transporting flowers to markets, thereby reducing growers' profit margins. As a result, many growers opt for spot sales, where they sell their produce immediately to avoid incurring additional expenses. This practice of spot sales often results in growers accepting lower prices for their flowers, as they prioritize quick sales over maximizing profits.

Marketing channels involved in marketing of floriculture

The cut flower market in India reflects a largely unorganized and inefficient system. Flowers are typically brought to wholesale markets, which often lack proper infrastructure and operate in open yards. From there, they are distributed to local retail outlets, which are commonly roadside stalls with minimal facilities for preserving the quality of the flowers. These channels affect marketing costs (transport, commission charges, etc.) and market margins received by intermediaries such as traders, commission agents, wholesalers, and retailers. The price to be paid by the consumer and the share of it received by the producer depends on this channel. However, producers are still relying on these intermediaries to avoid the risk of spoilage, lack of transportation facilities, price fluctuation, etc. Various marketing channels were studied for floriculture produce by various experts and it was observed that the producer's share in the consumer's rupee in open cultivation is very little varying from 38 % to 70%. Rest is earned as profit by the wholesalers and retailers. A marketing channel is termed efficient when it ensures both the availability of the product to the consumer at the cheapest price and the highest share to the producer in the consumer's rupee.

Marketing strategies for profitable marketing of flowers

The high margin to farmer-consumer price difference indicates poor marketing efficiency. The availability of various online platforms holds the potential to improve the existing marketing efficiency considerably. Therefore, reliable market information systems and internet access are the need of the hour for farmers. This could be a reason why the Prime Minister of the country envisions every farmer in the country owning a drone and mobile phone. Although it is equally important for a farmer to understand various aspects of marketing, it is not possible to predict the future market for any flower crop with certainty. However following aspects if taken into consideration before adopting a market strategy can be useful:

Clearly define your product: Variety, size, colour of the product, and knowledge regarding demand in the market for specific grade, quality, or size of the product should be clear to the producer. Understanding of behavioral characteristics of potential consumers is another pre-requisite for the successful marketing of the flowers.

Identification of niche market: It can be beneficial for generating higher profits, particularly for new and off-season varieties.

- Favorable market window and perfect timings for the sale of the products should be known to the producer.
- Number of competitors in the market in case of highly specific produce.
- Volatility of the price in the market for a particular floral commodity.
- The geographic location of the consumers should also be taken into consideration as it determines the cost of transportation to the market.
- Behavioural characteristics of potential consumers: It is also very important to study the behavioural characteristics of the consumers like their needs, motives, personalities, income group, and socio-economic status to determine the marketing strategies.

Keeping all that in view, many innovative marketing channels can be explored by the producers as well as the intermediaries. Online and offline innovative channels are mentioned below:

Agmarknet (AGMARKNET): This

is a pan-India portal of the Government of India that provides information related to trends of commodity arrival and prices for the *mandis* of the districts and in other *mandis* of the states. Such information enables farmers in better decisions regarding the marketing of flowers at all India levels. The farmers can get information about different markets on the portal www.agmarknet.gov.in. It provides access to more markets and buyers, and farmers can select a market to sell their produce by checking the prices at a particular *mandi*. Awareness regarding market rates of nearby *mandis* increases the benefit percentage of the farmer.

Registration can be done through either of the following ways:

Via e-NAM portal: http://www.agmarknet.gov.in

- Through mobile application
- Through *mandi* registration (at gate entry)

Use of ICT (Information and Communication Tools): Modern Information and Communication tools refer to the communication devices or applications (television, radio, internet, mobile, etc.) that can help farmers in the production and marketing of flowers. The farmers can form groups on WhatsApp and Facebook to sell their produce. Such groups are beneficial for the city consumers who lack time but are ready to pay for fresh flowers. Such groups are operational for various commodities like fruits, dairy, and poultry other than vegetables at both small level and commercial levels. The formation of ICT-enabled clusters will allow farmers to plan their cropping pattern, aid in better decision making, and reduce transportation costs which will improve marketing efficiency.

Farmers' market (Apni Mandi): The farmers' markets are also operational once or twice a week in major towns and cities of the state. It allows producers and consumers to build direct contact that works in favour of both as there are no intermediaries. Producers receive remunerative prices, while the consumer gets fresh produce at a relatively lower price. Such markets should be better publicized in the cities for further expansion and development.

Farmer Producer Organization (FPO): This organization is advantageous for small and marginal farmers who have limited input resources. The formation of FPOs provides farmers access to quality inputs, efficient technologies, credit and market facilities, bargaining powers and participation in the value chain. There are 122 FPOs registered by different agencies in Punjab, seven by SFAC (Small Farmers' Agri-Business Consortium), 93 by NABARD, and 22 FPOs under the Central Sector Scheme (CSS) for formation and promotion of 10,000 FPOs] in 19 districts of the state with 11,799 shareholders. Farmers can form FPOs with the help of these agencies for financial assistance in production and marketing.

Contract farming: The concept of contract farming was introduced to provide an agricultural commodity of a type and quality required by a prior recognized buyer. It has the competence to reduce transaction costs as it allows coordination of production, marketing, processing, and retailing. The main advantage for the farmer is the distribution of various risks between producers and agri-business firm. Companies assist farmers in seed procurement and guide cultivation practices, irrigation, pesticides, etc. Contract farming can further aid in crop diversification, however suitable policies need to be formulated by the government to protect farmers' rights.

Along with all this, training programs can polish the skills of flower growers by learning about floriculture practices, modern farming techniques, post-harvest management, quality control, and business management. It is very important for the flower grower to have complete and timely information about the arrival and value of flowers in the domestic and international markets, and therefore should use AGMARKNET and ICT. Proper quality materials should be used for cold storage units, refrigerated trucks and packaging to minimize post-harvest losses and ensure quality maintenance during transportation. New technologies for flower cultivation, high-yielding and disease-resistant flower varieties should be given priority. Marketing Cooperatives should provide proper management of marketing, transportation, packaging, storage, etc. at low cost to the cultivators so that the cultivators can reach the poor markets. In other parts of the country, many transport and marketing facilities are available for the benefit of the farmers. In Bihar, the Loop Vehicle Sharing System (Loop Vahan Sharing System) is in use. Through this, small farmers come together and share a vehicle to transport their produce to potential markets. For this, Loop mobile app has been launched which helps farmers know about vehicle availability, booking and transportation. Similar systems can be adopted in Punjab and other parts of the country to overcome the traffic bottlenecks. Several social models operate as an open buyer-seller market for rural areas and provide a direct-to-consumer platform for marketing products by farmers, self-help groups, farmer production organizations and rural entrepreneurs such as aa.marketmirchi.com and www.kalgudi.com. Also village level collection/procurement centres, post-harvest technology, cold chain for flowers from producers to consumers, improvement of cargo handling facilities, increasing frequency of international flights and flower cargo handling chartered flights can help floriculture flourish in the near future. With all these efforts and strategies, farmers can sell their produce in distant markets at a good price with a higher share of consumer rupee. The government should draft policies to improve the marketing of flowers and its products so that farmers can sell their produce on time and at remunerative prices. Corresponding email: mavihk05@pau.edu

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Become turmeric processor for better returns

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Turmeric is very important and commonly used spice in India. The crop commonly known as haldi is grown for its rhizomes which are used as spice in any culinary preparations. Other uses are in drug and cosmetic industry. Turmeric has been cultivated in India since ancient times. Although this crop is not native to Punjab state, but the farmers have shown a lot of interest in cultivation of this crops in the last 20 years. At present, this crop is grown in almost every part of Punjab. On the average, this crop yields about 80-100 quintals of fresh rhizomes per acre. The final use of this spice crop is in its processed produce. The commercial level turmeric industry is almost nonexistent in Punjab. Therefore, the cultivators seldom gets good price of raw turmeric. This has led to development of small scale processing industry at farmers' level, which in turn has put an extra financial burden for purchasing and setting up of processing plant. There is a need to introduce new innovative and cost effective methods for processing of turmeric. If farmers can devote 1-2

Figure 1: ***Turmeric washer cum polisher***

Figure 2: ***Mobile Turmeric Boiler***

Figure 3: ***Turmeric Solar Dryer***

Figure 4: ***Turmeric Grinder (Hammer mill)***

months on its processing after nearly 10 months of its cultivation, they can easily double their profit. Punjab Agricultural University has developed some cost effective turmeric processing machines which can be used effectively for proper processing. During processing, a number of unit operations are to be performed, which are discussed below:

Washing of turmeric: First of all, the freshly harvested rhizomes are washed to remove the soil, dirt etc. This washing can be done manually or in PAU fruits and vegetables washing machine which can wash 2.5 to 3.0 quintals of turmeric per hour. This machine cost Rs. 1.00 lakh and runs with 1 hp motor (Figure 1). When a small entrepreneur starts his work, he may do this manually also to decrease the initial investment.

Boiling: In turmeric processing, boiling is the most technical operation which may affect quality and quantity of final product. After washing, the finger rhizomes are boiled. This process continues till the rhizomes become soft and uniform in colour. This process helps in better retention of colur, faster drying, higher yield and low polishing losses. Boiling in open pan at 100°C can take up to 1 hour. If boiling is done under pressure of 10-15 lb/in^2, the process can be completed in 20-30 minutes. Steam boiled turmeric is slightly better in quality. This can be accomplished in big pressure cookers where agricultural by products are used as fuel. Nowadays the farmers are also using mobile steam boiling units (Figure 2). These units are of high capacity (about 10-12 quintal per hour) and use agricultural waste as fuel, but the cost of this machine is approx. Rs. 3.00 lakh. Farmers also prefer to take this machine on custom hiring basis (at Rs. 5000/- per day) and process their produce of about one acre in one day in the field itself (the machine does not require any electricity).

To reduce the initial investment, the farmers can boil their produce in open pan also with some modification. This method helps in uniform boiling of turmeric resulting in better quality end product as well as saving in fuel. In this method, raw turmeric is not put directly into the boiling water in the open pan. Rather it is put first in a cage made of perforated sheets. Then this cage is put in the boiling water in the pan in such a way that the bottom of the cage does not touch bottom of the pan and its handles rest on the frame of the pan. This helps in easy loading and unloading. Moreover it will help in reducing the wastage of hot water due to spillage while removing the blanched turmeric from the pan.

Drying: After boiling the turmeric fingers are dried in the open sun to bring the moisture content below 10%. A good sunshine may dry the product in 15-20 days. Mechanical drying can be done in commercial dryers and the process takes about 72 hours at 60°C. Punjab Agricultural University has developed a solar dryer (Figure 3) which is of 3 quintal capacity and costs approx. Rs. 2.5 lakh. As compared to sun drying, this dryer can reduce the drying time by half. Some processors have already installed such dryers in their plants.

Polishing: After drying, the fingers are polished to remove the outer brown layer. During sun drying dust, sand particles and other impurities mix with the turmeric fingers. These impurities are also removed during polishing. Therefore, polishing helps in getting impurity free turmeric powder along with its better colour. This operation can be performed by rubbing the fingers against some rough surface. The dual purpose PAU turmeric washing and polishing machine can also be used for the purpose.

Grinding: After polishing, the fingers are ground in a grinder. It is always recommended to grind the spices in hammer mill type grinder than that of a traditional attrition mill to avoid the rise in temperature during grinding. Suitable capacity (15-20 kg/hr) grinders are easily available in the market at approximate cost of Rs. 50000/-. Hammer mill type grinders (Figure 4) are best suited for grinding of spices as it does not allow the temperature of the produce to rise and maintains the quality of ground spice.

Machinery required for commercial turmeric processing plant

- Washer
- Cookers for boiling
- Mechanical /Solar dryer
- Abrasive Polishers
- Hammer Mill
- Packaging machine/ manual packaging

We can obtain about 20 kg of turmeric powder from 100 kg of fresh turmeric fingers. The powder can be packed in polythene pouches or preferably aluminum laminated pouches for better retention of colour. It cost nearly Rs. 100/- (cost of raw turmeric and processing expenses) to get 1 kg of turmeric powder. This powder can be sold in wholesale market @ Rs. 150/kg or in retail market @ Rs. 200/kg. Further technical information can be obtained from Head, Department of Processing and Food Engineering, PAU, Ludhiana.

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Improved production techniques of turmeric

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Turmeric is an important spice crop and a principle ingredient in Indian culinary. Besides, its commercial production by the farmers in Punjab, people even from urban areas are inclined to raise turmeric to fulfill their domestic requirements. It is also widely used in drugs, dyes and cosmetic industries. Because of its wider range of medicinal benefits, it has been extensively used in Ayurveda for centuries and home remedy for various diseases. Turmeric is mainly cultivated for its rhizomes, which at maturity are yellow in colour due to the presence of curcumin that mainly ranges from 1.8 to 5.4 %. In addition, turmeric also contains 2.5-7.2 % of essential oil, and turmerol. Turmeric also holds a significant position in various religious and ceremonial occasions.

Improved varieties: The PAU, Ludhiana has recommended two high yielding varieties *viz.* Punjab Haldi 1 and Punjab Haldi 2 for cultivation in the state. Punjab Haldi 1 takes 215 days and Punjab Haldi 2 takes 240 days to mature and give average yield of 108 and 122 q/acre, respectively.

Land preparation: A well prepared field free from stubbles and weeds is beneficial for the growth of the plant. Depending on soil type, field should be ploughed well to obtain a good seed bed. In general, 2-3 ploughing followed by planking are enough to obtain good tilth.

Method of planting, planting time and seed rate: Depending on soil types, appropriate method of planting can be adopted. In case of sandy loam soil where water stagnation is not a constraint, flat planting can be opted. In flat planting, rhizomes should be planted in lines with row to row spacing of 30 cm and plant to plant distance of 20 cm. In case of heavy soils and poor drainage, bed planting is better option. Two rows of turmeric should be planted on 67.5 cm wide beds (37.5 cm bed and 30 cm furrow) with plant to plant spacing of 18 cm. For higher productivity, planting should be done by the end of April which can be extended up to first week of May. Use 6-8 quintals of fresh, healthy and disease free rhizomes are required for planting an area of one acre. Before planting, rhizomes should be dipped in water for 12-24 hours.

The soaking of rhizomes in water for 12-24 hours before planting is helpful for enhancing germination. Apply straw mulch @ 3.6 tons per acre immediately after planting. Soil moisture needs to be maintained until the sprouting of rhizomes.

Nutrient management: Farmers should ensure that 10-12 tonnes of well rotten farmyard manure per acre in field is mixed well with soil in which the turmeric has to be sown. Alternatively, 5 tonnes FYM along with 55 kg urea per acre can be applied. The FYM should be applied before planting and 55 kg urea should be applied in two equal splits at 75 and 100 days after planting. In addition, a basal dose of 60 kg single super phosphate and 16 kg muriate of potash should be applied at the time of planting. To increase the turmeric rhizome yield, consortium biofertilizer @ 4 kg per acre should be applied as soil application at the time of planting.

Irrigation:, Turmeric takes longer time to emerge and also grows slow during the initial phase of crop growth. The soaking of rhizomes in water for 12-24 hours before planting helps in early germination. Straw mulch helps to keep soil moist and better sprouting of rhizomes. Further, lighter and frequent irrigations favors the better crop stand. In case of drip irrigation and fertigation, turmeric needs to be irrigated at three days interval using lateral pipes with drippers placed at 30 cm apart and dripper discharge @ 2.2 litre per hour as per the following schedule:

Month	Time of irrigation (min)*
May	63
June	60
July	48
August	36
September	32
October	24
November	19

Fertigation should be started at 45 days after planting and 20 kg N, 8 kg P_2O_5 and 8 kg K_2O/acre should be applied in 15 equal splits at nine days interval. Drip irrigation results in about 25 per cent higher yield along with saving of 36 per cent irrigation water and 20 per cent nutrients over check basin method of irrigation and soil application of fertilizer application.

Weed management: Depending on the severity of infestation, weeds can be effectively controlled by one or two manual hoeings. Uniform spreading of straw mulch @ 36 quintals per acre after planting adequately suppresses and reduces the weeds infestation in the field.

Harvesting: Complete yellowing and drying up of the plants are the indication of maturity of turmeric crop. The crop is ready for harvesting by the end of December. The rhizomes are dug up and cleaned to remove the roots and sticking soil.

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Green manuring for improving soil health

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Adoption of intensive rice-wheat cropping system along with cultivation of high-yielding varieties has resulted in depletion of fertility status of soils of Punjab. Approximately 40 per cent cultivated area of Punjab has brackish underground irrigation water and this poor quality water has bad effect on soil productivity as well as soil fertility. Moreover, soil organic carbon status in soils of the area is very low as there is more carbon mineralization due to high temperature during the summer, resulting in poor soil health. A poor soil is deprived of the availability of essential plant nutrients, causing deficiency of nutrients like iron (Fe), zinc (Zn) and manganese (Mn). For getting sustainable high crop yields, soil fertility status must be maintained. Punjab Agricultural University, Ludhiana's research shows that inclusion of green manuring in crop rotation improves soil health, increases crop yields and reduces the harmful effects of brackish underground irrigation water. To sustain soil health, incorporation of crop residues, FYM along with inclusion of green manures in crop rotation is of utmost importance. Among organic manures, the importance of green manure is manifold. The green manure crops increase the nitrogen (N) content of the soil through symbiotic association with *rhizobium* bacteria in their root nodules. The important green manure crops are sesbania, sunhemp, clusterbean, cowpea and moongbean. These crops can be ploughed (generally before flowering) for the better soil health or for maximum benefits. Punjab Agricultural University, Ludhiana has recommended the cultivation of sesbania, sunhemp, cowpea and cluster bean as green manure crops, before rice cultivation. However, sesbania and sunhemp are the best green manure crops as they can produce highest green biomass in a short duration period and be easily decomposed in soil. These two crops are not sensitive to excess concentration of soluble salts (soil salinity), and require less water.

Benefits of incorporation of green manure crops

Green manure increases the N content of soil and improves the availability of other nutrients.

- The N requirement of proceeding crop is decreased after incorporation of green manure. When sesbania is incorporated in soil before rice, it requires only 55 kg urea for per acre.
- The incorporation of green manure crops also ameliorates the Fe deficiency in sandy soils. Upon decomposition in soils, organic acids are produced which decrease the soil salinity level and reduce the harmful effects of poor quality irrigation water.
- Green biomass addition increases the water retention capacity of soil.
- Green manuring improves physical, chemical and biological properties of soil by increasing soil organic matter content.
- After green manuring, sandy soil starts retaining water in root zone due to increased soil organic matter, whereas in heavy textured soils, green manuring improves soil aeration and water infiltration. Incorporation of organic residue or green manure crops decreases the soil erosion through air or runoff.

Important tips for green manure crop cultivation

Punjab Agricultural University, Ludhiana has recommended such crops for green manures which have faster growth rate. Those green manure crops are the best which can produce highest green biomass within a short period and contribute maximum towards soil organic matter. The *rhizobium* bacterium present in the root nodules of these crops can fix atmospheric nitrogen in their bodies and in turn get carbohydrates from the plant roots. In other words, they (plant and bacteria) work in symbiosis; plant gets N from bacteria and in turn provides shelter and food to *rhizobium*. Among different green manure crops, sunhemp is the best suited green manure crop as it requires less water to produce biomass in large quantities and has little attack of insect-pests. Sesbania and sunhemp are not much sensitive to poor quality water and soil salinity.

Sesbania (*Dhaincha*)

It can grow well on all types of soils but sandy loam to loamy sand soils are suitable for its cultivation. It is relatively tolerant to both salinity and sodicity. Punjab Dhaincha-1 is a bold seeded variety of *dhaincha* which has quick growth with comparatively more nodules. It can successfully be cultivated from April to July months. After 45 days of sowing, it attains a height of 3-5 feet. Following Punjab Agricultural University's recommendations of 20 kg seed per acre, it can contribute 50 to 80 quintals of green biomass per acre to soil after its *in situ* incorporation. The sowing should be carried out with seed drill in lines 20 to 22.5 cm apart. At the time of sowing, application of 75 kg of single super phosphate (SSP) is recommended. The application of SSP can be omitted if recommended dose of P has been applied to proceeding wheat crop. Depending on prevailing weather conditions and soil type, it requires 3-4 irrigations. Plough the crop sown in April when it is about

Contd on page 22

Baby corn for crop diversification and more profit

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Baby corn is a young finger like unfertilized cob of maize harvested within 1-3 days of silk emergence. As the baby corn, crop can be harvested within 60-65 days, hence multiple crop of baby corn can be raised which would fetch additional income to the farmers. It is used in preparation of diverse recipes *viz.* sweet products (*halwa*, *kheer*, *burfi*), preserved products (jam, *chutney*, pickle, candy, *murabba*), chinese products (soup, manchurian, chowmein etc.) and traditional products (*pakora*, cutlet chaat, salad, dry vegetables, *kofta*, mixed vegetable, riata) etc. In recent years, baby corn is becoming more and more popular especially in urban areas because of its taste and nutritional value. Thus, baby corn can be effectively used as a nutritious vegetable and as an export crop to earn valuable foreign exchange.

Recommended hybrid: Hybrid Punjab Baby Corn 1 is recommended for baby corn purpose. This is a CMS based maize hybrid by PAU. The earlier recommended varieties need detasseling at flowering to get good quality baby corns for commercial use. This hurdle has been successfully overcome in this hybrid. In this hybrid, farmers need not to remove the tassels which save time and labour cost incurred to remove the tassels at the time of flowering. This hybrid will be ready for first picking (harvest of baby ears) in 52 days after sowing and farmers can take 2 to 3 pickings within a span of 10-12 days. Average baby corn yield (without husk) of this hybrid is 8.4 q/acre. After picking of baby corn the stalks can be used as green fodder, this hybrid gives 128 q/acre green fodder yield after picking of baby corn.

Time and method of sowing: Baby corn can be sown any time from April to first week of August. The crop should be sown in well prepared field in 30 cm apart rows keeping plant to plant distance of 20 cm with 20 kg seed per acre. It is suggested to attempt sowing on short intervals (staggered sowing) to maintain the continuous supply of baby corn depending upon the demand in the market.

Crop rotation: Baby corn is a short duration crop and vacates the field in just 60-65 days, so it can be adjusted easily in different crop cycles. For instance one crop of baby corn may be raised in between wheat and rice. Another option is two to three crops of baby corn may be obtained during April to September in place of single crop of rice. Two crops of baby corn may be produced successfully before planting of pea and potato in the month of September and October.

Fertilizer requirement: Nitrogen dose is low for baby corn because of short duration of crop. Apply 52 kg urea, 75 kg super phosphate or 27 kg DAP and 15 kg muriate of potash per acre. 10 kg zinc sulphate per acre should also be applied in the Zn deficient soils. If DAP @ 27 kg per acre has been used, the urea dose may be reduced by 10 kg per acre. Apply half dose of urea and whole of the phosphorus and potash at the time of sowing and remaining half dose of urea at knee high stage.

Nutritional quality of baby corn : Nutritional quality of baby corn is at par or even superior to most of the seasonal vegetables. Besides protein, vitamins, calcium and iron, it is also richest source of phosphorus . Baby corn is a low-carbohydrate, high-fiber, fat-free vegetable and helps in weight management. Baby corn is preferred over vegetables because it remains free from any residual effect of pesticides as the young ear is wrapped up with husk and well protected from insect and diseases.

Harvesting/ picking: The most appropriate time of picking of baby corn is immediately after silk initiation but before fertilization. The top ear would be ready for first pick and lower one will be ready for harvesting few days later. Normally two or three ears should be picked from each plant and picking of ears appearing later should be avoided as they may not be of good quality. After picking, cobs should be placed in shade and cold stored immediately to retain their freshness and hence, to ensure good consumer acceptability and market price. The baby corn ears should be picked along with the husk. Farmers need to follow the picking schedule of baby corn strictly. Delayed picking, even 2-3 days, will not only reduce sweetness of baby corn but also lead to increase in length and girth of ears which may render it unfit for the marketing.

Marketing and export potential: It is in great demand in hotels, airlines, shipping companies and many European countries. Therefore, a great potential for this crop is visualized in future. Many private companies in India are undertaking baby corn export business. Baby corn cultivation offers rich dividends especially for the dairy farmers of peri-urban areas. Adoption of baby corn on wide scale will improve net farm income of farmers and also promote crop diversification in the state.

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Tips for the successful cultivations of cucurbits

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Cucurbits are a big group of vegetable crops cultivated in Punjab i.e. muskmelon, watermelon, cucumber, bottle gourd, sponge gourd, bitter gourd etc. To get maximum yield and high returns farmers should follow improved cultivation practices which are given below:

Soil and Climate: Well drained loam to sandy loam soils rich in organic matter are best suited for cultivation of cucurbits. Lighter textured soils which warm up quickly in spring give high early yields. In heavier soils although vine growth is more but fruit maturity is delayed. Cucurbits are warm season crops and highly susceptible to frost. Seed germination is severely reduced below 15°C temperature. In muskmelon and watermelon, cool nights and warm days are ideal for accumulation of sugars in the fruits.

Agronomic Practices: Best time for sowing cucurbits is February-March and June-July. To maintain regular supply their sowing can be extended from second fortnight of February to first fortnight of August at the interval of 15 days. When sowing is done either earlier or later than the optimum sowing time, pollination and fruiting ability is severely affected. To overcome this problem two colonies of honey bees per acre are advised to keep in the fields. Lack of pollination leads to either no fruit set or deformed fruit set thereby affecting quality of the produce.

Direct sowing of cucurbits should be done on both sides of the beds parallel to each other. Apply whole Single Super Phosphate and Muriate of Potash along with one third of Urea in two parallel bands 45 cm apart and the channel should be prepared in between the fertilizer bands, before the sowing of seeds. The remaining dose of N should be applied to the vines near the base (but not touching it) and should be mixed with the soil during the early part of the growing season to ensure the maximum growth, early fruit set and maturity. Seedlings prepared either in plug trays or polythene bags can also be transplanted similarly on both sides of the beds. The details of seed rate, varieties, spacing, and fertilizer requirements is given in Table 1.

During summer, irrigate the crops every week. Depending upon soil type and weather conditions, irrigate the fields 8-12 times. In watermelon and muskmelon, at the time of fruit maturity, water should be given only when it is absolutely necessary. The over-flooding of the field should be avoided. In no case, water should be allowed to come in contact with fruits.

Harvesting, Care and Marketing: In muskmelon fruits should be harvested at mature green stage for distant marketing and at 'half slip' stage for local market. In watermelon harvest fruits when tendrils are dry or fruits change colour to yellow where touches the ground or give dull sound on thumping. In pumpkin, fruits are ready for harvesting when skin turns pale brown and flesh becomes golden-yellow. Cucumber, bottle gourd, squash melon, sponge gourd fruits should be harvested when fruits are tender and medium sized. In peak season harvesting should be done at regular interval of 3-4 days to maintain marketing quality.

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Table 1: Seed rate, varieties, spacing and fertilizer requirement of cucurbits

Name of vegetable	Varieties	Seed rate (kg/ acre)	Spacing (cm)	Fertilizers (Kg/acre)			
				FYM (tons)	Nitrogen	Phos-phorus	Pot-ash
Muskmelon	Punjab Amrit Punjab Sarda MH-51 MH-27	0.4	3.0 × 0.60	10–15	50	25	25
Cucumber	Punjab Naveen	1.0	2.5 × 0.60	-	40	20	20
Watermelon	Punjab Mithas	1.5-2.0	3.0 × 0.60	8-10	25	16	15
Bottle gourd	Punjab Barkat Punjab Bahar	2.0	2.5 × 0.45-0.60	20-25	28	-	-
Pumpkin	Punjab Nawab PAU Magaz Kaddu-1 PPH-1	1.0	1.5 × 0.45 3.0 × 0.60	8-10	40	-	-
Bitter gourd	Punjab Karela-15 Punjab Jhar Karela-1	2.0	1.5 × 0.45	10-15	40	20	20
Round gourd	Punjab Tinda-1	1.5	1.5x0.45	-	40	20	20
Sponge gourd	Punjab Nikhar	2.0	3x0.75	-	40	20	20
Wanga	Punjab Tarwanga-1 Punjab Wanga No-1	1.0	2.5x0.60	-	40	20	20

Crop regulation and ecofriendly practices for improving quality of guava fruits

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Guava is the second most important fruits crop after citrus in Punjab. It performs well even under suboptimal saline and alkaline soil conditions. It represents 12.8% of the total fruit production in the state. In comparison to other fruit crops, cost of cultivation of this fruit crop is less. Guava fruits are rich source of minerals and nutrients. Generally, fruits are consumed fresh, but also processed commercially into juice, jam, jellies, powder, and other culinary products. The returns from guava fruits mainly depends upon the quality of the produce. *A better quality produce fetches higher price in the market*. In this article, we have emphasized on various means to improve fruit quality of guava for increasing the net revenues from the produce.

Crop regulation for obtaining winter season crop

In Punjab, guava produces mainly two crops: rainy season crop (July-August) and winter season crop (November-January). The fruits of rainy season crop are usually insipid in taste and have poor shelf life. Also, the attack of fruit fly and anthracnose is more in this crop. The fruits of winter season crop are superior in size, quality, taste, aroma and have lesser incidences of pests and diseases, thus, fetch higher price in the market. Due to heavy flush in March-April, guava bears profuse flowering for rainy season crop, while the intensity of winter season crop is generally small. A heavy rainy season crop causes glut in the market, leading poor price to the grower. For specifically taking the profitable high quality winter season crop, crop regulation can be done. Crop regulation involves manipulation of tree growth and flowering. The following crop regulation measures are helpful in obtaining the remunerative winter season fruit crop.

Pruning: Terminal 20 or 30 cm of shoot growth should be pruned between 20th to 30th April to avoid flowering for rainy crop.

Withholding irrigation: Withholding of irrigation during April-May causes dropping of flowers of rainy season crop. After that in June, irrigate and apply the recommended dose of manure and fertilizer to encourage growth in July-August for getting maximum flowering during August-September for winter season crop.

De-blossoming: At a small scale, flowers can also be removed manually, but in commercial plantations, it becomes laborious and uneconomical. For large scale plantations, spray 10 % Urea (10 kg Urea in 100 litres of water) or 600 ppm NAA (Naphthalene Acetic Acid) (dissolve 60 g NAA in 150-200 ml alcohol and make the solution 100 litres with water) during the month of May at peak of the flowering.

Ecofriendly practices to improve quality of rainy season fruits

For improving quality of guava fruits in summer crops, following interventions can be taken:

Fruit bagging: PAU has recently recommended the use of white non-woven bags to cover the rainy season fruits. Bagging the mature green hard fruits during June end to middle of July (at color break stage) protects them from fruit fly infestation, reduces bird damage and improves the peel colour. The bagged fruits fetch better price in the market.

Fruit fly traps: Fruit fly infestation can also be managed with installation of eco-friendly fruit fly traps. These traps contain pheromones for attracting males of fruit fly and disrupt their natural life cycle. Fix PAU fruit fly traps @16 traps/acre in the first week of July to manage fruit fly population.

Cultural practices: Regularly remove the fruit fly infested fruits from the ground and bury them in distant pits at least 2 feet deep. Shallow ploughing with cultivator during summers is also effective in exposing and killing the pupating larvae which are mostly present at 4-6 cm depth.

Adopting the discussed measures can help harvest better quality guava fruits and net economic returns.

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Decision of cotton cultivar to grow: Foundation of crop returns

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In Punjab, cotton is the second most important crop after paddy in *Kharif* season and a major cash crop of the state. Cotton has good global demand which gives good economic returns. It offers a good viable alternative option to break rice-wheat cropping system especially in dry areas of Punjab which may play an important role in crop diversification in Punjab. The major constraints of cotton crop is that it is highly prone to insects-pests and diseases. If we look into the past decade, cotton crop has witnessed major epidemics of insects pests like whitefly in 2015; pink bollworm in 2021 and cotton leaf curl virus disease (CLCuD)/whitefly in 2022 which caused huge losses to the state cotton production. During *Kharif* 2022, it has been observed that farmers sow some area under un-recommended/non descriptive cotton hybrids. These un-recommended /non descriptive hybrids were highly susceptible to whitefly and cotton leaf curl virus disease and were not suitable to be grown in Punjab conditions. This was one of the major reasons of outburst of CLCuD and whitefly to cotton crop along with other factors during kharif 2022. While selecting crop varieties, farmers should select a variety which is suitable for their environment because selection of variety is the first step which will decide the crop returns. Farmers

Table 1: List of Bt cotton hybrids recommended for cultivation in Punjab state during Kharif 2024 as evaluated by Interstate Committee for cotton in Kharif 2023.

Hybrid Name	Yield (Kg/ ha)	Hybrid Name	Yield (Kg/ ha)
GBCH 85 BGII	3529	RCH 650	2988
MRC 7361	3474	NCS 4455	2986
BIO 6451-2 BGII	3399	ABCH 4899	2953
VICH 310	3393	KCH 172	2948
KSCH 213 BGII	3382	PCH 9604	2942
ANKUR JASSI	3362	NCS 9024	2939
MRC 7365	3359	NCS 950	2913
SUPER 971	3334	PCH 9611	2909
BIO 6539-2	3259	ACH 33-2	2903
BIO 2510-2	3257	SUPER 965	2895
BIO 311-2	3247	KDCHH 641	2890
VICH 309	3235	PRCH 333	2890
KDCHH 441	3234	RCH 314	2883
NCS 495	3232	BIO 841-2	2866
ANKUR 3224	3228	MRC 7301	2843
ANKUR 999 BGII	3223	RCH 776	2829
NCS 9013	3216	PCH 879	2817
BIO 846-2	3203	SOLAR 77	2805

Hybrid Name	Yield (Kg/ ha)	Hybrid Name	Yield (Kg/ ha)
SWCH 4750	3161	PCH 877	2773
MH 5302	3151	ABCH 248	2768
KDCHH 621	3114	ANKUR 5642	2755
NCS 855	3100	ACH 133-2	2749
SHAKTI 9	3088	ACH 155-2	2714
NCS 9002	3078	ACH 777-2	2704
PCH 225	3057	ABCH 254	2703
ACH 177-2	3054	SUPER 544	2699
SUPER 721	3047	ABCH 243	2697
PRCH 302	3046	RCH 653	2693
KSCH 207	3045	RCH 773	2652
KCH 999	3044	SOLAR 56	2619
PRCH 7799 BGII	3036	VICH 308	2600
NCS 459	3031	SWCH 4735	2598
SUPER 5	3028	SUPER 931	2594
ANKUR 3228	3027	NAMCOT 616	2579
ABCH 252	3016	SOLAR 65	2568
ANKUR 3244	3013	SWCH 4768	2558
NCS 857	3005		

are also advised that they should not plant whole area under one variety as monoculture increases the risks of diseases and pests outbreaks. To get maximum yield, the farmers are advised grow only recommended varieties/hybrids of cotton. The cultivation of following varieties/hybrids is recommended by Punjab Agricultural University for current crop season.

American Cotton

***Bt* cotton varieties:** Following *Bt* cotton varieties developed by PAU Ludhiana are also being recommended for cultivation in Punjab.

PAU Bt 3: It is a *Bt* cotton variety with inbuilt resistance against spotted and American bollworms. Its average seed cotton yield is 10.2 quintals per acre. Its average fibre length is 26.2 mm and ginning out turn is 36.5 %. It is tolerant to jassid and cotton leaf curl disease.

PAU Bt 2: It is a *Bt* cotton variety with inbuilt resistance against spotted and American bollworms. Its average seed cotton yield is 10.0 quintals per acre. It possesses average fibre length of 27.6 mm and ginning outturn of 34.4 %. It matures in 160-165 days. It is tolerant to jassid and cotton leaf curl disease.

Bt cotton hybrids

Every year Punjab Agricultural University evaluated *Bt* cotton hybrids produced/sponsored by private companies for yield, insects pest and diseases attack. Based on that screening, following *Bt* cotton hybrids of different private companies are being recommended for cultivation in Punjab during *Kharif* 2024.

In addition to these, the hybrids (Raghuvir, ACH 945-2, ACH 955-2, RCH 938-2, RCH 951, RCH 846, RCH 926, MC 5403, MC 5408, KCH 307, C 9313 BG II, C 352 BG II, KCH 9323 BG II, KCH 9333 BG II and RCH 960 BG II) notified by Central Ministry of Agriculture and Farmer Welfare during 2020 to 2022 for the north zone evaluated under AICRP on cotton are also recommended for *kharif* 2024.

Non *Bt* cotton varieties:

F 2228: It gives an average seed cotton yield of 7.4 quintals per acre. Its ginning outturn is 34.4% and fibre length is 29.0 mm. It is moderately resistant to jassid and bacterial blight.

LH 2108: It gives an average seed cotton yield of 8.4 quintals/acre. It matures in 165-175 days with average plant height of 145 cm. It has 34.8% ginning outturn and 27.9 mm 2.5% span length.

II *Desi* cotton varieties

Due to rise in surgical, absorbent, upholstery cotton and denim in day today's life, the demand for short stable and coarse cotton is gaining importance. *Desi* cotton is highly resistant to cotton leaf curl virus disease and tolerant to whitefly. So growing of desi cotton is comparatively more profitable as requires less water and other inputs than American cotton *Bt* hybrids. Three *desi* cotton varieties i.e. LD 1019, LD 949 and FDK 124 developed and recommended by Punjab Agricultural University are as under**.**

LD 1019: It is a new shattering tolerant variety requires only 2 or 3 pickings as compared to other *desi* cotton varieties which require at least 5 pickings. It gives an average seed cotton yield of 8.6 quintals/acre. This variety is tolerant to jassid, whitefly, fusarium wilt and bacterial blight.

LD 949: The average seed cotton yield of this variety is 9.9 quintals/acre. It possesses ginning percentage of 40.1. This variety is moderately resistant to *Fusarium* wilt and bacterial blight. It is tolerant to whitefly and jassid. Its fibres are short, coarse and suitable for surgical cotton.

FDK 124: It is short staple, coarse fibre variety with 2.5% span length of 21.0 mm and ginning outturn of 36.4%. It gave an average seed cotton yield of 9.28 quintals/acre. It is resistant to jassid and whitefly.

Following points should be kept in mind to get optimum yield from cotton cultivation:

- Grow only recommended varieties/ hybrids of cotton.
- Heavy pre-sowing irrigation is must to obtain good germination and early establishment of plants. Preferably *rauni* should be done with canal or good quality water as this not only ensures better germination but also protects young seedling from mortality.
- Farmer's must complete the sowing by 15 May. Late sowing reduces the yield drastically due to poor plant stand, less vigorous plants and higher incidence of sucking pests. Give first irrigation 4-6 weeks after sowing depending on soil type.
- Give 4 sprays of 2% potassium nitrate (13:0:45) starting at flowering initiation, at weekly interval.
- In *desi* cotton, the first spray against bollworms specially spotted bollworms must be done when at least 25 per cent plants started producing squares and subsequent sprays should be need based.
- Use recommended insecticides only.
- Do not use readymade insecticidal mixtures and avoid tank mixing.

Do not stalk the cotton sticks under shade or in the field. Beet the sticks on ground to dislodge the pink bollworm larvae surviving in the unopened bolls.

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Tips for the successful management of whitefly in cotton

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Whitefly is a major pest of cotton crop in Punjab state. During 2015, it appeared in an epidemic form in Punjab and other northern states of India, which damaged cotton crop, resulting in huge losses to cotton growers in the cotton belt. Whitefly adults and nymphs generally feed on lower side of leaves by sucking the sap from the underside of leaves and weaken the plants resulting in low fruiting with reduced yield. They excrete large amounts of honeydew which encourage sooty mould growth, thereby, adversely affecting the process of photosynthesis. This pest also causes lint discoloration and stickiness. It also acts as vectors of cotton leaf curl virus, which adversely affect the growth and yield of cotton crop. Whitefly has a very wide host range including vegetable crops and different species of weeds. Management of whitefly requires a year round Integrated Pest Management (IPM) approach as whitefly is highly mobile, can quickly build resistance to many insecticides and numbers can rapidly expand especially if natural enemies are reduced by insecticidal sprays.

Alternate host species during the off season

Whitefly passes the winter on weeds and alternate host plants, thus, removal of hosts and maintaining a host free period during this time will reduce the inoculum for next season. Control weeds in/ near the farm all year round. Favoured host species includes *Bhindi*, *mung*, *arhar*, *castor*, *dhaincha*, *kangi buti*, *peeli buti*, *tandla*, *gutputana*, *datura, makoh*, congress grass, cucurbits, volunteer cotton, etc. Destruction of crop residue after harvest and field sanitation will help in reducing the inoculum/carryover of whitefly to next season crop.

Management of whitefly- Year round practices

For implementation of an effective management strategy in cotton crop following points should be considered

Survey and surveillance on alternate host crops: Survey on alternate host crops should be carried from February onwards. Management of whitefly using various chemical and non-chemical methods on these crops should be done so that its carryover to cotton crop is reduced.

Selection of suitable field for cotton plantation*:* Avoid planting cotton near orchards. Also, avoid cotton planting near/in other host crops of whitefly *viz*. Brinjal, tomato, cucurbits, *moong* etc. This will help to avoid early population build up in cotton crop. Prefer to grow desi cotton varieties in fields having a higher incidence of whitefly in earlier years.

Clean cultivation: As whitefly passes the winter on various weed species and alternate host plants, thus, maintaining a host free period during this time will reduce the inoculum for next season. Destruction of crop residue after harvest and field sanitation will help in reducing the inoculum/carryover of whitefly to next season crop.

***Maintain a healthy crop*:** To maintain a healthy crop sow the recommended varieties/hybrids of cotton before 15th of May. The crop sown after this period is more prone to attack of whitefly. Avoid moisture stress by following proper irrigation schedule as moisture stress increases severity of whitefly.

Encourage beneficial insects: Beneficial insect populations play dominant role in maintaining ecological balance in nature. If their numbers and habitats are disrupted, pest populations build faster. Presence of natural enemies of whitefly such as lady bird beetles, *Encarsia*, *Chrysopa*, minute pirate bugs, spiders etc. is important in field which is sometimes overlooked and need to be promoted and popularize among the farmers. The beneficial insects can be encouraged by using IPM approaches including spray based on economic threshold levels. Go for spray of neem based insecticide like Home made neem extract, Achook, Nimbecidine etc in initial crop stage of cotton. Use of eco-friendly approaches like use of yellow sticky traps @ 40 traps

per acre should be encouraged. Also, for conserving these natural enemies, there is a need for the careful selection of the insecticides. Avoid early season use of broad spectrum insecticides, particularly synthetic pyrethroids and organophosphates group insecticides.

Practice Insecticide Resistance Management Strategies: Due to its fast multiplication rate whitefly has the ability to develop resistance to insecticides used. Follow Economic Threshold Levels (ETL) (6 adults/leaf) to get effective control of whitefly. By following ETLs, we are able to minimise the number of sprays/ chemicals as well as it helps in delaying the development of resistance. Do not repeat applications of same insecticides or the products with same mode of action. Also, do not apply more than the maximum number of applications recommended for a particular chemical. Always follow label directions. Knowledge of the registered products can help to improve management decisions.

Insecticides recommended by PAU, Ludhiana for the management of whitefly in cotton

Insecticide	Dosage	Brands
Afidopyropen 50 DC	400 ml/ acre	Sefina
Dinotefuran 20 SG	60 g/acre	Osheen
Diafenthiauron 50WP	200 g/ acre	Polo
Pyriproxyfen 10EC	500 ml/ acre	Lano/Daita
Spiromesifen 22.9 SC	200 ml/ acre	Oberon
Clothianidin 50 WG	20 g/acre	Dantotsu
Ethion 50 EC	800 ml/ acre	Fosmite/E-mite/Volthion
Neem based biopesticide	1.0 litre/ acre	Nimbecidine or Achook
* PAU Homemade neem extract	1200 ml/ acre	-

***Method of preparation:** Boil 4.0 kg terminal parts of the shoots of neem trees including leaves, green branches and fruits in 10 litre of water for 30 minutes. Then filter this material through muslin cloth and use the filtrate for spraying at the recommended dose.

Decision making in selection of insecticide

- If adult whitefly population is higher on cotton then use any adulticide followed by a nymphicide *viz*. pyriproxyfen 10EC/ spiromesifen 22.9 SC after 8-10 days of first spray.
- If nymphal population of whitefly is more in field then spray pyriproxyfen 10 EC/ spiromesifen 22.9 SC and followed by adulticide *viz*. ethion 50EC / afidopyropen 50 DC after 8-10 days of first spray.
- If both whitefly adult and nymphal population is more in field and crop canopy become dense (after first fortnight of August) spray diafenthiuron 50 WP.
- Use Economic thresholds levels (6 whitefly adults/leaf) and clean cultivation to avoid unnecessary sprays. Conduct surveillance and monitoring for whitefly population weekly right from the beginning. Randomly sample 10-20 plants per field and count for whitefly adults on fully formed upper 3 leaves/ plant before 10.00 AM in the morning.
- In the beginning of crop season on appearance of whitefly, first spray of nimbecidine or Achook @1 litre per acre or Homemade neem extract @ 1200 ml/acre should be given. Also, use yellow sticky traps @ 40 traps per acre in June- July.
- Avoid repeated applications of same insecticide, go for alternate use of chemicals and don't apply same insecticide more than twice in a crop season.

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Green manuring for improving....contd from page 15

45 days old or when it attains a height of about 5 feet. It is recommended to incorporate the crop in soil one or two days before transplanting of paddy crop. If maize is to be sown after incorporation of sesbania crop, it should be ploughed in soil approximately 10 days before sowing so that it may decompose easily.

Sunhemp

It is also an important leguminous crop that is quick growing and has the advantage of tolerating adverse conditions of drought, salinity and sodicity. It has potential to contribute 38 to 65 quintals of green matter to soil after its incorporation. Two varieties of sunhemp *viz.* PAU 1691 and Narinder Sanai-1 are being recommended by Punjab Agricultural University for their cultivation as green manure crop in the state. These varieties attain a height of 130-190 cm within 45-60 days after sowing and can contribute green matter upto 65 quintals per acre. These can be sown from April to July months. After seed bed preparation, 20 kg seed is sown either with drill in rows 22.5 cm apart or can also be sown by broadcasting. For better germination, soaking in water for one to two hours is recommended to improve its germination. The application of 100 kg SSP per acre at time of sowing is recommended. Sunhemp requires less number of irrigations as compared to sesbania. Depending on the weather conditions and soil type, only two to three irrigations are sufficient.

Farmers have plenty of time (about two months) after wheat and before transplanting rice. So, they must practice green manuring in their fields under rice-wheat cropping system. The cultivation of recommended green manure crops not only improves the soil health but also enhances the crop yield of the succeeding crop as well as has residual effect on the next season crop.

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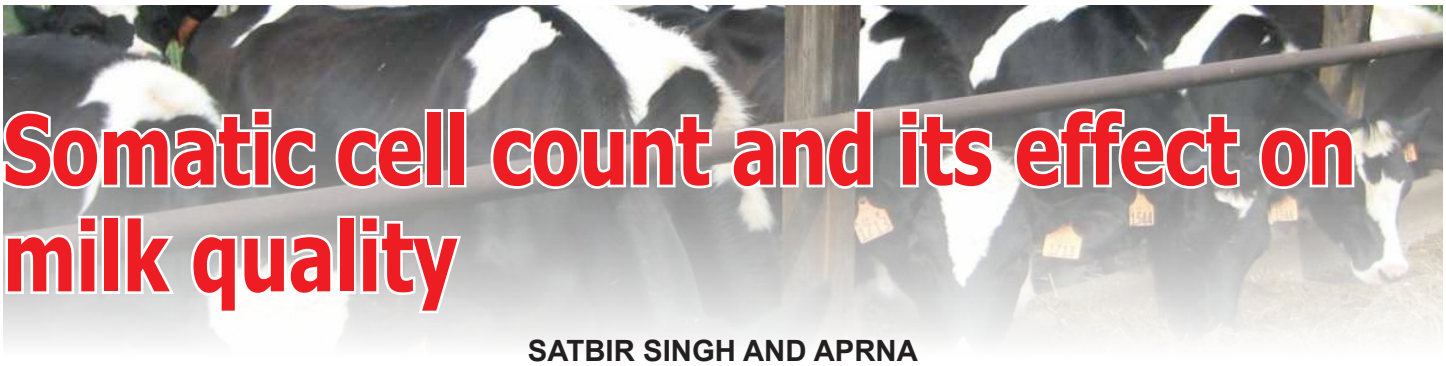

Somatic cell count and its effect on milk quality

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Genetic selections and advances in feeding and milking technology have led to milk production by animals more than their calves can consume. Higher yield, surrounding environment and removal of milk by hand or machine milking impose unnatural stress on the bovine udder. This has increased the chances of mammary infections in these animals.

Natural defence mechanism of mammary gland/udder

Mammary gland has natural defence mechanisms which help in preventing the establishment of pathogens in the udder. Pathogens usually gain entry to the quarter through the teat canal before, during, and after lactation periods. During dry periods and between milkings, teat canal is sealed by a keratin plug which is formed from the stratified squamous epithelial lining within the duct. This forms an effective physical barrier against invading microorganisms. However, damage to the plug can temporarily or permanently increase the penetrability of the teat canal, thus increasing the chances of mammary infections.

Milk somatic cells (SCs), means the body-derived cells that are normally present at low levels in milk. These include the milk leukocytes that serve as a part of the defence system, increases significantly once there is a bacterial infection. Their primary function is to fight disease and assist in repairing damaged tissue. The other type of cells in milk are from the udder secretory tissue (epithelial cells), The presence of such cells coming in milk is a normal physiological phenomenon and is necessary for the regeneration of normal epithelia. Hence the SCs represent the second line of defence, the first being the anatomical and chemical barriers of the teat apex and canal in the mammary gland.

What is SCC

Count of somatic cells per ml of milk is called somatic cell count (SCC) and is a recent parameter to assess the quality of milk, udder health, mastitis and hygienic conditions of milk production. These days developed countries are using milk somatic cell counts (SCCs) as a marker to monitor the prevalence of mastitis in dairy herds. Apart from developed countries some milk procuring agencies in India also have started using this parameter for quality control along with fat and SNF estimation.

Importance of SCC

Estimation of milk SCs is an effective method to detect the subclinical form of mastitis. Lower SCC count helps to give longer shelf life to milk. In the European Union, China, New Zealand, Australia, Switzerland, and Canada, the legal bulk milk SCC (BMSCC) limit is $3\text{-}4\times10^5$ cells/mL; in South Africa and Brazil, 5×10^5 cells/mL; and in the USA, 7.5×10^5 cells/mL.

Any intramammary infection (IMI) (mastitis) leads to an increase in these cells in milk and indicates poor hygiene of the produced milk. When the amount of SCC is around 1 lakh, it indicates that an animal is unaffected. Cows and buffaloes having more than 200,000 SCC/ml of milk are likely to be infected in at least one quarter. As the cell count elevates, it is directly related to the severity of infection and the number of infected quarters in a cow.

An increase in the milk SCC is also associated with a decrease in milk yield. This decrease in the milk yield may be observed at least about one week before clinical mastitis is diagnosed. This may be due to the fact that mastitis is subclinical before the onset of CM. Cows once infected may not return to their pre-mastitis milk yield level. The decrease in milk yield with an increase in milk SCC is mainly due to physical damage to the milk-producing epithelial cells.

Furthermore, higher SCC makes more energy get deviated toward the immune system rather than milk production, and furthermore the animal may eat less due to pain and decreased movements

Factors Affecting SCC

Effect of productivity on milk SCC: High milk-producing cows are under stress of milk production that affects their immunity leading to more SCC in their milk.

Effect of different stages of lactation on milk SCC: Milk yield is highest during early lactation and may have higher SCC

Effect of parity on milk SCC: Young primiparous cows produce less milk and have a lower milk SCC as compared to multiparous cows.

Age: The reaction of the milk SCs to pathogens may increase with age which makes them more prone to new infections. There may even be longer infections and more tissue damage in older cows.

Season: High humidity in some seasons like hot-humid and some micronutrient deficiencies due to the poor quality of fodder may also cause more growth of the infectious bacteria accompanied with low immunity.

Method of milking: the longer is the channel of marketing more will be the SCC.

Dry period: Dry period of 40 days is given to the cows during their lactation cycle. This period allows the mammary gland to be repaired and restored for the next lactation. Milk get accumulated in the udder which may act as a good culture media for bacteria. Dry cow therapy during this period may reduce the infections and thus reduce milk SCC in the coming lactation.

Milk SCs are an indicator of both resistance and susceptibility of dairy cows to mammary infections. For the consumers, lower milk SCC means extended product shelf life and improved flavour. For farmers, low milk SCC means fewer treatments, lower costs and higher milk yield per cow. Therefore, to enhance the confidence of consumers and to meet the requirements of marketing, there is a necessity to adopt this parameter as a management tool on a routine basis.

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Nutritious and healthy salads

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Three Bean Salad

Ingredients

Rajmah	:	50 g
White *chana*	:	50 g
French beans	:	50 g
Onion	:	50 g
Capsicum	:	50 g
Lemon	:	2
Vinegar	:	2 teaspoon
Salt/Chilli	:	as per taste
Ajwain	:	½ teaspoon
Oil	:	2 teaspoon

Method

- Soak *rajmah* and white *chana* separately overnight. Boil them separately in the morning.
- Cut French beans and cook until soft in water.
- Chop onion and capsicum in round shape.
- Soak capsicum in warm water for 5 minutes and onion in vinegar for 15-20 minutes.
- Mix all vegetables, *rajmah* and white *chana*. Sprinkle salt, chilli and add lemon juice. Mix all the ingredients.
- Roast *ajwain* in oil and put it over all the ingredients.
- Mix well and serve cold.

Sprout *Dal* Salad

Ingredients:

Whole *moong dal*:		250 g
Potato	:	250 g
Onion	:	100 g
Cucumber	:	250 g
Tomato	:	250 g
Lemon	:	4

Salt/black pepper powder:As per taste

Coriander leaves : ½ bunch

Method

- Wash *dal* in water and soak it for 8 hours.
- Put *dal* in muslin cloth and hang at some warm place. *Dal* will sprout in 12 hours in summers and 24 hours in winters.
- Boil potato, peel them and cut them in small pieces.
- Add lemon juice and mix again.
- Garnish with finely chopped coriander leaves.
- Serve cold.

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Soil and Water Testing: A key to sustainable agriculture

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The population of India has increased rapidly; it has led to a huge demand for food grains. However, the area of land under cultivation has not increased at the same rate. Punjab has played a critical role in meeting this demand by providing 60-70% of wheat and 40-50% of paddy to the national food reserves from only about 1.5% of the country's land. This achievement was made possible by adopting high-yielding varieties, mechanization, intensive cultivation, and good irrigation facilities during the Green Revolution era of the 1970s to 1980s. However, since 1990, the increasing population and food needs have been threatened by yield stagnation, resource sustainability issues, and environmental pollution. The cost of fertilizers has also increased significantly, with fertilizer expenses accounting for more than 50% of the total inputs used in agricultural production. To reduce the cost of cultivation, the only alternative left is to use fertilizers in the right amount, at the right time, and by the right method. Using fertilizers without testing the soil is like taking medicine without consulting a doctor. Without a soil test-based fertilizer recommendation, a farmer may be applying too much of one plant food element and too little of another, which can limit plant growth. This not only results in an uneconomical use of fertilizers, but can also reduce crop yields. Soil testing helps farmers use the correct proportion of applicable fertilizers at the proper stage to maximize returns on their fertilizer investment.

Soil testing has become even more critical in recent years. Currently, fertilizer consumption in the state is almost equal to the actual requirement for the existing cropping pattern. To increase the efficiency of applied fertilizers, we need to analyze the soil periodically. Continuous application of phosphatic fertilizers has improved the phosphorus status of some soils over the years. We can omit the application of phosphatic fertilizer to paddy if the soil phosphorus status is above 5 kg/acre and to wheat if it is above 20 kg/acre. Similarly, the application of potassium is only required in potassium-deficient soil. In Punjab, less than 10% of the area, primarily in sub-mountaneous districts, are low in available K. Additionally, evaluation of irrigation water quality is also important for sustainable crop production. Therefore, it's highly recommended to conduct proper soil and water testing before applying fertilizer and irrigation water for sustainable agriculture.

From where to get your soil tested?

The Punjab Agricultural University has established soil testing laboratories at its main campus in Ludhiana, as well as at Regional Research Stations in Gurdaspur and Bathinda, and at KVKs in respective districts. Additionally, the State Department of Agriculture has set up soil testing laboratories in each district. Markfed, IFFCO, Khribco, Citrus Estate, and other entities are also providing facilities for soil testing. Farmers are expected to collect a representative sample from their fields and deliver it to the soil testing laboratory either personally or through the field staff of the Department of Agriculture or Farmers Advisory Services of PAU. It is important to note that the accuracy of the results depends on the representativeness of the soil samples collected.

How to take soil sample?

The efficiency of soil testing services depends on the selection of site and method of soil sampling. Usually, soil testing is done for fertility evaluation, *kallar* reclamation and for garden plantation as described below:

I. For making fertilizer recommendations in field crops

To collect soil samples for fertilizer recommendations in field crops, first remove any surface litter and then make a V-shaped cut using a spade or *khurpa* to a depth of 6 inches (6") (Figure 1). Next, remove a uniform slice of soil that's about 1 inch thick from one side of the cut. Repeat this process in 7 to 8 places throughout the field, selecting areas with uniform texture and general fertility. Place all of the soil samples in a clean tray, cloth or polythene bags and mix thoroughly. Then, take approximately half a kilogram of soil and place it in a cloth bag/polythene bags. Label the bag with important information such as the field number, farmer's name, address, and date of sampling. Usually, soil samples are collected from fallow fields after crops harvesting. However, for crops other than rice, soil samples can also be taken during the growing season from the areas between rows.

II. For *kallar* reclamation

To collect soil samples for *kallar* reclamation, dig three feet deep pit with one side vertically straight and the other slanting. From the vertically straight side, with the help of *khurpa,* collect about 1" thick, half a kilogram of soil from each of the depths: 0-1/2 feet, 1/2-1 feet, 1-2

feet, and 2-3 feet (Figure 2). Put each soil sample in a separate clean cloth bag, and label each bag with the field number, depth of sample, name of the farmer, address, date of sampling, and any other relevant information.

III. For orchard plantation

To collect soil samples for orchard plantation, follow these steps. Dig a 6-feet-deep pit in the centre of the field. One side of the pit should be vertically straight, and the other side should be slanting. Use a *khurpa* to remove about 1 inch of soil from the vertically straight side, collecting about half a kilogram of soil from the depths: 0-1/2, 1/2-1, 1-2, 2-3, 3-4, 4-5, and 5-6 feet (Figure 3). If there is any concretion layer, sample it separately and note down its depth and width. If the soil samples are wet, dry them in the shade before putting them into a cloth bag.

Water quality

In order to ensure sustainable crop production without damaging the soil, it's important to test water before using it for irrigation. In Punjab, 23% of the total irrigated area is irrigated with canal water, while 77% is irrigated with tubewell water. The quality of canal water, which comes from rivers, is excellent for irrigating crops. However, this is not the case with tubewell water. Approximately 42% of the total aquifers used for irrigation have poor quality water, which is generally marginal or unfit for crop irrigation. When brackish water is used for irrigation, it harms the soil health, leading to a decrease in crop yield. Groundwater in Northern India is either high in total soluble salts or has a high amount of sodium, or both. Accordingly, it is called saline, sodic, or saline sodic, depending on its composition. The primary issue in Punjab is sodicity rather than salinity. Judicious use of water requires testing of water quality before irrigation. Soil testing labs in Punjab offer analysis of irrigation water.

Collection of water sample

To collect water from the tubewell, follow these instructions: 1. Run the tubewell for 15-30 minutes. 2. Take a clean bottle made of either plastic or glass material. 3. Rinse the bottle with tubewell water for 2-3 times. Do not use any soap or detergent to wash the bottle. 4. Collect about 500 ml water and tightly cork the bottle. 5. Paste the following information on the bottle: i. Name and address of the farmer ii. Depth of tubewell iii. Type of soil to be irrigated iv. Water table depth and v. Crops to be grown .

Characterization of irrigation water quality

The quality of irrigation water depends on numerous parameters. In Punjab, the soil testing laboratories evaluate two main parameters: total soluble salts (measured as electrical conductivity in µmhos/cm) and the concentration of carbonate and bicarbonates in relation to calcium and magnesium (measured as Residual Sodium Carbonate or RSC). Based on these parameters, Table 2 provides the rating limits for irrigation water quality. Although water with RSC greater than 5 meq/L is not fit for irrigation, high RSC waters up to 7.5 meq/L may be recommended with specific measures if the EC is very low.

Table 1: Rating limits fixed for Irrigation water quality

Water Quality	Conductivity (µmhos/cm)	**Residual Sodium Carbonate (meq/L)**
Fit	<2000	<2.5
Marginal	2000-4000	2.5 – 7.5
Unfit	>4000	>7.5

According to analysis, the water quality is assigned numbers 1 to 4. All waters falling in fit category with respect to EC as well as RSC are given number 1 and usable in all situations. For water quality of number 2 or 3 i.e. marginal with respect to its total salt content must be mixed or used alternatively with canal water. For such waters, gypsum should not be used. If water quality is of number 2 or 3 i.e. marginal with respect to higher residential sodium carbonate, then use gypsum according to recommendations of the test report. If the water quality is number 4 i.e. unfit with respect to either of the two criteria, then the water should not be used for irrigation purposes. In the year 2022-23, the Soil Testing Laboratory at the Department of Soil Science in PAU, Ludhiana analyzed 907 water samples. The results showed that 34%, 33%, and 33% of the samples were fit, marginal, and unfit for irrigation, respectively. The fact that a large percentage of the samples fell into the marginal and unfit categories highlights the need for water testing to maintain soil health and sustainable crop production.

Charges for testing of samples

Punjab Agricultural University is taking very nominal charges for testing of soil and water samples which are as below:

Type of sample	Rate
For fertility evaluation	Rs 50 per sample
For reclamation of salt affected soils	Rs 50 per profile of 4 samples
For orchard plantation	Rs 100 per profile of 7 samples
For micronutrients	Rs 50 per sample (Zinc, Iron, Manganese and Copper)
Irrigation water testing	Rs 50 per sample

How often to test?

It's recommended to have your soil tested at least once every three years or once in a crop rotation. If you have coarse textured soils, you should get them tested more frequently. You can collect soil samples at any time of the year, as long as soil conditions are favorable for sampling.

How to get the soil testing reports?

The reports with suggested recommendations are available in hard copy and sent through the post office. Farmers can also access the results of soil testing on their smartphones by clicking on the website www.pausoil.in. To generate test reports for macro, micronutrients and water testing online, farmers need to enter their receipt number on the above portal.

• ***Kuldeep Singh: 81465-50714***

Sardar Gurpreet Singh: A successful jaggery processor

INDIRA DEVI, RAKESH KUMAR SHARMA AND CHARANJEET KAUR

Farm Advisory Service Centre Hoshiarpur (Gangian)

Sugarcane occupies 86.8 thousand hectares of area in Punjab. Among this, Hoshiarpur district ranks first with 23.5 thousand hectares of area under sugarcane. Farmers prefer to cultivate sugarcane over other crops as two sugar mills are running in this district. These mills used to bring fortune to the farmers earlier, but for the last few years, farmers are facing problems regarding delay in payments and they have to wait in queues for long time to sell their produce to the sugar mills. The processing of cane juice to make jiggery blocks (*gur*), jaggery powder (shakar), etc. is one of the priorities among the farmers of this district as it is more profitable as compared to directly sending their cane to the sugar mills. Many farmers are involved in this venture and are getting good returns. Among these, Sardar Gurpreet Singh, s/o Sardar Balvir Singh of village Khuda, is one of the successful jaggery producers.

A 41-year old Sardar Gurpreet Singh is a graduate; he has adopted his family's profession of sugarcane processing. His grandparents were doing it on a small scale and with traditional method, but he gave it a modern look and turned it as a profitable venture by expanding it on a large scale. In 2015, he modified his unit with the establishment of steam boiler and continued upto 2018. The approximate jaggery production of his unit was 2.5 to 3.0 quintal per day and during processing, he used cane of his own 25 acre field. In 2018, with the help of Punjab Agricultural University, Ludhiana, he installed a modern jaggery plant (three pan boiling system) and started processing cane of 100 acres (25 acres of his own land and 75 acres procured from other farmers). He operates his processing unit from the first week of November and continues up to last week of April. During this period, the jaggery production is around 20- 25 quintal per day. For smooth working of unit, he has given employment to 35 persons (men and women) from his surrounding villages. He is in regular contact with Farm Advisory Service Centre, Gangian since 2021 for various queries related to agriculture.

This sugarcane grower has an edge over other farmers, as he is not only producing plain jaggery and its powder, but also producing 12 diverse products by adding different flavours like chocolate, *alsi, haldi*, coconut, peanut, black pepper, cardamom, mix *masala* and sesame to plain *gur*. He has recently started producing *desi* sugar also. These products are in great demand not only in Punjab but in other states and foreign countries like America, Canada, Dubai, etc. Markfed, Unnati and Punjab Agro also purchase these products from him on a large scale. Besides, he sells his produce in the village at his sale point named "Khalsa food" located on a national highway. He earns good profit annually from the sale of these products.

In addition to these products, he uses the by-product of sugarcane after extracting sugarcane juice as compost, cattle feed, fuel etc. which further add to his profit. The main reason behind his success is that he lives in a joint family and every member of his family contributes in successful running of this unit. He prefers to sell his produce himself. He is also a recipient of membership certificate from National Cooperative Exports Limited (NCEL). From this year, he has started growing organic sugarcane on seven acres of area with a motive to shift towards organic farming. He is an inspiration for the youths who are having enough land for farming but prefer to go abroad for employment. Sardar Gurpreet Singh wishes that Punjab farmer should involve himself in food processing along with farming to make good profit. Farmers should update modern agricultural practices by following Punjab Agricultural University's recommendations, and participate in regional and state level *Kisan Melas*, agro tech and trade fair exhibitions. Farmers have also been stressed upon to follow recommended agronomic practices for sugarcane cultivation and adopt sugarcane varieties suitable for quality jaggery production. His story inspires to blend tradition and innovation, paving the way for brighter and more sustainable future for the youths and encouraging them to adopt their ancestral profession. His journey is an ingenuity to what dedication, education and passion for progress can achieve in the world of agriculture.

• ***Indira Devi: 9459872106***

Sardar Surjit Singh Bimbh: Torch bearer for organic farmers

AJAIB SINGH AND MANINDER SINGH BONS
Krishi Vigyan Kendra, Hoshiarpur

In Punjab, some progressive farmers have championed in handsome earning by judicious use of resources and adoption of eco-friendly technologies. Sardar Surjit Singh Bimbh, a resident of village Birampur, block Hoshiarpur-1 of district Hoshiarpur, is a leading, well known and dynamic farmer who has adopted organic farming in his farm and become a torch bearer for the fellow farmers. Sardar Surjit Singh Bimbh did his M.Sc (Agronomy) from Punjab Agricultural University, Ludhiana. After retiring from bank services in 2005, he started organic farming upon the request of his son, Sardar Parmvir Singh and named his farm as "Bimbh Natural Farm" which fetches him a good profit.

He has an operational holding of 15 acres under organic farming, which he adopted to conserve natural resources efficiently as well as to provide healthy environment to the future generation. He cultivates sugarcane in trenches on 8 acres and successfully cultivates potatoes, peas, turmeric, carrot, garlic, onion, *rajmash*, moong, mash, chickpea, etc., on 4 feet beds in between sugarcane trenches. For nutritional requirement of crops, he uses farmyard manure, green manuring, vermi-compost, and incorporates crop residues into the soil and adopts pulses in the crop cycle. He uses organic ways for seed treatment, managing of insect-pests and diseases. This farmer himself markets his products through personalized sale in the district and other parts of the state, and has achieved a great success. He prepares 1.50 quintal of jaggery cubes/jaggery powder during peak season on daily basis which is completely sold out. He prepared 140 quintal of jaggery cubes/ jaggery powder during last year and no quantity was left unsold. His jaggery cubes/jaggery powder are also preferred by NRI Punjabis due to their excellent quality. He sells his jaggery cubes and jaggery powder at premium price of Rs 110 and Rs 120 per kg, respectively. Apart from this, he sells dry fruit mixed jaggery cubes @ Rs 300 per kg.

He successfully cultivates wheat organically on 4 acres and adopts *desi* wheat varieties. He is selling the organic flour to the neighboring farmers of the area also. The customers are satisfied with the quality. He sells various pulses @ Rs 120-150 per kg. He uses solar powered traps around the fields for insect-pest control. He has polyhouse for off season cultivation of various vegetables. He earns around Rs 15 lakh annually. His son who works in Merchant Navy also helps in various agricultural operations. He regularly interacts with the fellow farmers and guides them with his farming practices. He attends district and state level agricultural fairs to learn latest agricultural knowledge. Besides, he also believes in meticulous record keeping for proper budgeting of his farm.

Personal views

- Sardar Surjit Singh believes that the good quality organic products are always in demand and consumer friendly. The utmost important belief of the customer is the quality of the processed organic product.
- In organic farming, it is necessary to buffer zone around the organic fields to avoid any chemical effect of agrochemicals in organic fields.
- Crop rotations, crop residues, manure, compost, leguminous crops, on-farm wastes, etc. should be used to maintain soil productivity.
- Majority of the rural farmers have been reduced to mere producers who sell their raw produce to middlemen at throw away prices; they should adopt agro-processing of agricultural produce to increase their farm income.

• ***Ajaib Singh: 81465-50714***

Farm operations in May

RICE

1. Grow only recommended varieties of rice. Complete the sowing of paddy nursery between May 20-25 for PR121, PR 122, PR 128, PR 129, PR 131, PR 114 and PR 113. Nursery of PR 127, PR 130 and HKR 47 should be sown in the last week of May. Nursery of PR 126 should be sown from May 25 to June 20. For nursery raising, apply 12-15 tonnes of well-rotten farmyard manure per acre and irrigate the field to permit the germination of weeds. Plough the field twice after about a week to kill germinated weeds. Flood the field and puddle it well. Apply 26 kg urea, 60 kg single superphosphate and 40 kg zinc sulphate heptahydrate (21% Zn) or 25 kg zinc sulphate monohydrate (33% Zn) per acre at puddling. Prepare plots of convenient size.
2. For the management of root-knot nematode in nursery, apply mustard cake @ 40 g/sq m 10 days before sowing nursery with last predatory tillage operation after *rauni*.
3. Treat the seed with Sprint 75 WS by making slurry of 3g fungicide formulation in 10-12 ml of water for 1kg seed before sowing to prevent primary seed borne infection.
4. Sow the seed @ 1 kg/20 sq m. Keep the soil moist by irrigating the plot frequently. Apply another dose of 26 kg urea per acre about a fortnight after sowing.
5. Weeds in paddy nursery can effectively be controlled by applying 1200 ml per acre of any recommended brand formulations of Butachlor 50 EC. The herbicide should be applied by mixing with 60 kg of sand after seven days of sowing of the pre-germinated seed of paddy. So fit 37.5 EC (pretilachlor + safener ready mix) @ 500 ml per acre can also be used as sand mix after three days of broadcasting seed. Similarly weeds can also be controlled by applying Nominee Gold 10 SC @ 100 ml/acre as spray in 150 litres of water at 15-20 days after sowing of nursery.
6. During the initial stages of growth, light irrigation should be given but after about 10 days; irrigation should be given regularly to avoid iron deficiency particularly in case of coarse textured soil. If the seedlings in the nursery show yellowing of younger leaves, spray 0.5-1 % ferrous sulphate solution (0.5-1 kg ferrous sulphate in 100 litres of water) thrice at weekly intervals. If the leaves turn rusty brown after becoming yellow, give a spray of 0.5 % zinc sulphate heptahydrate (500g zinc sulphate heptahydrate dissolved in 100 litres of water) or 0.3% zinc sulphate monohydrate solution (300 g zinc sulphate monohydrate dissolved in 100 litres of water).

COTTON

1. Complete the sowing of cotton upto 15th of this month and follow clean cultivation; destroy *Kanghi buti (Sida* sp.) and *Peeli buti (Abutilon* sp.) which act as collateral host of cotton leaf curl virus.
2. Eradicate the weeds like *kanghi buti, peeli buti, puth kanda* etc. growing on field bunds, waste lands, roadside and irrigation channels/canals to avoid further spread of whitefly to cotton fields.
3. Whitefly also attacks other alternate host crops like brinjal, potato, tomato, okra, *moong, mash* and *guar.* Regular surveillance should be done for timely management of whitefly on these crops.
4. Integrated weed management should be adopted; hoe the crop two or three times. The first hoeing should be done before first irrigation. Use tractor mounted cultivator/ tractor operated rotary weeder/*triphali* or wheel hand hoe for weeding. Their use after fruiting should be avoided. In situations, where *Itsit* emerges after first irrigation or with the rain shower, Stomp 30 EC @ 1.0 litre/acre in 200 litres of water can also be applied as post-emergence after first irrigation to cotton. Spray herbicide uniformly by dissolving in 200 litres of water. If some weeds emerge before the application of herbicide, those should be controlled by hoeing or interculture as stomp does not control germinated weeds. Give one hoeing/interculture about 45 days after sowing to control the weeds. Alternatively, spray 500 ml per acre Hitweed Maxx 10 MEC (pyrithiobac sodium 6%+quizalofop ethyl 4%) by dissolving in 150 litres of water after first irrigation, in moist soil, to control annual grass and broadleaf weeds. This herbicide also provides effective control of *lapeta* (*guara*) *vel* (*Ipomoea* sp.) when weed plants are at 2 to 5 leaf stage.

MAIZE

1. Start sowing maize during the last week of this month.
2. Sow only the PAU recommended hybrids/ varieties.
3. To avoid the adverse effect of excess rainfall, particularly at seedling emergence, sow the maize seed on top centre of the bed with row to row spacing

of 67.5 cm and plant to plant spacing of 18 cm or sowing should be done on the side of ridges preferably 6-7 cm above base with 60 cm apart rows and plant to plant spacing should be 20 cm. Wheat bed planter can be used for bed preparation.

4. Sowing can be done in trenches. Trench planted maize resists lodging and gives more yield.
5. Apply fertilizers on soil test basis. To medium fertility soils, apply one third i.e. 35 kg urea, 150 kg single superphosphate and 20 kg Muriate of Potash per acre to maize PMH 1, Parbhat and Sweet Corn 1; and 25 kg urea, 75 kg single superphosphate and 20 kg Muriate of Potash per acre to maize PMH 2, Kesri and Pearl Popcorn at sowing. Omit the application of phosphours, if maize follows wheat which received the recommended dose of phosphorus. Apply potash only to soil testing low in this nutrient. Application of FYM @ 6 tonnes per acre or green manuring before sowing is very beneficial.
6. For the control of weeds depending on the soil type, spray 800 g per acre Atrataf 50 WP (atrazine) on medium to heavy textured soils and 500 g per acre in light soils within 10 days of sowing by using 200 litres of water per acre.

SUGARCANE

1. Control weeds in the planted as well as ratoon crop. Due to prevailing hot weather conditions, sugarcane crop requires frequent irrigations at 8 to 10 days interval. Apply 65 kg urea per acre to ratoon crop. Moisture conservation may be done by spreading mulch in between cane rows. Use rice straw/wheat straw/ rice husk as mulch. This also checks the growth of weeds.
2. For checking attack of black bug, spray 350 ml of Dursban/Lethal/Massban/ Goldban 20 EC (chlorpyriphos) in 400 Iitres of water per acre. Direct the spray material into the leaf whorl for better results.
3. Sugarcane mite can be checked by destroying *Baru* (*Sorghum halepanse*) weed growing nearby which is an alternative host for mite.
4. Early shoot borer can be controlled by applying 10 kg Regent/Mortel/Rippen 0.3 G (fipronil) mixed in 20 kg sand or 150 g Takumi 20 WG (flubendiamide) or 150 ml Coragen 18.5 SC (chlorantraniliprole) or 2 litres of Durmet/Classic/Dursban/ Markpyriphos 20 EC (chlorpyriphos) in 400 litres of water/ acre with sprinkler along the rows at post germination stage (about 45 days after planting). Earth up slightly and follow with light irrigation. These insecticides will also control termites.
5. Sometimes iron deficiency appears in ratoon and planted crops on light textured and calcareous soils. The deficiency symptoms first appear on younger leaves as yellow stripes between green veins. Later, the veins also turn yellow. To control this, spray the crop with 1.0 kg ferrous sulphate dissolved in 100 litres of water. Two-three sprays at weekly intervals are sufficient.

GROUNDNUT

1. After the harvest of wheat, groundnut can be sown upto the end of May after applying *rauni*. The seed should be further treated with 2 ml Neonix 20 FS or 1.5g Seedex or 5 g Thiram or 3 g of Indofil M-45 per kg of kernels. Seed treatment with Neonix also controls white grubs and termites.
2. Apply 13 kg urea, 50 kg single superphosphate, 17 kg Muriate of Potash and 50 kg gypsum per acre at the time of sowing. If recommended dose of phosphorus had been applied to wheat, its application to groundnut can be omitted. Apply potassium only to soils testing low in this nutrient. In soils having zinc deficiency, apply 25 kg zinc sulphate heptahydrate (21%) or 16 kg zinc sulphate monohydrate (33%) per acre; this quantity is sufficient for 2-3 years.

ARHAR

1. Sow *Arhar* crop in the second fortnight of May for obtaining high grain yield. Use 6 kg of seed per acre at a row spacing of 50 cm and the plant spacing of 25 cm.
2. *Arhar* can be successfully grown on raised beds in medium to heavy textured soils. Sow one row of *Arhar* per bed, on beds spaced 67.5 cm apart (37.5 cm bed top and 30 cm furrow) by using wheat bed planter. Raised bed sowing not only saves irrigation water but also saves the crop from adverse effect of heavy rainfall.

SUMMER MOONG

1. Summer *moong* is severely attacked by thrips, which are small, dark brown and found in flowers and cause flower drop, deformation of pods, deterioration of grain quality and ultimately heavy reduction in yield.
2. Last irrigation to summer moong should be stopped 55 days after sowing. This would help in uniform ripening of the crop.

SUNFLOWER

1. Due to prevailing hot weather conditions, sunflower would require irrigation at 8-10 days interval during this period. Various types of caterpillars such as Tobacco caterpillar and hairy caterpillar feed on green leaves and defoliate the attacked plants. Monitor the field regularly at weekly interval, and collect and destroy egg masses/gregarious larvae of these pests.

MENTHA

1. Due to prevailing hot temperature conditions, *mentha* crop requires frequent but light irrigations.

TURMERIC

Complete the sowing of turmeric during the first week of this month in the sub-montaneous and Northern districts. Do not allow the planted crop to suffer from water stress. Give light and frequent irrigations till crop emerges. After the sowing of crop, spread the paddy/wheat straw over the crop. It helps in reducing irrigations and weeds.

FODDER PRODUCTION

1. Grow mixture of non-leguminous and leguminous crops i.e. maize + cowpea to get more nutrients.

VEGETABLES

1. Irrigate vegetable crops at weekly intervals depending on soil and climate conditions.
2. Harvest fruits of okra, bottle gourd, cucumber, bitter gourd, sponge gourd, *tinda,* and summer squash when green and tender. Harvest muskmelon and watermelon after checking for sweetness and flesh colour. Chilli can be harvested green or red depending on requirement. Harvest in evening to avoid disruption in pollution.
3. Harvest mature umbels of seed crop of onion and carrot at weekly intervals. Dry, thrash, clean and store the dry seed in a dry place. Harvesting should be completed in 3 to 4 rounds in the morning

as it prevents shattering of seed.

4. Harvest the onion and garlic bulbs. Cure under shade and store them in a dry place. The garlic should be stored with stalks intact and after tying in small bundles. The onion stalk should be cut just 2-3 cm above the bulb before storage to prevent the infection during storage.
5. Since prices are low during this period, buy tomato in bulk to prepare ketchup, chutney, juice etc. for later use.
6. Fruit and shoot borer of brinjal should be controlled by spraying Proclaim 5 SG @ 80 g or Coragen 18.5 SC @ 80 ml in 100-125 litres of water per acre.
7. Brinjal mite may also be checked by spraying 300 ml Omite 57 EC in 100-150 litres of water per acre.

HORTICULTURAL OPERATIONS

1. Special attention to irrigate the orchards laden with fruits must be given during this month. In peach, plum and pear orchards, apply light and frequent irrigations for proper development of fruit size and better quality. To grapes, apply irrigation at weekly intervals during this month. The young litchi plants may need irrigation twice a week.
2. As the temperature rises considerably in this month, so to protect the fruit plants, whitewashing of tree trunks should be done as soon as possible if not done in previous month.
3. Second fortnight of May is the best time for pruning of *ber* trees, as the trees shed their leaves and become dormant. After pruning, apply 100 kg well rotten farm yard manure to full grown trees. Immediately after pruning, groundnut variety TG 37A can be sown as an inter cropping in *ber* orchards to generate additional income. This variety matures in 100-110 days.
4. Spray 1.0 % potassium nitrate (10 g/litre water) at the end of May in Kinnow, specially in the areas of Potassium deficient soils for fruit quality improvement.
5. To get high quality winter guava crop and avoid rainy season crop in guava, spray 10% urea or 600 g NAA, when full bloom in guava occurs during April-May. Dissolve NAA 600 g in 1.5-2.0-liter alcohol before making solution in 1000 liters of water.
6. In guava, apply the first half of recommended dose of the inorganic fertilizers along with full dose of FYM by the end of this month. Apply paddy straw mulch @ 4 tons per acre during this month for weed suppression and water conservation.
7. Splitting of fruits in many fruits *viz.* litchi, pomegranate, lemons is common phenomenon during summer months. Mulching the soils with paddy straw and water spray on fruit plants can be done to improve the microclimatic conditions and maintain the soil moisture as a measure to reduce fruit cracking.
8. Zinc deficiency in citrus and plum can be controlled by giving foliar spray with 0.3 per cent (3.0g/liter water) zinc sulphate solution.
9. For Banana, apply 60 g urea and 60 g Muriate of Potash per plant.
10. Harvesting of fruits of peach, plum, *phalsa* and mature bunches of perlette grapes may be undertaken and marketed after proper grading and packing.
11. In grapes, spray Bordeaux mixture 2: 2: 250 in the last week of May for controlling anthracnose.
12. Spray 10g of 2, 4-D Sodium salt (Horticulture grade) by dissolving it in 500 litres of water in the first week of this month to check fruit drop in mango.

ORNAMENTALS

Lawns

Timely irrigation and mowing is required as the grass grows vigorously due to higher rate of photosynthesis with rising temperature. For establishing the new lawn, deep plough the soil and expose to hot sun rays during this month. Irrigate the soil and rough out the weeds completely with roots.

Roses

Rose plantations need judicious watering to keep the soil at optimum level of moisture. The root suckers arising from the rootstock and diseased/dried shoots should be removed frequently. Remove buds over the shoots and allow the rose bushes to rest by avoiding flowers during this stressful period.

Chrysanthemum

In small flowered (Korean) varieties, second pinching should be done followed by nutrient application for getting more number of shoots and subsequent terminal cuttings.

Permanent plants

Trees, shrubs and climbers should be irrigated at an interval of 5-7 days, ensuring the soil around is moist. Young plants should be enclosed by erecting *kullies* made of paddy straw and if required, staking should also be done to keep their trunk erect. The trunk of grownup trees should be white washed till 4.5 feet height from the ground level.

Pot plants

The potted foliage plants should be shifted under partial shady area or be kept at place receiving morning sunlight and not afternoon sun. These plants can be kept under shade of trees or can be covered by 50% shade nets intercepting half of the sunlight.

FARM FORESTRY

Poplar

- Turmeric can be sown in poplar having less than three years of age. In the plantations of three year and more than three years age, *kharif* fodders such as maize, sorghum, *bajra*, cowpea, etc. should be grown.
- Apply irrigations at weekly interval to nursery and field conditions.
- Poplar leaf defoliator and leaf webber in nurseries should be controlled by collecting and destroying the infested leaves.
- Apply one third dose of recommended nitrogen fertilizer during this month. In light textured soils, the deficiency of Zinc is seen. Apply the Zinc Sulphate 21 % (100, 200 and 300 g per plant in first, third and fifth year, respectively).

BEEKEEPING

To protect honey bee colonies from harsh summer heat, place the colonies under thick shade of trees, else make other alternative arrangements to provide some artificial shade. To move colonies to a closer distance shade, move colonies daily by 3 feet maximum. If the colonies are to be shifted to shade at a longer distance, close the colonies entrances in the late evening and shift these to some suitable place more than three kilometers from the original site and bring these to the already selected shady place after about seven days. Maintain proper distances among the colonies to prevent drifting and robbing menaces which otherwise may spread bee diseases and mites. To meet the increased water requirement, put a few sticks/bushes or pieces of wooden planks in the water tanks of tubewells, for the bees to sit on for collecting water. This requirement can also be met by providing water in earthen pots kept under

the legs of hive stand. This would also keep the ants away from the colonies. Ventilation in the colonies may be improved by placing thin twig pieces (splinters) between bottom board and brood chamber, and between brood chamber and super chamber, but make sure that these gaps are not big enough for bees to pass through. The increased ventilation also hastens the honey ripening. Extract sealed (ripe) honey from earlier clover (*Berseem*) or sunflower nectar flow. Follow all recommended precautions to avoid robbing during and after honey extraction. If infestation by the brood mite, *Tropilaelaps clareae,* is noticed, dust sulphur powder on the top bars of bee combs @ 1.0 g per comb. In the case of infestation by *Varroa,* destruction of sealed drone brood comb part, *Varroa* trapping on drone brood and then its destruction along with the capped drone brood, dusting of finely ground sugar powder on bees late in the evening and the use of sticky papers with *Varroa* bottom board, can be integrated. Proper spacing among the colonies and extraction of honey from only the brood-free combs obtained from supers separated from brood chamber with queen excluder help in preventing spread of brood menaces among the colonies in apiary. Keep a vigil on the brood diseases and on suspicion, immediately consult experts; appropriate control measures should be undertaken and non-chemical methods should be preferred; avoid the use of antibiotics.

MUSHROOM GROWING

1. Procure and store wheat straw at a dry place for its use in button mushroom composting during September.
2. For the cultivation of paddy straw mushroom (summer variety), clean and disinfect the growing rooms for bed preparation and make paddy straw bundles (approximately 1-1$^{1/2}$ kg each).
3. Soak the prepared bundles in water. Prepare the beds by layering spawn in the soaked bundles as per recommended technology of PAU.
4. Watering should be done twice a day on the beds and floors of the growing rooms for maintaining humidity.
5. Harvesting of the fruit bodies can be started after 10-12 days of spawn run which continues for one month.
6. For milky mushroom cultivation, the wheat straw is pretreated by boiling, spawned and filled in bags.
7. Casing should be done after complete spawn run (15-18 days). Watering should be continued for next 30 days till the harvesting of the mushroom.

DAIRY AND ANIMAL HEALTH

1. Silent heat is a major problem in buffaloes during hot months (from April to September). Observe the heat symptoms in the early hours of morning and late hours in the evening. Mucous discharge from vagina is the only prominent sign while other symptoms are weak in summer. AI should be done within 10- 12 hours of heat symptoms onset.
2. *Gal Ghotu*, Lumpy skin disease can cause heavy loss in unvaccinated animals. If it is not already done, get your animals vaccinated immediately against the disease. If vaccination against FMD is not yet done, then go for FMD vaccination first followed by vaccination for *Gal Ghotu* with a gap of 21 days between two vaccinations.
3. Save your animals, from ticks, lice and flies and internal parasites. These suck blood, cause irritation and spread parasitic diseases. Due precautions should be taken while applying the insecticide on the animal body. Repeat deworming every three months in adult animals with different chemicals to avoid drug resistance. Follow the instructions of veterinarian/ manufacturer strictly.
4. Keep the animals in shade and provide clean fresh drinking water. Provide good air flow using electric fans, and use sprinklers and foggers to reduce heat stress. Provide screens for control of insects, flies, etc.
5. Due to sun stroke if an animal starts bleeding from nose, do not disturb it much and pour ice cold water over face and head; and keep its head lifted. Transfer animal to a cool shady place. Consult Veterinarian at the earliest.
6. In case of high rise of temperature in dairy animals, get their blood tested for protozoan diseases from the Department of Parasitology, Guru Angad Dev Veterinary and Animal Science University, Ludhiana or State/District Laboratories near to your place.
7. Provide concentrate rations during cool hours of the day like early morning or late evening.

POULTRY FARMING

1. Provide double number of waterers for increasing space to meet increasing requirement of water. Change the water frequently to provide cool water. Provide cool air flow using desert coolers, use sprinklers and foggers to reduce heat stress.
2. Sprinkling of water around the shed and more green area surrounding the shed is helpful in reduction of heat. White washing of poultry shed from outside will be helpful in reflecting the sun rays back from the shed.
3. Increase protein, minerals and vitamins in feed as the feed intake is reduced during summer. Provide electrolytes in drinking water.
4. Provide no light to growers of 6-16 week age, but layers must be provided light at night and early in morning to compensate the decreased feed consumption during the day time.
5. Get your birds of 6-8 weeks of age vaccinated with injection of R2B Ranikhet disease. Do not give this vaccine in drinking water or *lassi*. In the case of an outbreak of *Ranikhet* disease immediately, give R2B vaccine injection to healthy birds to avoid further loss. Provide vitamin supplemented water to vaccinated birds.
6. If there is sudden fall in egg production or mortality, consult the Poultry expert immediately.
7. Do not provide feed during day hours to the birds as it will increase heat load. Fat content of the feed should be increased by 1-2% to meet the energy requirements in summer. Therefore, feed the birds during cool hours preferably during early hours in the morning and late in the evening.
8. To prevent *E.coli*, use 250 ml acidifier+120 ml sanitizer in 100 lit of drinking water. Don't fill water tank to full capacity during summer.
9. Use 1 g/10 lit ammonium chloride in drinking water to reduce temperature during summer.
10. Monitor shed temperature using thermometer and don't disturb birds frequently.

Compiled by: Amarjit Singh

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Training Programmes in May

KVK, AMRITSAR (98723-54170)

May 06 : Farm yard manure – preparation technique and effect on soil health
May 07-08 : Processing and packaging of turmeric
May 09 : Integrated Pest and Disease Management in *kharif* crops
May 13-24 : Dairy Farming
May 14 : Direct seeding of paddy/*basmati* - a resource conservation approach
May 15 : Weed management practices in orchards and vegetables
May 16 : New production technologies for *kharif* crops
May 17 : Identification and management of deficiency symptoms in *kharif* crops
May 20-28 : Recycling clothing and macrum to prepare household products
May 22 : Effects of Green Manuring on soil health
May 27 : Silage preparation for dairy animals during lean period
May 29-30 : Value addition to cereals and pulses by making *papad* and *warrian*

KVK, BATHINDA (0164-2215619)

May 06 : Judicious use of irrigation water
May 07 : Silage preparation for dairy animals during lean period
May 08 : Soil, water and nutrient management for sustainable crop production
May 09 : Seed treatment- a preventive measure for seed-borne diseases
May 14 : Low cost nutritious recipes using seasonal ingredients
May 15 : Role of green Manuring to enhance soil health
May 17 : Importance of Green Manuring
May 23-31 : Dairy Farming
May 24 : Direct seeding of paddy/*basmati*-a resource conservation technique

KVK, FARIDKOT (01639-253142)

May 02 : Recent advances in preservation and nutritious diet
May 03 : Improved cultivation techniques of *kharif* crops
May 06-08 : Seed production of okra (at different stages)
May 07 : Paddy mechanization and resource conservation technologies in agriculture
May 08 : Integrated Pest Management in *kharif* crops with impetus on splat technology in cotton
May 09 : Garment enrichment through different techniques
May 13-17 : Goat Farming
May 14 : Integrated Nutrient Management in field crops
May 15 : Solar cooker and solar dryer as renewable sources of energy
May 16 : Safe use and handling of spraying equipments and farm machinery
May 17 : Cultivation of millets
May 20 : Soil, water and nutrient management for sustainable crop production
May 22 : Safe and judicious use of pesticides
May 27 : Silage preparation for dairy animals during lean period

KVK, FATEHGARH SAHIB (01763-221217)

May 03 : Cultivation practices for millets and soybean
May 07 : Seed treatment for control of seed borne diseases in *kharif* crops
May 09 : Micro-irrigation and fertigation practices in orchards
May 13 : Direct Seeded Rice technology
May 14 : Solar cooker as a renewable source of energy
May 16 : Integrated Nutrient Management in Direct Seeded Rice
May 20-24 : Poultry Farming
May 21 : Cultivation of paddy straw and milky mushroom
May 22 : Prevention and control of *ecto*-parasites in dairy animals
May 23 : Integrated Pest and Disease Management in *kharif* crops
May 24 : Bio-agents and non-chemical methods for disease and pest control
May 27-31 : Value addition of summer horticultural crops
May 28 : Soil, water and nutrient management for sustainable crop production

KVK, FEROZEPUR (MALLEWAL) (01632-279517)

May 02 : Drip irrigation system in fruit plants
May 03 : Organic Farming
May 07 : Marketing of chilly
May 08-17 : Dairy Farming
May 09 : New emerging and zoonotic diseases of livestock
May 13-17 : Value addition to agricultural produce
May 14 : Improved cultivation techniques of *kharif* crops
May 15 : Contagious diseases of livestock and preventive measures to prevent their spread
May 20 : Improved cultivation techniques of *kharif* crops
May 21 : Integrated Pest and Disease Management in *kharif* crops

KVK, GURDASPUR (01874-220743)

May 07 : Paddy mechanization including mat type nursery raising
May 09 : Improved cultivation techniques of *kharif* crops
May 13 : Use of laser land leveller
May 14 : Irrigation scheduling in orchards during summer season
May 15 : Direct seeding of rice/*basmati*-a resource conservation approach
May 16 : Management of nematodes in vegetables crops
May 17 : Integrated Nutrient Management through green manuring and Farm yard manure in *kharif* crops
May 22 : Identification and management of nutrient deficiencies in *kharif* crops

May 27 : Improved production and protection practices in *kharif* crops
May 28 : Management of dairy animals during summer season
May 29 : Good Agricultural Practices in orchards (mulching, drip irrigation etc.)

KVK, HOSHIARPUR (BAHOWAL) (98157-51900)

May 06 : Value addition to pulses and oilseeds
May 07 : Silage making
May 08 : Cultivation practices for millet crops
May 09-16 : Scope of agro-processing complexes for enhancing farmers' income by value addition of produce
May 13-24 : Dairy Farming
May 27-31 : Embellishment of clothes using modern and traditional techniques
May 14 : Improved cultivation techniques of *kharif* crops
May 16 : Seed treatment: a preventive measure for insect pest management
May 21 : Use of solar energy gadgets
May 24 : Balanced diet for different age groups
May 27-31 : Preservation of seasonal summer fruits and vegetables
May 28 : Integrated Farming System

KVK, JALANDHAR (NURMAHAL) (01826-292053)

May 02 : Methods of collecting soil and water samples and interpretation of results
May 03 : Improved cultivation techniques of *kharif* crops
May 08 : Judicious use of water in *kharif* crops
May 09 : Use of solar cooker and solar dryer as renewable sources of energy
May 13-21 : Pig Farming
May 16 : Cultivation of rice/*basmati* through Direct Seeded Rice technique
May 17 : Improved cultivation techniques of *kharif* crops
May 20-24 : Repair and maintenance of agricultural machinery
May 21 : Post-harvest management/ handling of summer vegetables
May 22 : Summer management and feeding of dairy animals
May 23 : Integrated Nutrient Management in *kharif* crops
May 24 : Tips for custom hiring of agricultural machinery as subsidiary occupation
May 28 : Seed treatment in *kharif* crops

KVK, KAPURTHALA (01822-233056)

May 06 : Direct seeding of paddy/*basmati*- a resource conservation approach
May 07 : Rain water harvesting and irrigation techniques for saving water
May 08 : Use of solar cooker and solar dryer as renewable sources of energy
May 09 : Methods of collecting soil and water samples and interpretation of results
May 14 : Integrated Pest and Disease Management in *kharif* crops
May 15 : Bio-agents and non-chemical methods for disease and pest control in vegetables
May 16 : Cultivation of millets
May 17 : Judicious use of water and fertilizers in *kharif* crops

KVK, LUDHIANA (SAMRALA) (01628-261597)

May 02 : Solar cooker and solar dryer as renewable sources of energy
May 03 : Seed treatment in paddy and *basmati*
May 06 : Crop regulation in guava
May 07 : Balanced diet for different age groups
May 08 : Organic Farming
May 09 : Water conservation techniques including rain water harvesting
May 13-17 : Preparation of eco-friendly cleaning agents
May 20 : Improved cultivation practices of *kharif* crops
May 21 : Integrated Pest Management in *kharif* crops
May 23 : Custom hiring of agricultural machinery
May 24 : Soil, water and nutrient management for sustainable crop production

KVK, MANSA (01652-280843)

May 02 : Direct Seeding of paddy/*basmati*- a resource conservation approach
May 03 : Solar cooker and solar dryer as renewable sources of energy
May 06 : Organic Farming in vegetables
May 07 : Integrated Pest and Disease Management in *kharif* crops
May 08 : Soil, water and nutrient management for sustainable crop production
May 09 : Judicious use of irrigation water in *kharif* crops
May 13 : Pesticide residue free *basmati* cultivation
May 14 : Nutritious recipes for young children and pregnant/ lactating women
May 16 : Integrated Nutrient Management in field crops
May 17 : Summer management and feeding of dairy animals
May 27-31 : Poultry Farming

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

May 06-17 : Dairy Farming
May 07 : Improved cultivation techniques of *kharif* crops
May 08 : Seed treatment– a preventive measure for seed-borne diseases
May 09 : Use of solar energy gadgets
May 13-17 : Embellishment of clothes using modern and traditional techniques
May 15 : Improved cultivation techniques of *kharif* crops
May 17 : Efficient utilization of non-conventional energy gadgets
May 22 : Direct seeded paddy/*basmati*
May 23 : Value addition to pulses
May 24 : Care and management of newly born calves and pet animals
May 28 : Improvement in soil health through organic manures
May 30 : Summer management and feeding of dairy animals

KVK, PATHANKOT (98762-95717)

May 02 : Preparation of mat-type nursery of paddy
May 03 : Methods of collecting soil and water samples and interpretation of results
May 06 : Different types of millets and their benefits
May 09 : Improved cultivation techniques and Integrated

nutrient management in *kharif* crops
May 13 : Laser leveller -efficient water saving technique
May 14 : Prevention and control of *ecto*-parasites (ticks) in dairy animals
May 15 : Improved cultivation techniques of *kharif* crops
May 16 : Improved varieties for *kharif* crops
May 20-24 : Beekeeping
May 27-31 : Seed production of *kharif* crops

KVK, PATIALA (RAUNI) (94642-10460)

May 02 : Organic Farming
May 03 : Seed treatment of paddy and *basmati* against seed borne diseases
May 07 : Hybrid seed production of chilli
May 08 : Improved cultivation practices of *kharif* crops
May 09 : Processing of tomato
May 13 : Nutrient management in fruit plants and vegetable crops
May 14 : Personal hygiene and nutritional practices for adolescent girls
May 15-21 : Processing of horticultural produce
May 16 : Direct seeding of paddy/*basmati*-a resource conservation approach
May 22 : Summer management of honey bees
May 23-31 : Entrepreneurship development programme in Dairy Farming
May 27 : Soil health management through green manuring, vermicompost, biofertilizers and FYM use
May 30 : Recharging of underground water and judicious use of poor quality water for irrigation in crops

KVK, ROPAR (01881-220460)

May 02 : Methods of collecting soil and water samples and interpretation of results
May 03 : Preventive methods of post-harvest losses of vegetables
May 06 : Processing of milk at domestic level
May 07 : Integrated Nutrient Management in *kharif* crops
May 08 : Integrated Pest and Disease Management in *kharif* crops
May 09 : Cultivation of *kharif* crops in *Poplar* and *Eucalyptus*
May 13-23 : Dairy Farming
May 14 : Feeding and management of poultry birds
May 15 : Judicious use of water in *kharif* crops
May 16-22 : Preparation of millet based bakery and confectionary products followed by their packaging
May 24 : Integrated Nutrient Management in *kharif* crops
May 27 : Improved cultivation techniques of *kharif* crops
May 28 : Seed treatment in *kharif* crops

KVK, SANGRUR (KHERI) (01672-245320)

May 02 : Organic Farming
May 03 : Seed treatment of paddy and *basmati* against seed borne diseases
May 06 : Organic Farming of vegetables
May 07 : Seed production of summer vegetables
May 08 : Improved cultivation practices of *kharif* crops
May 09 : Raising of mat type nursery for mechanical transplanting of paddy
May 13 : Machinery for *kharif* crops and establishment of custom hiring centres of agricultural machinery
May 14 : Improved production practices for *kharif* crops and cultivation of Direct Seeded Rice
May 15 : Personal hygiene and nutritional practices for adolescent girls
May 16 : Water conservation techniques including Direct Seeded Rice and Rain Water Harvesting
May 17 : Direct seeding of paddy/ *basmati*-a resource conservation technique
May 20 : Summer management and feeding of dairy animals
May 22 : Summer management of honey bees

KVK, SHAHEED BHAGAT SINGH NAGAR (LANGROYA) (01823-250652)

May 02 : Solar cooker and solar dryer as renewable sources of energy
May 03 : Seed treatment – a preventive measure for seed-borne diseases
May 06-13 : Value addition of summer horticultural crops and *wadi* making
May 07 : Water conservation techniques
May 08 : Post-harvest management/handling of summer vegetables
May 09 : Summer management and feeding of dairy animals
May 13-27 : Dairy Farming
May 14 : Cultivation practices for millet crops
May 15 : Improved cultivation techniques of *kharif* crops
May 16 : Micro irrigation, fertigation and weed management practices in orchard
May 28 : Integrated Farming System

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

May 06 : Organic Farming
May 07 : Seed treatment –a preventive measure for seed borne diseases
May 08 : Solar cooker and solar dryer as renewable sources of energy
May 13-17 : Preservation of seasonal summer fruits and vegetables
May 14-22 : Dairy Farming
May 16 : Improved cultivation techniques of *kharif* crops
May 17 : Integrated Pest Management in *kharif* crops
May 23 : Direct seeding of paddy/*basmati*-a resource conservation approach
May 27 : Formulation of balanced feed using domestic ingredients
May 28 : Nutritious recipes for young children and pregnant/ lactating women
May 29 : Silage making for dairy animals during lean period
May 30 : Personal hygiene and nutrition for adolescent girls

SKILL DEVELOPMENT CENTRE (0161-2401960 EXT 261)

May 02 : Cultivation of Direct Seeded Rice, raising mat type nursery and mechanical transplanting
May 14-16 : Cultivation of summer/tropical mushroom
May 20-24 : Preparation of natural vinegar, low-alcoholic naturally carbonated beverages and lacto fermented pickles

Compiled by: Dr Inderpreet Kaur Boparai and Dr Manoj Sharma

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