Soil, air and water conservation
Adopt this practice for future generation

Virtual Kisan Melas

Ludhiana  March 24-25

Ballowal Saunkhi   March 14
Nag Kalan Jahangir (Amritsar) March 14
Rauni (Patiala)   March 16
Gurdaspur       March 21
Faridkot        March 21
Bathinda        March 29
Dear farmers, farm women and youths

Here come the Kisan Mela, there is an upsurge of spirit with the festivity round the corner. The Punjab Agricultural University, Ludhiana has been rendering a yeoman’s service to the India’s and Punjab’s agriculture by being a guiding light for the farming community. Punjabi farmers, the masters of the soil and the founders of the prosperity, have been riding the waves and winds to fill the godowns with food grains. The assiduousness and fortitude of Punjabi farmers as well as men of intellect at PAU has proved to be a unity of strength for the state and the nation. Truly, the PAU-farmers’ relationship is a sign of goodwill as well as success that has turned the fortunes of agriculture.

Just as warehouses are jam-packed with food grains, in the same way, PAU Kisan Mela are the storehouse of agricultural knowledge and technologies. Even during the toughest times of COVID-19, PAU’s research and extension wing dedicated their energies towards transferring the latest technologies to the farmers at their doorstep through virtual communication tools. The University started ‘Virtual Kisan Mela’ in September 2020 which received an overwhelming response from the farming community. This year, in March 2022, Virtual Kisan Mela are scheduled to be held on March 14 at Ballowal Saunkhri and Nag Kalan Jahangir (Amritsar), March 16 at Rauni (Patiala), March 21 at Gurdaspur and Faridkot, March 24-25 at Ludhiana campus and March 29 at Bathinda.

This issue of Progressive Farming is specifically dedicated to the 55 years of PAU Kisan Mela and covers vital contributions of research and extension programmes to the agri-development of Punjab and India; cotton cultivation and management of pink bollworm in the crop; cultivation of pulses, oilseeds (canola and gobi sarson) and date palms for diversification; disease and insect-pest management in sugarcane and spring maize and role of subsidiary occupations (beeking, mushroom cultivation, animal husbandry, etc.) in profitability.

You are the ‘aan, baan, shaan’ of these melas, which will lay thrust on promoting crop diversification, conservation of natural resources, adoption of subsidiary occupations and financial as well as agricultural sustainability. Quality seed and planting material, biofertilizers, farm literature (by PAU) and household items (by self-help groups) will be sold during these melas. Participate in these melas along with your families. Your gracious presence will make it a mega success.

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Research at Punjab Agricultural University (PAU) continues to provide strong underpinnings to agricultural development in the region. Rapid uptake of the PAU recommended technologies by the farmers not only reflects wealth of trust earned by the PAU research and extension system over the years, but also its huge role in sustaining the upward trajectories in crop productivity. Total parmal paddy arrival during the year 2021-22, so far remains among the highest (about 187 lakh MT) over the years, where in varieties recommended by the PAU have had around 65 per cent share. Likewise, wheat productivity during the previous season touched 48.6 q/ha with most of the varieties recommended by the PAU, which occupied 93 per cent of total acreage in the state.

Productivity achievements, however, get eclipsed by the huge water footprint and crop residue management challenges posed by the rice based cropping systems. The PAU research continues to evolve in order to engage with such challenges. Short duration rice varieties, agronomic practices and farm machinery developed and recommended by the university have made significant contribution in countering this issue. Direct Seeded Rice (DSR) technology upgraded and recommended on emergency basis to address COVID induced labour shortage during 2020, is here to stay; the area under DSR continued to rise gradually from 60 thousand ha in 2019, through 5 lakh ha in 2020, to 6.01 lakh ha in 2021. Mainstreaming of this technology has substantial implications for natural resource conservation. However, these within-system approaches cannot provide rapid and complete success with the groundwater depletion and crop residue management challenges unless these are complemented by the approaches involving diversification towards other crops. Dear farmers, it is highly gratifying to note that most of you are aware of these grave threats to sustainability of agriculture in the region. Perceptible changes are being witnessed through increase in area under vegetable crops over the years (from 258.5 thousand ha in 2017-18, 273.6 in 2018-19, 289.4 in 2019-20 to 305.4 thousand ha in 2020-21). Likewise, is the appreciation in area under fruit crops (83.6 thousand ha in 2017-18, 86.8 in 2018-19, 90.4 in 2019-20 to 93.6 thousand ha in 2020-21). The Punjab Agricultural University has been laying special thrust towards this alternative. Not only these and other diversification crops continue to have a predominant share in varietal output of research at the PAU, but the production-protection technologies have been matching the pace to stay relevant and provide a complete up-to-date package.

It is high time that Punjab after helping the nation in realizing the tall order of becoming food secure is making the country nutritionally secure as well. Leaving national role aside, a large chunk of Punjab’s population, especially, children and pregnant or lactating mothers need to be targeted for better nutritional outcomes. In this regard, home gardening can be a game-changer. The PAU had already recommended some years back an ideal kitchen gardening set up to model upon. The PAU extension system has been playing a significant role in adoption of the technology, especially among rural families. However, urban areas/suburbs cannot practice this model due to land constraints. The university has been alive to such limitations.
and recently standardized containerized vegetable production technology with respect to the geometry/size of the pot and growing media. This technology can harness spaces like window sills, balcony, doorsteps, patios, rooftops, etc. and make a significant dent in vegetable needs of the family. Decreased reliance on soil based media can help ward off soil-borne diseases, nematodes, poor soil aeration, etc. The lighter weight media can help in effective harnessing of sunlight. Container vegetable production can also provide gainful employment to womenfolk. It can also help children and adults alike in reaping mental health rewards from gardening.

Cotton cultivation, another diversification alternative, in traditional south-west belt had been making significant gains in acreage until it was disrupted by the pink bollworm attack during the recent season. The pest invasion did not let farmers capture full benefits from kind of record high prices (hovering much above the minimum support price, at about Rs 10,000 per quintal) prevailing in many markets. The PAU has been responding effectively to the pink bollworm challenge through its research. It has been recommended to adopt clean technologies like shredding, followed by ploughing in soil, the leftover cotton stalks after harvest with the help of a mulcher/shredder in order to curtail carry-over of the pink bollworm larvae residing in the infested bolls. A novel SPLAT based mating disruption technology has also been recommended. The technology will be further validated through field demonstrations during the coming season.

Pink bollworm attack also tended to reverse the decreasing pesticide usage trend brought about so painstakingly by the university and the line departments of the State government through extended adoption of integrated pest management approaches. The chemical footprint is also being tamed by promoting biopesticides, homemade neem-based solutions and defining economic threshold levels (ETLs). The pesticide use has been sliding in general (from 5,843 tonnes in 2016-17 to 5,193 tonnes in 2020-21) and use of biopesticides has been gaining wider acceptance (134 tonnes in 2016-17 and 210 tonnes in 2020-21). Use of the PAU homemade neem extract is being validated for increasing number of crops. During the last year, biofertilizers for 60,000 acres across 16 crops were prepared for promoting eco-friendly nutrient management.

Crop residue management is another grave challenge. However, many of you deserve appreciation for having shifted tangibly towards eco-friendly management of crop residues. Data provided by the Indian Council of Agricultural Research agency show that crop residue burning event count till November 30, 2021 stood at 71,304 in comparison to 83,002 over the same period during 2020. It is hoped that together, we will be able to hold onto upward momentum during the coming season. These endeavours will in the long term help realize significant gains in soil health – our important ally in sustaining productivity and natural resource endowments.

Some important technologies, which emerged recently from the research programmes running at the PAU are as under:

- In areas with poor quality irrigation water, fodder based cropping sequences, involving sorghum, berseem and ryegrass can be sustained by using good quality irrigation water at the time of sowing and alternating use of good quality and poor quality water thereafter.
- For higher saving in irrigation water, nursery of PR 126 rice variety can be sown up to June 20 and 25-30 days old seedlings can be transplanted up to July 10 or 20 by 15 cm spacing.
- PAU Leaf Colour Chart (LCC) technology has been extended to need-based nitrogen fertilizer topdressing in baby corn.
- Boron deficiency in arhar can be corrected by using borax (@ 5 kg/acre) at the time of sowing.
- An integrated nutrient management module has been recommended for DSR-potato-onion cropping system.
- Pneumatic planter has been recommended for maize planting. It will go a long way in ensuring even seeding of costly hybrid maize seeds.
- Paddy straw mulching has been recommended for effective weed control in marigold.
- Two annual chrysanthemum varieties AC 19 (cream) and AC 23 (yellow) have been developed and recommended. Corrugated Fibre Board (CFB) (3-ply) boxes have been recommended for efficient storage of chrysanthemum flowers.
- The CFB boxes (2, 4, and 10 kg capacity) can be used for packaging and transporting of the pear fruit.
- Process of pectin extraction from Kinnow and Mausambi waste has been standardized.
- Ultra-violet (UV) radiation induced vitamin D₂ biofortification of button mushroom paste has been recommended.

Research outcomes of the University can only be validated by their performance in your field or enterprise. Your feedback has been playing a significant role in fine-tuning of research agenda of the University. The University duly acknowledges your valuable partnership. Let us continue to nurture this exemplary symbiosis between the Punjab Agricultural University and hardworking peasantry of the region.
To ensure food security for the rising Indian population, Punjab has made an amazing progress and transformed the agricultural scenario of the country from a period of begging bowl to self-reliance in food production. Apart from making India self-sufficient in food grains, it has opened gates for export as well, but this accomplishment has led to over-exploitation of its natural resources, especially, groundwater to a threatening level. Looking at the reality of the groundwater table, it is the bitter truth that paddy was never a traditional crop of most of areas of Punjab, despite this the area and production under paddy has jumped by 10.7 and 43.1 times, respectively during the last five and a half decades (1965-66 till date). The cropping intensity has increased from 129 per cent to more than 200 per cent. To fulfill the irrigation needs of the rising area under paddy-wheat rotation, the number of tubewells has escalated from 26,000 to 14.75 lakh in the above said period. Presently, the tubewells are meeting 77 per cent of irrigation requirements, whereas canal water is being used only for 23 per cent. Continuous withdrawal of groundwater has disturbed the water balance in the state and more than 70 per cent of area is under extreme dangerous level of water depletion, particularly, in central districts of the state. Presently, out of 138 blocks of the state, 109 blocks are over-exploited and it is a matter of serious concern. As per the report of Central Groundwater Board, and Water Resources and Environment Directorate, if the existing trend of groundwater extraction continues, then the water resources will extinct in the next 20-25 years. To preserve the groundwater resources, legislation was passed by the Government of Punjab ‘Preservation of Sub-soil Water Act 2008’ (also known as Punjab Rice Nursery Act) which prohibits the farmers from transplanting rice nursery before June 10. The Punjab Agricultural University has also developed many short duration varieties and production techniques to conserve water and other natural resources.

Water saving technologies: The issue of conservation of groundwater is gaining immense importance due to the advent of water scarcity in the country, particularly, in Punjab. The Punjab Agricultural University has developed many varieties and technologies to address the problem of depleting water table. These innovations focus on reducing water use and improving its efficiency without any adverse impact on the crop yield, quality and economic returns. The short and medium duration rice varieties such as PR 126, PR 121, PR 124, PR 127, PR 129, etc. are gaining popularity in the state due to low input costs, especially, irrigation needs and higher net returns as compared to PUSA rice varieties. The water conservation technologies such as laser land levelling, drip irrigation, direct seeding of rice, raised bed planting, need based irrigation, use of tensiometer, mulching etc. have been recommended to improve water productivity. Laser land leveller has been adopted widely in Punjab and presently, almost entire cropped area is levelled with this technology. It has become popular not only due to its water saving potential but also due to significant economic benefits arising out of yield increment. Earlier, intensive ploughings of the crop fields were recommended to grasp higher productivity, however, later it was realised that intensive pulverisation of the soil was only adding to the cost of production and not bringing any improvement in the crop yield. The Punjab Agricultural University has also developed a simple and economical device called ‘tensiometer’ to standardise the use of water for rice crop according to the field conditions of available soil moisture and the crop water requirement. It improves the water-use
efficiency, thereby, saving a significant amount of water without any adverse impact on productivity. The need-based application of irrigation to paddy crop is very helpful to conserve underground water. The groundwater resources can also be managed to their sustainable level with delayed transplanting of rice. It can save a significant amount of water due to fall in evapo-transpiration rate of paddy.

Similarly, direct seeded rice in dry fields and at Tar-Wattar fields can save 10 and 20 per cent of water, respectively. In addition to surface irrigation systems, PAU has also recommended sub-surface irrigation and fertigation. With similar technology in zero till direct seeded rice-wheat system, saving of 47 per cent applied irrigation water and 20 per cent nitrogen can be achieved over conventional rice-wheat system. Rice can be transplanted on beds in heavy soils. It is worth mentioning that owing to shortage of labour for transplanting of paddy and extensive extension services of the university, the area under direct seeded rice is increasing every year. It has crossed 6.0 lac hectares during the last year. In addition to these technologies, the cultivation of basmati rice in particular areas is also helpful in sustainable use of natural resources.

Besides paddy, water saving techniques have also been developed for other crops such as cotton, sugarcane, maize, etc. Sub-surface irrigation can save 28.5 per cent of water and 20 per cent of nutrients in maize-wheat-summer moong rotation. Crop cultivation on permanent raised beds is being promoted to reduce water-use as compared to flat planting technique. In bed planted maize-wheat cropping system, farmers can save 53 per cent of water and 20 per cent of nitrogen fertilizer. Similarly, the sub-surface irrigation in cotton-wheat rotation also saves the ample amount of water and nutrients.

An extensive water saving is possible in horticultural crops as these crops, especially, fruit crops are permanent in nature. Drip fertigation in fruit and vegetable crops not only saves the water but also improves the crop yield, produces quality, reduces weed biomass and improves atmosphere-soil-plant relationship. About 10-25 per cent of fertilizers can be saved without harming the crop yield and quality. The Punjab Agricultural University has recommended drip irrigation and fertigation schedules for many fruit and vegetable crops. In brinjal, chilli and rabi-onions, 40-50 per cent of water can be saved as compared to conventional irrigations. In potato and peas, about 38 and 30 per cent of water saving is possible by using drip irrigation, respectively. Drip irrigation and fertigation schedules for Kinnow and guava orchards according to the age of fruit plants have also been recommended by the university. By employing drip fertigation system, orchardists can save 30-35 per cent of water and 20-25 per cent of nutrients. Paddy straw mulching in different vegetable and fruit crops is very helpful for conservation of soil moisture. Moreover, mulching improves the fruit yield and quality, suppresses the weed growth and reduces the cultivation costs in these crops.

Hence, there is an urgent need to take steps to ensure sustainable agriculture. Diversification of the existing cropping system to the maximum possible extent by shifting to less water requiring crops is one of the major viable options in present day scenario. The farmers must adopt PAU developed technologies to conserve groundwater, improve soil health, reduce use of agro-chemicals and for efficient management of crop residues. The Punjab Agricultural University is doing its best to provide the extension services even during the COVID-19 pandemic. It has launched new virtual tools to keep the farmers abreast of latest agricultural knowledge and technologies. To disseminate the newly evolved technologies, the university broadcasts the Facebook live programme every Thursday (available on YouTube channel also) and issues Kheti Sandesh, a weekly digital newspaper, every Wednesday. So, farmers must link with the University information system.

Dear farmers, the university will extend full support for providing every possible input and knowledge for harvesting of rabi crops and sowing of kharif crops in coming months. The improved seeds will be provided to every corner of the state and the virtual kisan melas will be organized to transfer new techniques at the farmer’s level. So, it is my humble request to all the farmers, not to burn wheat stubbles in the coming harvesting season because it will not only cause pollution but also destroy the essential nutrients, damage the microorganisms and other flora and fauna. For sowing and transplanting of paddy and other crops, farmers must follow the recommended practices and sow recommended varieties for the sake of natural resource conservation.
To serve the farming community with good quality seeds, Punjab Agricultural University, Ludhiana is engaged in quality seed production of various field and vegetable crops besides research, teaching and extension. The university invariably follows field and seed standards as per Indian Minimum Seed Certification Standards (IMSCS) during seed production. The quality seeds are provided to the farmers during the Kisan Melas of the university held at different locations of Punjab and also distributed at PAU Seed Shop, Seed Production Farms, Krishi Vigyan Kendras (KVKs), Farm Advisory Service Centres (FASCs) and Regional Research Stations. The following field and vegetable seeds will be made available during the March 2022 Kisan Melas:

The seed of the field and vegetable crops will be available for purchase during the Kisan Melas in March 2022. In addition, summer vegetable kits for kitchen gardening, summer vegetable seeds in small packets and turmeric seed will be sold at the melas. The seed of potato is available for sale at the University Seed Farm, Ladhowal.

### Crop Variety Packaging size (kg) Sale rate (Rs/ packet)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety</th>
<th>Packing size (kg)</th>
<th>Sale rate (Rs/ packet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy</td>
<td>PR 129 PR 128 PR 127 PR 126 PR 124 PR 122 PR 121 PR 114</td>
<td>8</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>1,050</td>
</tr>
<tr>
<td>Basmati</td>
<td>Pb Bas 5 Pb Bas 4 Pusa Bas 1121 Pusa Basmati 1509 Pusa Basmati 1637 Pusa Basmati 1718 CSR 30</td>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>1,500</td>
</tr>
<tr>
<td>Moong</td>
<td>SML 1827 ML 2056</td>
<td>2</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>900</td>
</tr>
<tr>
<td>Mash</td>
<td>Mash 1008 Mash 1137 Mash 114</td>
<td>2</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>720</td>
</tr>
<tr>
<td>Arhar</td>
<td>AL 882 PAU 881</td>
<td>2</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>720</td>
</tr>
<tr>
<td>Fodder maize</td>
<td>J 1006 J 1007</td>
<td>5</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>750</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>1,500</td>
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<tr>
<td>Fodder cowpea</td>
<td>FBC 16 PCB 165</td>
<td>2</td>
<td>120</td>
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<td></td>
<td>4</td>
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<tr>
<td>Cotton</td>
<td>F 2228 F 2383</td>
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</tr>
<tr>
<td>Cotton (Desi)</td>
<td>LD 949 LD 1019 FDK 124</td>
<td>3</td>
<td>180</td>
</tr>
</tbody>
</table>

Besides, the seed of the newly released variety of basmati will also be made available during these melas. In addition to the seed of field crops, summer vegetable kits for kitchen gardening, summer vegetable seeds in small packets and
turmeric seed will be sold at the melas as detailed above.

The performance of varieties/seeds sold by PAU holds good only when the seeds after purchase are stored under optimum storage conditions; protected from the ill-effects of the environment like temperature, rain and humidity; protected from the storage pests and diseases; and grown under optimum conditions. Mishandling/negligence of the seed by the farmer/user can result in damage/loss/non-reproducibility of results. For more information regarding crop cultivation, please refer to the ‘Package of Practices for Crops of Punjab’ being published by PAU twice a year.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety</th>
<th>Packing size (g)</th>
<th>Sale rate (Rs/packet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottle gourd</td>
<td>Punjab Komal</td>
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<td>30</td>
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<tr>
<td>Sponge gourd</td>
<td>Punjab Naveen</td>
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<td>20</td>
</tr>
<tr>
<td>Cowpea</td>
<td>Cowpea 263</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Punjab Bajra</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Long melon</td>
<td>Punjab Long Melon No. 1</td>
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<td>20</td>
</tr>
<tr>
<td>Muskmelon</td>
<td>MH 27</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>Muskmelon</td>
<td>Punjab Sunehari</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td>Okra</td>
<td>Punjab Suhawini</td>
<td>100</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>150</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>Pb Samrat</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>PPH 1</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Punjab Magaz Kadoo</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Tinda</td>
<td>S 48</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>Tinda</td>
<td>Punjab Tinda 1</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Pb Haldi 1</td>
<td>2.5 kg</td>
<td>100</td>
</tr>
<tr>
<td>Vegetable kit (no.)</td>
<td>-</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

* Seed of potato is available for sale at university seed farm, Ludhowal

Turmeric seed will be sold at the melas as detailed above.

To keep the seed of paddy or basmati from the commercial crop for using it in next year, select a good plot of the standing crop and rogue it thoroughly so that it is made free from all admixtures and diseased plants. Harvest and thresh this plot separately. Dry the produce well; clean and store separately in disinfested bins. In this way, farmers can use their own saved seed for three years after purchasing new seed from the University. Similarly seed of composite maize, vegetables and other field crops can be used from the commercial crop, if safe distance from fields of other varieties has been ensured, so that there is no decline in genetic purity due to out-crossing. However, the seed of hybrids needs to be procured afresh every year, as it cannot be retrieved from the commercial crop.

Due to pandemic, the Kisan Melas are not organized physically during March 2022, but still the seeds of kharif crops and vegetables will be made available well in time at all the KVKs, FASCs, Regional Research Stations, Seed Production Farms and PAU Seed Shop located at gate no. 1 of Ludhiana campus. The seed sale outlets of PAU shall remain open seven days a week. To buy seed, farmers can contact the nearest seed sale outlet of the university.

Table: The contact numbers of various seed sale outlets located in different districts of Punjab are as under:

<table>
<thead>
<tr>
<th>Amritsar</th>
<th>81463-22553</th>
<th>Mohali</th>
<th>98722-18677</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathinda</td>
<td>95014-00556 and 97800-24223</td>
<td>Muktsar</td>
<td>98556-20914</td>
</tr>
<tr>
<td>Barnala</td>
<td>81461-00796</td>
<td>Mansa</td>
<td>94176-26843 and 98778-97080</td>
</tr>
<tr>
<td>Ferozepur</td>
<td>95018-00488</td>
<td>Jalandhar</td>
<td>84371-17010 and 81460-88488</td>
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<tr>
<td>Fatehgarh Sahib</td>
<td>81465-70699</td>
<td>Patiala</td>
<td>94173-60460 and 94633-78865</td>
</tr>
<tr>
<td>Faridkot</td>
<td>98554-49420 and 94171-75970</td>
<td>Pathankot</td>
<td>98723-54170</td>
</tr>
<tr>
<td>Fazilka</td>
<td>94639-74499</td>
<td>Roopnagar</td>
<td>81464-00248 and 98884-60091</td>
</tr>
<tr>
<td>Gurdaspur</td>
<td>78887-53919 and 98555-56672</td>
<td>Samrala</td>
<td>94650-62593 and 98721-66488</td>
</tr>
<tr>
<td>Hoshiarpur</td>
<td>98157-51900 and 95014-34300</td>
<td>Sangrur</td>
<td>99881-11757 and 94172-81311</td>
</tr>
<tr>
<td>Kapurthala</td>
<td>98155-47607 and 94643-82711</td>
<td>SBS Nagar</td>
<td>98727-45890</td>
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<tr>
<td>Ludhiana</td>
<td>81469-00244</td>
<td>Tarn Taran</td>
<td>89689-71345 and 94637-74731</td>
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<tr>
<td>Moga</td>
<td>81465-00942</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Tarvinder Pal Singh: 98724-28072
Kisan Melas (Farmers’ Fair), organised by Punjab Agricultural University (PAU) twice a year in March (kharif) and September (rabi), stand unparalleled till date. Unique in themselves, melas have proved to be salubrious for sedulous farmers, farm women and rural youths of Punjab and adjoining states since their inception in 1967. They have played a pivotal role in disseminating the latest agricultural knowledge among the farming community.

People of Punjab, the land of five rivers, have always been vigorous and conscientious. It is the place from where the Green Revolution sparked off and turned the country from food deficit to food surplus. The journey from ‘Begging Bowl’ to ‘Food Bowl’ and from ‘unproductive’ to ‘productive’ has been perilous. Hunger, starvation, disease and inadequate health and family care facilities deeply affected the normal life of the Punjabi farmers, who were torn-up by the roots during independence. After losing their fertile lands in Pakistan, they cultivated the uncultivated in Punjab (India) and lit the torches with their diligence. Even the hardest and the cruellest times failed to dampen the spirits of the Punjabi farmers; their invigorating spirits were a testimony to their optimism and spiritual strength. Green Revolution made its inroads with the introduction of land reforms; use of short-saturated, high-yielding varieties of wheat and rice; development of irrigation infrastructure; advanced use of chemical fertilizers; construction of rural link roads; provision of rural electrification; expansion of mechanization; availability of crop loans and price support policy; able administration of the government and unmatched scientific expertise. Technical guidance and know-how, provided to the Punjabi farmers during the melas, proved to be a boon for the state as the farmers were able to apply the gained knowledge in their fields that also led to the advent of Green Revolution. Punjabi farmers and agricultural scientists carved a niche for themselves by making the impossible possible.

Farmers along with their families have been participating in the melas enthusiastically. The University organizes seven kisan melas with one each at the main campus of PAU, Ludhiana; Krishi Vigyan Kendras at Rauni (Patiala) and Nag Kalan (Amritsar); Regional Research Stations at Ballowal Saunkhri, Bathinda, Faridkot and Gurdaspur. But during the last two years, COVID-19 has brought disaster in the entire world. As a result, everything has become online from offline. Even in the most distressed times, PAU organised Virtual Kisan Mela to remain in touch with the farmers and farm women of the state. Nearly 2,65,740 farmers, farm women and youths participated in the Virtual Kisan Mela in September 2020. Last year, in 2021, the mela saw massive participation that is more than 6 lakhs in March and September. The Directorate of Extension Education, PAU put in its best efforts to provide updated and improved agricultural knowledge, technologies and seed to the farmers at their doorstep during the pandemic. Information and Communication Technology (ICT) tools (as per 2021 report) such as WhatsApp group (827 groups), PAU Kisan App (79,000 subscribers), PAU Farm Inputs App (3,700 subscribers), PAU Web Channel (13,800 YouTube subscribers), Live Programme (Facebook and YouTube - reach 5 lakh in weekly programme), PAU Facebook (49,200 followers), PAU Twitter (1,000 followers), Farmers Portal on PAU Website in Punjabi (5,11,606 views), weekly digital newspaper (Kheti Sandesh - about 9,37,799 farmers), weather agro advisory (9.38 lakh farmers), Kisan Mobile Advisory Service (1,03,614 farmers) and PAU doots (message to fellow farmers through public address system of Gurdwaras/Mandirs) have been

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Adopt IPM strategies to manage pink bollworm on Bt cotton

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Bt cotton is the most important kharif crop grown in South-Western districts of Punjab, namely Bathinda, Mansa, Sri Muktsar Sahib, Sangrur, Barnala and Faridkot. The major bottlenecks in cotton cultivation is the attack of various insects and diseases, which causes damage to the crop throughout the season. After the cultivation of Bt cotton in the Northern India in 2005, the incidence of bollworms (American bollworm, spotted bollworm and pink bollworm) has reduced but during the last 5-6 years, the incidence of pink bollworm has been recorded on Bt cotton hybrids in the central and southern India. In 2020, the incidence of pink bollworm was recorded on Bt cotton in some villages of districts Bathinda and Mansa. However, during 2021 crop season, the incidence of pink bollworm was recorded in the whole cotton belt of Punjab and it varied from 0 to 90 per cent. To make the farmers aware of the possible attack of this pest on the cotton crop in the coming years, regular monitoring and campaign by the scientists of Punjab Agricultural University, Ludhiana and the officers from the Department of Agriculture and Farmers’ Welfare, Punjab has been going on since 2020. Thus, various off season and seasonal management strategies, developed by PAU, are discussed below along with its biology, damage symptoms and carryover.

Life cycle

Eggs are white when first laid but then turn orange 3-4 days before hatching but difficult to see with naked eyes. Young larva is white in color with dark brown head up to second instars. It becomes pinkish in third and fourth instar. The mature larva is 10-12 mm long, having broad horizontal bands of pink colour with larval period lasting for about 10-14 days. After feeding, it enters pupal stage near by the flower base or inside the boll or seeds. Larval period is of 7-10 days. Adults are small, greyish brown, with fringed hind wing. It may live for 1-2 months.

Nature and symptoms of damage

After hatching, the young larvae penetrate in ovaries of flowers or young bolls within two days of hatching. Larvae prefer feeding on developing seeds and generally pupate inside the seeds and bolls. Cotton lint in the infested bolls gets

To make the farmers aware of the possible attack of pink bollworm on the cotton crop in the coming years, regular monitoring and campaign by the scientists of Punjab Agricultural University, Ludhiana and the officers from the Department of Agriculture and Farmers’ Welfare, Punjab has been going on since 2020.
damaged by secondary fungal infection. The infested flowers can be identified from their typical rosette appearance (flower does not open fully), harbouring pink bollworm larvae smeared with pollen. Pre-mature boll/bud shedding can be seen on the soil. The larvae also damage the developing seeds and cotton lint. If boll is cut open, the pink caterpillar can be seen in the damaged lint.

**Cultural and mechanical control**

The sticks should be stacked vertically away from the field area where maximum penetration of sunlight in the sticks is there. These sticks should be used for fuel purposes by the end of February. Movement of the cotton sticks carrying unopened or half opened bolls from the infested areas to the new areas should be strictly avoided.

If possible, cover the stored sticks with a mosquito net (fine net) so that the emerging adults do not come out.

**Integrated Pest Management**

Being monophagous in nature, pink bollworm (PBW) feeds only on cotton. Therefore, it is easy to manage this pest by breaking its food cycle. The following integrated pest management strategies should be adopted for its effective management.

**Cultural and mechanical control**

- Sow recommended early maturing and short duration Bt cotton cultivars.
- Grow non-Bt cotton as refugia in Bt cotton. This is to avoid the development of resistance in bollworms against the Bt gene.
- Timely sowing (April to May 15) of varieties/Bt cotton hybrids helps in escaping the late season attack of pink bollworm.
- Before stacking, the sticks should be beaten up on ground to dislodge the unopened bolls that may be harbouring the larvae of PBW. These unopened bolls should be destroyed.
- The sticks should be ginned by the end of March and ginning waste must be destroyed immediately.
- By April-May, the left over seed lots should always be covered with polythene sheets so as to avoid the spread of pink bollworm to the nearby cotton fields.
- Destroy all trash collected during the ginning process.
- Fumigate the seed left uncrushed in the mills before the end of April with Celphos/Phostoxin/Delicia @ one 3-g tablet per cubic metre space, giving an exposure of 48 hours or use two tablets with an exposure of 24 hours.
- Non-fumigated seed should not be retained or sold by the ginneries.
- Only cotton-seed cake (khal) should be fed to the cattle and no seed should be kept for this purpose.
- The seed meant for sowing must be acid-delinted/fumigated in the ginneries before it is sold. The acid treatment kills the larvae of the pink bollworm. It also removes fuzz and thereby facilitates mechanical sowing.

**Surveillance procedure**

- Install one sticka/delta trap/ha and replace the lure after 15 days interval regularly for detection of the pink bollworm moth emergence around ginneries and cotton field round the year. Place it at least 15 cm above the crop canopy.
- For monitoring, collect 100 flowers from different spots at weekly interval, especially, examine the rosette flower of the cotton. Out of these, if five flowers show the above symptoms, then go for the spray.
- From different spots, pluck 20 green bolls, dissect them and count the number of pink bollworm larvae. If we get more than one larva, then immediately go for spray.

**Chemical control**

- Upto 60 to 120 days old crop, if 5 per cent damage of flowers or green bolls is observed, then spray the crop with 500 ml Curacon 50 EC (profenophos) or 200 ml Avant 14.5 SC (indoxacarb) or 250 g Larvin 75WP (thiodicarb) or 300 ml Bulldock 0.25SC (beta cyfluthrin) or 800 ml Fosmite 50 EC (ethion) per acre.
- On 120 to 150 days old crop, for the management of pink bollworm, spray 160 ml Decis 2.8 EC (deltamethrin), 200 ml cypermethrin 10 EC or 100 ml fenvalerate 20 EC or 300 ml Bulldock 0.25 SC (beta cyfluthrin) per acre basis.

Farmers should remain vigilant and contact *Krishi Vigyan Kendras* or Farm Advisory Service Centres or Regional Research Stations of PAU or Department of Agriculture and Farmers’ Welfare, Punjab, if any incidence of pink bollworm on Bt cotton is observed.

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Cotton plays a vital role in agricultural, industrial, economic and social sectors of our country. It is predominately cultivated in South-Western districts of Punjab, namely Bathinda, Mansa, Fazilka, Muktsar, Faridkot, Sangrur and Barnala. Cotton is the best option for crop diversification in South-Western Punjab. During the last few years, area under cotton cultivation is shrinking because of unpredicted yield losses either due to biotic or abiotic factors. During 2021, there was a severe attack of pink bollworm in the cotton belt of Punjab, especially, at Mansa, Bathinda and adjoining districts of Haryana. As per crop loss assessment report of district authorities, nearly one-third area of cotton was severely affected by pink bollworm in the cotton belt of the state. Additional problems of weed infestation, physiological disorders and nutrient deficiencies/imbalances are also responsible for poor yield of cotton and need to be addressed through agronomic interventions. To sustain cotton productivity, profitability as well as area under cotton cultivation, there is a need to adopt PAU recommended technologies for cotton production.

Cotton can be cultivated on all types of soils except too sandy, saline or waterlogged soils. The field should have proper drainage, especially, during rains as the crop is sensitive to water stagnation.

Improved varieties/hybrids: Selection of improved variety/hybrid is the most important decision in cotton cultivation. A list of Bt cotton hybrids, recommended by Punjab Agricultural University, is being published by the State Department of Agriculture and Farmers’ Welfare in popular newspapers every year prior to the start of sowing season. The University has also recommended Bt variety (PAU Bt 1), non Bt varieties [F 2228, LH 2108, LH 2076 and F 2383 (for high density planting system)], non Bt hybrid (LHH 144) and desi cotton varieties (LD 1019, LD 949 and FDK 124) for cultivation.

Tillage operations: Cotton fields having problem of hard pan or poor infiltration rate require sub-soiling for higher yield. Cross sub-soiling at 1.0 × 1.0 m spacing at 45-50 cm depth before normal ploughings/plankings can be done by tractor drawn sub-soiler (chiseler). This will help in breaking hard pan, increasing water infiltration rate and better root development, and ultimately increase productivity. For seed bed preparation, give 2-3 ploughings in a dry field, followed by heavy pre-sowing irrigation (rauni) by canal water or mixing tubewell water with canal water. When the field comes
in proper moisture condition (wattar), again give 2-3 ploughings and plankings. Avoid field preparation during noon hours as it causes excess moisture loss.

**Time of sowing:** All hybrid/varieties of American cotton (narma) and desi cotton should be sown from April to May 15. Late sowing leads to yield reduction due to poor plant growth and high incidence of insect-pests and diseases, especially, whitefly and cotton leaf curl virus disease.

**Seed rate:** The recommended seed rate is the primary factor for ensuring good plant stand and consequently higher yield. The seed rate for Bt cotton hybrids is 900 g Bt + 240 g non Bt (refuge) seed/acre (two packets of 450 g + 120 g each). Nowadays, non Bt refuge seed is already mixed with Bt seed in the packet. The recommended seed rate for Bt cotton variety (PAU Bt 1) is 4 kg/acre along with 1.0 kg/acre non Bt (refuge). The seed rate for American cotton (narma) varieties like F 2228, LH 2108 and LH 2076 is 3.5 kg/acre and for desi cotton varieties such as LD 1019, LD 949 and FDK 124 is 3.0 kg/acre. While seed rate for non Bt hybrid of American cotton (LHH 144) is 1.5 kg/acre.

**Sowing and planting geometry:** It is better to sow cotton at proper depth and soil moisture condition (wattar) in the morning hours or late afternoon because of higher moisture loss during noon hours in summer. The sowing may be done with tractor driven drill keeping row to row distance at 67.5 cm and by maintaining plant to plant distance of 45 cm in case of PAU Bt 1. All the varieties of American cotton should be sown at 67.5 × 60 cm and desi cotton at 67.5 × 45 cm. However, distance between plants of all American cotton hybrids (Bt and non Bt) should be maintained at 75 cm with a row to row spacing of 67.5 cm.

**Gap filling by transplanting:** Gaps due to poor germination or burning of seedlings must be filled for getting higher seed cotton yield. For this, three week old nursery grown in 4” × 6” polythene bags, filled with 1:1 mixture of soil and FYM, can be transplanted just before first irrigation.

**Fertilizer application:** For medium fertile soils, PAU has recommended 30 kg of nitrogen (65 kg urea) to all non Bt varieties, 37 kg of nitrogen (80 kg urea) to a Bt variety (PAU Bt 1) and 42 kg of nitrogen (90 kg urea) for all the hybrids (both Bt and non Bt hybrids) on per acre basis. Apply first half of nitrogen at thinning after first irrigation and remaining half at initiation of flowers for all varieties/hybrids. If cotton follows wheat and the recommended dose of phosphorus was applied to the wheat crop, omit its application to cotton. If phosphorus status of soil is low and not applied to preceding wheat crop, then apply 12 kg of phosphorus (75 kg SSP or 27 kg DAP) to all the varieties and hybrids on a per acre basis at the time of sowing. Wherever 27 kg of DAP is applied, reduce the urea dose by 10 kg.

In light soils, apply 20 kg muriate of potash and 10 kg zinc sulphate heptahydrate (21%) or 6.5 kg zinc sulphate monohydrate (33%) per acre at the time of sowing. In case of low fertile soils, one-third dose of nitrogen may be applied at the time of sowing. Need based application of urea through the use of leaf colour chart is helpful in reducing urea input without any reduction in yield. In boron deficient (< 0.5 kg available boron per acre) calcareous soils having 2% or more calcium carbonate, apply 400 g boron (4 kg borax) per acre at the time of sowing. However, boron should not be applied indiscriminately, as excessive boron application may cause toxicity.

**Foliar nutrient application:** In addition to soil applied fertilizers, there is a need of foliar application of some nutrients to fulfill the crop requirement for obtaining higher yield. Four sprays of 2% potassium nitrate (13:0:45) per acre should be given at weekly interval starting with the first spray at flower initiation. It reduces flower and squares drop in cotton. For making 2% solution, dissolve 2 kg potassium nitrate in 100 litres of water. To prevent reddening of leaves in cotton, give two sprays of 1% magnesium sulphate (1 kg magnesium sulphate dissolved in 100 litres of water) per acre at 15 days interval at full bloom and boll development stage. Cotton under low fertility soils shows wilting due to multi-nutritional deficiency after peak
flowering and boll development stage. Since nutrient demand at these stages is very high and soil applied nutrients are unable to meet it, this results in wilting/burning/reddening of cotton leaves. This problem can be prevented by timely and balanced use of recommended doses of fertilizers including four sprays of 2% potassium nitrate and two sprays of 1% magnesium sulphate.

**Weed management:** The major weeds of cotton field are *itisit, madhana, makra, chulai, tandla, bhakhra, khanghi booti* and *peeli booti*. These weeds can be controlled either by 2-3 hoeings or by use of herbicides. *Triphali* or wheel hoe or tractor drawn cultivator can also be used in the early stages of crop growth but their use should be avoided particularly during flowering and fruiting period as these may cause shedding of flowers and young bolls. However, chemical weed control in cotton is cheap and efficient. For control of weeds by herbicide, spray Stomp 30 EC (pendimethalin) @1 litre in 200 litres of water for one acre as pre-emergence within 24 hours of sowing. In situations where there are chances of weeds’ emergence after first irrigation or rains, Stomp 30 EC can also be applied after irrigation or rain when the field is in proper moisture (wattar) condition. Stomp should be sprayed uniformly by dissolving in 200 litres of water at recommended rate with flat fan or flood jet nozzle. Give one hoeing/interculture around 45 days after sowing to control the weeds, emerging after herbicide application.

Post-emergence application of Hitweed Maxx 10 MEC (pyrithiobac sodium 6% + quizalofop ethyl 4%) at 125 g a.i./ha (500 ml/acre), in moist soil after first irrigation also provides effective control of annual grasses and broadleaf weeds in cotton. As an alternate to hoeing/interculture, especially during rainy season, apply Gramoxone 24% SL (paraquat) @ 500 ml/acre or Sweep power 13.5% SL (glufosinate ammonium) @ 900 ml per acre in 100 litres of water as a directed spray using protective hood to control the crop rows at 6-8 weeks after sowing when the crop is about 40-45 cm. Both Gramoxone 24% SL and Sweep power 13.5% SL are non-selective herbicides and can cause injury to the cotton crop. So, care should be taken to avoid herbicide spray drift by keeping the boom height at 15-20 cm above the ground. Always use protective hood and spray on non-windy day.

**Reduction of excessive vegetative growth:** In highly fertile soils, excessive vegetative growth of cotton becomes a problem. Apply Chamatkar (mepiquat chloride 5% w/w) @ 600 ml per acre in two splits (300 ml at 60 days after sowing and repeat at 15 days interval using 80-100 litres of water to check excessive growth. Time of application may vary with the initial growth of crop to maintain optimum plant height.

**Irrigation and drainage:** Generally, 4-6 irrigations depending on rainfall are enough for raising a good cotton crop. Give first irrigation 4-6 weeks after sowing and the subsequent ones at interval of 2-3 weeks depending on soil type and rainfall. Last irrigation can be given by end of September so as to hasten boll opening. The crop must not be allowed to suffer from severe moisture stress during the flowering and fruiting period as it will cause shedding of flowers and young bolls. Cotton is also very sensitive to water stagnation, especially, during early growth stage. Therefore, drain out the stagnant water, if such a situation arises.

**Drip irrigation and fertigation:** Both surface and sub-surface drip irrigation along with fertigation improve yield of American cotton and save huge water. In case of surface drip irrigation, drip inline laterals are laid on the surface along the crop rows at spacing of 67.5 cm and dripper are placed at 75 cm apart having a discharge of 2.2 litres per hour. Cotton should be drip irrigated for 50, 45, 40 and 35 minutes during May-June, July, August and September, respectively at seven days interval. In case of sub-surface drip irrigation, drip inline laterals are laid at the depth of 20 cm using tractor operated sub-surface drip layering machine and dripper are placed at 20 cm apart having discharge of 2.2 litres per hour. Cotton should be irrigated for 40, 35, 30 and 25 minutes during May-June, July, August and September, respectively at five days interval. For fertigation, apply 100 kg of urea/acre in 10 equal splits at seven and five days interval in surface and sub-surface drip, respectively. Start irrigation at 30-35 days after sowing and complete in 110-120 days.

**Defoliation in cotton:** To enhance earlier and uniform boll opening, apply a spray of Ethrel 39% (Ethephon 39%) @ 500 ml in 100 litres of water in the last week of October. It leads to 85-90 per cent defoliation after 7-10 days of spray.

**Picking:** Earlier and frequent picking is required in desi cotton as compared to American cotton. Pick clean and dry cotton at 15-20 days interval to avoid loss because of shattering on ground. Keep first and last picking separate to fetch good price in the market.

**Cotton stack management:** To prevent the carryover of pink bollworm to the next cotton season, cotton stalks must be managed efficiently. The cotton sticks should be stacked vertically away from the field area where maximum penetration of sunlight in the sticks is there. All cotton stalks should be used for fuel purpose by the end of February to prevent the pink bollworm carryover to the next season. Another way is that cotton stalks can be shredded in field with cotton shredder or mulcher. Super Seeder can be used for soil incorporation of stalks and wheat sowing in one go.

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 Sugarcane is an important agro-industrial crop after cotton and the best alternative crop to diversify the prominent rice-wheat cropping system in Punjab. In Punjab, it is cultivated over an area of nearly 91 thousand hectares and produced an average cane yield of 325 quintals per acre during 2019-20. It is a long duration crop of 10-14 months and infected by number of insect-pests and diseases, which causes significant reduction in cane yield and sugar recovery. The major insect-pests and diseases of sugarcane and their recommended control measures are as follows:

**INSECT-PESTS**

**Termite:** Its infestation usually occurs soon after planting of setts in the spring planted crops. Termites are active during April to June and become more serious under prolonged drought conditions, particularly in light textured soils where proper irrigation facilities are not available and in stressed crop due to disease or physical damage. The cut-ends and the buds of cane setts are the first to be attacked, resulting in drying up of shoot after germination, leading to a gappy stand of the crop.

In Punjab, sugarcane is cultivated over an area of nearly 91 thousand hectares. It is a long duration crop of 10-14 months and infected by number of insect-pests (termite, early shoot borer, top-borer, stalk borer, black bug and pyrilla) and diseases (red rot, wilt, smut and Pokkah Boeng). Farmers should follow the PAU recommended control measures for the management of these insect-pests and diseases.

**Management**

- Apply well-rotten farmyard manure 15 days before planting.
- Remove the stubbles and debris of previous crop from the field.
- Apply 200 ml Coragen 18.5 SC (chlorantraniliprole) using 400 litres of water over seed setts in furrows before covering them with soil or spray 45 ml Imidagold 17.8 SL (imidacloprid) in 400 litres of water with sprinkler along the rows at post germination stage (about 45 days after planting).

**Early shoot borer:** It appears from April to June. Its incidence is more pronounced in areas where drought and hot weather prevail during early stages of the crop growth. Larvae bore into the shoot to feed on the central leaves of the shoot. Infested shoots typically produce dead hearts which can be easily pulled out emitting foul smell.

**Management**

- Plant the crop early, i.e. before the mid-March.
- Apply 10 kg granules of Regent/Mortel 0.3 G (fipronil) before the setts are covered with soil by planking or 150 g Takumi 20 WG (Flubendamide) or 150 ml Coragen 18.5 SC (chlorantraniliprole) or 45 ml Imidagold 17.8 SL (imidacloprid) in 400 litres of water/acre with sprinkling can be done along the rows at post-germination stage (about 45 days after planting). For earthing up slightly, follow light irrigation.
- Use Tricho-card having 20,000 eggs of *Corcyra cephalonica* parasitized (seven days old) by *Trichogramma chilonis* per acre at 10 days interval from mid-April to end of June. These eggs are fixed on cards of 10 x15 cm size. Cut the cards into 40 pieces/strips, each having approximately 500 parasitized eggs. Staple these pieces of strip on the lower surface of the leaves uniformly at 40 spots per acre during evening hours. Normally eight releases are required. The Tricho-cards should not be stapled on rainy days.

**Top-borer:** It is unique among the moth borers as it infects sugarcane during all the stages of the crop growth. This pest appears from March to October and causes severe damage
during July-August. The central leaf of the cane top dries up and turns dark. The other typical symptoms are the shot-holes in the leaf, white or red streaks on the upper side of the leaf midrib and bunchy tops from July onwards.

**Management**
- Collect and destroy its moths and egg-clusters.
- Cut the attacked shoots at the ground level from April to June.
- Use Tricho-card having 20,000 eggs of *Corcyra cephalonica* parasitized (seven days old) by *Trichogramma japonicum* per acre at 10 days old interval from mid-April to end of June.
- Apply 10 kg granules of Ferterra 0.4 GR or 12 kg Furadan/Diafuran/ Furacarb/ Carbofuran/Fury encapsulated 3G (carbofuran) at the base of the shoots in the last week of June or in the first week of July only if the top boror damage exceeds 5 per cent level. Earth up slightly to check the granules from flowing with the irrigation water and irrigate the crop immediately.

**Stalk borer:** It is active throughout the year. The larvae overwinter in the stubble and water-shoots. The attack remains low during April-June and increases in July. Its incidence is highest during October-November. There are no outward symptoms of the attack of this pest. Entrance or exit holes on the attacked canes can be seen only after stripping. A larva sometimes damages upto three nodes and the cane may be attacked at several places. The cane yield and sugar recovery are adversely affected in the case of serious attack.

**Management**
- Do not use the cane seed from the infested field.
- Staple 40 Tricho-cards (5 cm x 2.5 cm) hard paper piece glued with 7 days old eggs of laboratory host, *Corcyra cephalonica* parasitized by *Trichogramma chilonis* to the under-sides of sugarcane leaves from July to October at 10 days interval. Each card should have approximately 500 parasitized eggs and be spread uniformly at 40 spots per acre. Normally 10-12 releases are required.
- At harvest, do not leave the water-shoots in the field.
- Do not ratoon a heavily infested crop. Plough the affected fields, collect the stumps and destroy.

**Black bug:** It is a pest of sugarcane mainly in ratoon crop. It prefers hot and dry conditions. The black adults and pink young nymphs suck the sap from the leaf sheaths. The attacked crop looks pale. This pest is active during April to June.

**Management:** Spray the crop with 350 ml of Dursban/Lethal/Massban/Goldban 20 EC (chlorpyriphos) in 400 litres of water per acre with manually operated sprayer. Direct the spray material into the leaf whorl.

**Pyrella:** This pest appears in April-May and severely damages the crop in August-September. The leaves of the damaged plants turn yellow, which result in reduction in cane yield and sugar recovery.

**Management:** Spray the crop with Dursban 20EC (chlorpyriphos) @ 600 ml per acre using 400 litres of water with manually operated knapsack spray pump.

**DISEASES**

**Red rot:** It is caused by fungus. The disease is primarily caused through infected setts and appears from July till the crop is harvested. The disease mainly affects the cane stalk though symptoms also appear on leaves. The first symptoms appear mostly on third or fourth leaf which turns pale, ultimately leading to withering and drying up of the whole crown. Later the whole clump dries up and upon splitting open the diseased cane longitudinally, the tissue exhibits red discoloration interspersed with white spots (bands) which are usually elongated at right angle to the long axis of the stalk. The pith of affected cane emits alcoholic smell and juice turns sour.

**Management**
- For planting, use seed from absolutely disease free seed plot. Cultivation of fairly resistant varieties like Co Pb 95, CoPb 96, Co 15023, CoPb 92, Co 118, CoPb 98, CoPb 93, CoPb 94, CoPb 91 and CoJ 88 should be done.
- Avoid planting of susceptible varieties like Co 238 and CoJ 85 and other unrecommended varieties like Co 89003, etc.
- Do not plant sugarcane in the disease affected fields for one year.
- Crush the affected crop early and plough up the fields soon after harvesting the crop. Collect and burn the stubbles.
- Rogue out the diseased clumps and destroy it by burning.
- Avoid ratooning of the diseased crop.

**Wilt:** This disease appears from July onwards. The leaves of the affected cane top first turn yellowish and finally dry up. On splitting open the diseased cane longitudinally, the tissue exhibits dirty red or diffused purple discoloration which is invariably darker near the nodes than in the remaining internodal portion. The tissue emits a disagreeable smell. The affected stalk becomes light and hollow. The control measures against this disease are the same as those of red rot. As the causal fungus persists in the soil over long period, the affected field should not be put under sugarcane for three years.

**Smut:** Smut is another disease caused by a fungus. This disease is prevalent throughout the year but is severe from May to July and again in October-November.

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Maize (Zea mays L.) is a versatile crop having wide adaptability under varied agro-climatic conditions. Globally, maize is an important cereal with high nutritive value and it is not only used as a food grain but also consumed as feed for livestock and poultry. In Punjab, it is the third most important food crop after wheat and rice. Spring season maize is gaining popularity because it gives more productivity as compared to the main season kharif crop. Moreover, it fits well in the cropping system with potato as the third crop. In Punjab, the cultivation of spring maize is very popular in the districts of Hoshiarpur, Kapurthala, Shaheed Bhagat Singh Nagar, Jalandhar, Ropar and Gurdaspur. Spring maize crop is attacked by various insect-pests along with diseases from time to time, which cause economic losses to the farmers. However, proper management of these insect-pests and diseases can increase their production and improve the quality. Hence, this article is focused on various insect-pests along with their control measures.

INSECT-PESTS

Maize shoot fly: Maize shoot fly is the most serious insect-pest of spring maize. It attacks very young (3-7 days old) seedlings, producing deformed, twisted and dead hearted plants. For its control, treat the seed with 6 ml Gaucho 600 FS (imidacloprid) per kg seed. The treated seed should be sown within 14 days. If seed treatment is not done, then apply 5 kg Furadan 3 G (carbofuran) per acre in the furrows at the time of sowing.

Armyworm: The larvae feed on the tender leaves of the whorl or may eat out the whole leaf including the mid-rib. Presence of faecal pellets on the whorl leaves indicates the occurrence of this pest. Attack is relatively more on the border rows adjoining wheat field in March.

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

Adopt the following control measures

- Sow the crop at recommended time only.
- Avoid staggered sowing of maize in adjacent fields to minimize the spread of this pest.

DISEASES

Seed rot and seedling blight (Fusarium, Penicillium, Aspergillus spp.): The symptoms are mainly characterized by poor germination due to seed rot in soil, unthrifty seedlings and seedling mortality after germination. To avoid this problem, growers should use disease free seed.

Post-flowering stalk rots (Macrophomina phaseolina, Cephalosporium maydis, Fusarium spp.): The disease appears during reproductive stage and plants wilt after flowering. Discolouration of the rind and basal internodes is diagnostic symptom of the disease. When the diseased stalk split opens, discolouration of pith progressing upward is also seen. Infection with M. phaseolina results in black sporulation in the pith region. Dry conditions at tasseling stage favour disease development. Water stress at the time of flowering favours the disease. Farmers should grow recommended varieties and avoid cultivation of un-recommended varieties to prevent onset of this disease.

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

Rakesh Kumar Sharma: 98728-82111
Pulses are an important source of dietary protein and calories for vegetarian masses. These crops are gifted with unique property of fixing atmospheric nitrogen symbiotically in their nodules, and play an important role in maintaining soil fertility and supplying protein to a large population of the country. The amino acid profile of pulse protein is such that the mixed diet of cereals and pulses has superior biological value over either of the components alone. Therefore, pulses hold a great potential in view of alleviation of increasing protein hunger and malnutrition prevalent amongst the poorer section of the society.

The Indian Council of Medical Research has recommended 52 g/capita/day of pulses. According to a rough estimate, Punjab needs about five lakh tonnes of pulses annually, while at present the state is producing only about 30,000 tonnes of pulses. Due to predominance of rice-wheat cropping system, the area under pulses in Punjab has declined substantially. So, there is a dire need to increase the area under pulses in Punjab. The short duration pulses like summer moong and summer mash offer the most valuable option for crop diversification. Summer moong, being a short duration crop, fits well in wheat-rice cropping system of the state. There is tremendous potential for its expansion. Moong helps in saving about 25 per cent of nitrogen for succeeding crop. The cultivation of summer pulses also helps in saving a lot of irrigation water as compared to spring maize. So, there is a great scope to increase area and production of summer pulses through the promotion of recommended improved varieties and agronomic practices amongst the farmers in the Punjab state.

There is a dire need to increase the area under pulses in Punjab. The short duration pulses like summer moong and summer mash offer the most valuable option for crop diversification.

**BY GURIQBAL SINGH, HARPREET KAUR VIRK AND RANJIT KAUR GILL**

*Department of Plant Breeding and Genetics*

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**Varieties of summer moong and summer mash as given below:**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Varieties</th>
<th>Days to maturity</th>
<th>Average yield (q/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moong</td>
<td>SML 1827, SML 832 and SML 668</td>
<td>60-62</td>
<td>4.5-5.0</td>
</tr>
<tr>
<td>Mash</td>
<td>Mash 1137 and Mash 1008</td>
<td>72-75</td>
<td>4.2-4.5</td>
</tr>
</tbody>
</table>

**Soil type:** Summer pulses should be grown on well-drained, non-saline/alkaline loamy to sandy loam soils.

**Land preparation:** Field should be prepared by giving 2-3 ploughings followed by planking to get it free from clods and bring it into good tilth to ensure good germination.

**Seed inoculation:** Seed of summer moong with one packet of consortium biofertilizer [Rhizobium sp. (LSMR-1) and Rhizobacterium (RB-3)], and summer mash with one packet of Rhizobium (LUR 6) per acre should be inoculated at the time of sowing. After seed inoculation, seed should be sown within one hour of inoculation. Seed inoculation improves grain yield of summer pulses.

**Sowing time, seed rate and method of sowing:** Timely sowing is an important non-monetary input which affects the yield considerably. The optimum time of sowing of summer moong crop is from March 20 to April 10, and of summer mash is from March 15 to the first week of April. However, sowing of summer moong can be extended upto third week of April.

The crop should be sown during the recommended period only. Early sowing of summer moong after potato should not be done because too early sowing of the crop results in poor germination due to prevailing low temperature. Sowing of summer moong can be extended upto third week of April but there is a risk of pre-monsoon showers at maturity.

A seed rate of 15 kg per acre for SML 668 and 12 kg per acre for SML 1827 and SML 832 for summer moong is sufficient, whereas for summer mash varieties, 20 kg seed per acre is sufficient. Both moong and mash are sown at a row spacing of 22.5 cm with seed drill at 4-6 cm depth.
Summer moong can be sown timely without any preparatory tillage with zero-till drill after the harvest of wheat if there is no wheat straw lying in the field or it can be sown with Happy Seeder after combine harvested wheat crop, in the presence of wheat straw.

In heavy to medium textured soils, two rows of summer moong at a spacing of 20 cm can be sown on 67.5 cm wide beds (37.5 cm bed top, 30 cm furrow) by using wheat bed planter. Raised bed planting of summer moong saves 20-30 per cent of irrigation water.

Fertilizer application: Apply 5 kg of N (11 kg urea) and 16 kg of P\(_2\)O\(_5\) (100 kg single superphosphate) per acre to summer moong and 5 kg of N (11 kg urea) and 10 kg of P\(_2\)O\(_5\) (60 kg single superphosphate) per acre to summer mash at the time of sowing for the proper growth of the plants. There is no need to apply any fertilizer to summer moong in case it is sown after potato in maize/rice-potato-summer moong rotation.

Weed control: Weeds cause a heavy reduction in grain yield if not controlled at the right time. In pulses, weeds can be controlled manually through hand weeding. Summer moong crop requires two hand weedicings, 4 and 6 weeks after sowing and summer mash requires one hand weeding at 4 weeks after sowing.

Irrigation: Generally, 3-5 irrigations are required by summer pulse crops depending on sowing time, soil type, and time and intensity of rainfall. For synchronous maturity of the crop, stop the last irrigation 55 and 60 days after sowing in summer moong and mash, respectively. If we go on applying irrigation, then flowering continues and the crop does not mature synchronously.

Harvesting: Harvest the summer pulses when about 80 per cent of the pods mature.

Farmers should adopt these improved technologies and boost the area, productivity and production of summer pulses.

- Guriqbal Singh : 94174-52596
- TS Riar: 98142-10269

PAU Kisan Melas.................contd from page 9 instrumental in transferring the latest technologies to the end users.

Kisan melas are an agricultural encyclopaedia for the farming community. Farmers are familiarised with new technologies through online technical sessions, live demonstrations and exhibitions. All the queries of the farmers are addressed during the online question-answer session. Virtual live demonstrations of field crops with improved varieties, production and protection technologies, straw management techniques, mushroom cultivation, beekeeping, protected cultivation, kitchen gardening, etc. are also organised for the farmers during these melas. Besides, the seed of improved crops and vegetable varieties, planting materials of vegetables/fruit/forest/ornamentals and biofertilizers are made available (offline and online) to the farmers in these melas. In addition, farm literature (offline and online), brought out by the Communication Centre of PAU, is sold to the farmers. An elaborated agro-industrial exhibition of other farm inputs including fertilizers, pesticides, implements and farm machinery is also shown virtually. These melas aim at guiding the farmers and farm women about crop diversification, conservation of natural resources, climate change, environmental protection in addition to subsidiary occupations such as value addition and agro-processing, apiculture, mushroom growing; poultry, dairy, pig and fish farming; garment enrichment (through stitching, embroidery and painting) and other household management practices.

Dear farmers, PAU shares an exemplary linkage with the farm fraternity. This deep-rooted connection between the scientists and the farmers must go on. The university has always striven to serve the farmers and the farm women with utmost dedication, in future also, it stands committed to the farmers’ welfare.

- TS Riar: 98142-10269

Protect sugarcane crop..................contd from page 16 Its incidence is more pronounced in the ratoon crop. The disease is easily recognized by the appearance of long whip-like shoots covered with dusty black mass of spores. These whips may arise from the top of the canes as well as from the lateral sprouted buds.

Management
- Use only smut free canes for seed. Reject even the healthy looking canes in the diseased stools or those growing in the vicinity of the smutted clumps.
- Remove the smutted whips gently after putting them inside a closely woven drill bag. Then uproot the entire diseased clumps and burn or bury them deep.
- Do not ratoon the smutted crop.

Pokkah Boeng (top rot): This disease appears during rainy season from July–September. The young leaves in the top portion of the plant become chlorotic at the base, and get distorted and shortened. They turn dark red and fall off gradually. In severe cases, the rotting of the top portion of the cane occurs.

Management: Regular rouging and burying of diseased stools helps to mitigate the disease.

Grassy Shoot Disease (GSD): The affected plants give rise to numerous thin tillers; leaves become chlorotic and are reduced in size, and give grassy appearance. The severely diseased clumps remain stunted and may produce one or two weak canes. The disease increases in successive ratoon crops.

Management
- This disease is seed transmissible; always use disease free seed from the crop raised after the heat treatment.
- Rogue out the diseased clumps regularly and do not keep ratoon of the diseased crop.

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- Rajinder Kumar: 99880-99124
Jaggery/gur industry is one of the old and large agro-processing cottage industries in India. The production of gur starts from October and continues up to May, depending on the location. The jaggery manufacturers are mostly small and marginal farmers relying on quick returns from gur. As the total gur produced is not consumed immediately after production, it is stored for a period of 10-12 months. However, the major problem associated with jaggery storage is the change of colour due to non-enzymatically oxidation of polyphenols and other minerals. High moisture content and high relative humidity also invite microbial contamination. The problem of using chemical clarificants is that in most of the cases, the limit of addition exceeds the permitted level. Vegetable clarificants like mucilage’s of bhindi, Moringa leaf juice extract, lemon juice, etc. are used. Small quantity of edible oils can be added to prevent frothing during boiling after removal of entire scum.

Hygienic processing, proper packaging, storage conditions and value addition of jaggery can help in long term storage and enhance shelf life of jaggery. Value added jaggery will be a cheap source of nutrition to the poor and malnourished.

Packaging and storage of jaggery

Jaggery storage is always a big problem during the summer and rainy seasons.

- Polyethylene terephthalate (PET) film or PET jars are generally preferred to store jaggery at low temperature to keep the quality.
- Jaggery stored in PET films with modified atmospheric packaging (MAP) (70% N₂+30% CO₂) at ambient condition is a good technique to keep quality parameters including colour.
- The PET film with MAP as 100 per cent nitrogen gas is the best combination to enhance the shelf life of jaggery cubes up to 210 days.
- Solid jaggery can be stored in small IISR jaggery drying-cum-storage bin (as shown in Figure 1) for longer period by maintaining the moisture by aeration. This bin has four holes in the lower periphery. The smaller lid of bin is kept open. Dry air passes through these holes and helps in drying of jaggery. In May, these holes are closed with the help of wooden plugs and the lid is placed.
- Edible coating (solution was applied evenly using a brush and left for drying at ambient conditions for 3 hours) with 8 per cent of whey protein concentrate (WPC) on...
Punjab’s contribution of wheat to central pool and marketing of *rabi* crops

BY RAJ KUMAR, GS ROMANA AND SANGEET RANGUWAL

*Department of Economics and Sociology*

Punjab, the state to pioneer the ‘Green Revolution’ in India, despite having only 1.53 per cent of the total geographical area of the country, produces about 18 per cent of the total wheat production of the country. After advent of Green Revolution in early seventies, the Punjab farmers adopted fertilizer and irrigation responsive high yielding varieties (HYVs) of wheat, which resulted in huge jump in the area and production under this crop. Since then, Punjab is the major contributor of wheat to the central pool, thereby making country self-sufficient in wheat production. To maintain the tempo of food grains production, the government often provides incentives for production to the farmers like increase in minimum support prices. As a result of the assured market at remunerative prices coupled with market infrastructure and available production technology, the Punjab farmers have pushed up the paddy and wheat production remarkably. Area under wheat crop in Punjab has doubled from 16.1 lakh hectares during 1966-67 to 35.3 lakh hectares during 2020-21. During the same period, there is a sevenfold increase in production of wheat in the state (from 24.5 to 171.9 lakh tonnes). The contribution of Punjab to the Central pool was 63.8 per cent during the crop year 1966-67 which declined to 51.2 per cent during 2000-01. It touched 75.3 per cent in the crop year 2005-06. During 2020-21, the state contributed 30.5 per cent of wheat to the Central pool. The state has surpassed all its previous records of contribution of wheat to the Central pool during 2020-21. During this year, it contributed 132.2 lakh tonnes of wheat to the Central pool which is all time high. During the last decade, the state regularly contributed about 65 to 70 per cent of its total wheat production towards the national food security, which is commendable due to the sincere efforts put in by the hardworking farmers, agricultural scientists and extension workers of the state.

**Marketing of *rabi* crops**

Due to fully mechanization of harvesting and threshing, the arrivals come in the markets within a short period. As improved technology is necessary for the assured and maximum production, similarly efficient marketing is the yard stick for maximizing the margins in the markets. Some important hints for efficient marketing of crops are given as under:

- **Harvesting of any crop at proper stage is highly essential for its efficient marketing.** In case the crop is harvested early or it is delayed from full maturity, the quality of the grains gets affected and the produce fetches lower price in the market besides fear of the yield loss.
- **Sometimes, the crops are threshed over a muddy/*katcha* floor which allows the grains to mix with dust and dirt. So, before taking such a produce in the market, it should be cleaned properly and dried well to avoid wastage of time in the market for cleaning of the produce.**
- **The produce should be properly graded or sorted before taking it to the market in order to realize higher prices over the ungraded produce.**
- **It is required that farmers should have complete information about the market before taking the produce to the market.** They should know about the extent of produce arriving in the market, prevailing market prices and also about the date of entry of different procurement agencies in 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 on forces of demand and supply in the post-harvest period.** It is, therefore, important for the farmers to be fully aware of the prices prevailing in the nearby local as well as distant markets of other states. If the prices in the distant markets are higher than the local market, the farmer can sell their produce there also. But before taking the produce to the distant markets, the farmers should take into consideration the additional transportation and labour costs also.
Table 1: Area, yield, production and contribution of wheat to central pool

<table>
<thead>
<tr>
<th>Crop year</th>
<th>Area (lakh ha)</th>
<th>Yield (kg/ha)</th>
<th>Production (lakh tonnes)</th>
<th>Quantity contributed (lakh tonnes)</th>
<th>Contribution as % of production</th>
<th>% share in Central pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966-67</td>
<td>16.1</td>
<td>1,524</td>
<td>24.5</td>
<td>5.7</td>
<td>23.3</td>
<td>63.8</td>
</tr>
<tr>
<td>1970-71</td>
<td>23.0</td>
<td>2,238</td>
<td>51.5</td>
<td>29.4</td>
<td>57.1</td>
<td>57.6</td>
</tr>
<tr>
<td>1980-81</td>
<td>28.1</td>
<td>2,730</td>
<td>76.8</td>
<td>37.7</td>
<td>49.1</td>
<td>43.0</td>
</tr>
<tr>
<td>1990-91</td>
<td>32.7</td>
<td>3,715</td>
<td>121.6</td>
<td>55.4</td>
<td>45.6</td>
<td>71.5</td>
</tr>
<tr>
<td>2000-01</td>
<td>34.1</td>
<td>4,563</td>
<td>155.5</td>
<td>105.6</td>
<td>67.9</td>
<td>51.2</td>
</tr>
<tr>
<td>2005-06</td>
<td>34.6</td>
<td>4,179</td>
<td>144.8</td>
<td>69.5</td>
<td>48.0</td>
<td>75.3</td>
</tr>
<tr>
<td>2010-11</td>
<td>35.1</td>
<td>4,693</td>
<td>164.7</td>
<td>109.6</td>
<td>66.5</td>
<td>38.7</td>
</tr>
<tr>
<td>2015-16</td>
<td>35.1</td>
<td>4,583</td>
<td>160.7</td>
<td>106.5</td>
<td>66.3</td>
<td>46.4</td>
</tr>
<tr>
<td>2016-17</td>
<td>35.0</td>
<td>5,046</td>
<td>176.4</td>
<td>117.1</td>
<td>66.4</td>
<td>38.0</td>
</tr>
<tr>
<td>2017-18</td>
<td>35.1</td>
<td>5,077</td>
<td>178.3</td>
<td>126.9</td>
<td>71.2</td>
<td>35.7</td>
</tr>
<tr>
<td>2018-19</td>
<td>35.2</td>
<td>5,188</td>
<td>182.6</td>
<td>129.1</td>
<td>70.7</td>
<td>37.8</td>
</tr>
<tr>
<td>2019-20</td>
<td>35.2</td>
<td>5,004</td>
<td>176.2</td>
<td>127.1</td>
<td>72.1</td>
<td>32.6</td>
</tr>
<tr>
<td>2020-21</td>
<td>35.3</td>
<td>4,868</td>
<td>171.9</td>
<td>132.2</td>
<td>76.9</td>
<td>30.5</td>
</tr>
</tbody>
</table>

Source: Statistical abstract of Punjab (various issues) and Department of Agriculture and Farmers’ Welfare, Punjab

Grade specifications

In order to realize remunerative price, produce should be taken to the market as per the fixed grade specifications by the government. In wheat, the maximum prescribed limit of moisture content, foreign matter, admixture of other grains, damaged grains, slightly damaged grains and shriveled/broken grains is 12.0, 0.75, 2.0, 2.0, 4.0 and 6.0 per cent, respectively. The maximum prescribed limit of moisture content for barley, gram, lentil and rapeseed and mustard is 12.0, 12.0, 12.0 and 8.0 per cent, respectively. Therefore, the farmers should try their best to follow the prescribed grade specifications to get fair price of their produce.

Minimum Support Price (MSP) of rabi crops

The Government of India has been implementing the price support policy for agricultural commodities since mid-1960s. Under this policy, MSPs are announced well ahead of the sowing season so that farmers can take informed decisions on cropping. As per the decision taken by Union Government regarding the fixation of MSPs, now more importance is given to the cost of production for recommending MSPs through providing a 50 per cent margin on the paid-out costs of farmers plus the imputed cost of family labour use (Cost A+FL).

For the crop year 2021-22, the MSP per quintal has increased from Rs 1,975 to Rs 2,015 for wheat crop; Rs 1,600 to Rs 1,635 for barley and Rs 5,100 to Rs 5,230 for gram. The MSP for lentil is fixed at Rs 5,500 per quintal. The MSP of rapeseed and mustard has been increased from Rs 4,650 per quintal to Rs 5,050 per quintal and that of sunflower, from Rs 5,650 to Rs 5,885 per quintal. The relative high increase in the MSP of pulses and oilseeds in this marketing season is due to an increasing gap between the domestic demand and supply of these commodities as a result of which reliance on import is increasing. Government has, therefore, given a price signal to farmers to increase acreage and invest for increase in productivity of these crops. The MSP is applicable from the date at which, the Food Corporation of India (FCI) enters the market for public procurement. Therefore, the farmers of the state should bring their produce in the market only after the announcement is made in this regard by the FCI. Before such announcement, the farmers are not entitled to get the current MSP.

Table 2: Minimum support price of the rabi crops, 2020-21 and 2021-22 (Rs/q)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Crop year 2020-21</th>
<th>Crop year 2021-22</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>1,975</td>
<td>2,015</td>
<td>40</td>
</tr>
<tr>
<td>Barley</td>
<td>1,600</td>
<td>1,635</td>
<td>35</td>
</tr>
<tr>
<td>Gram</td>
<td>5,100</td>
<td>5,230</td>
<td>130</td>
</tr>
<tr>
<td>Lentil (Masar)</td>
<td>5,100</td>
<td>5,500</td>
<td>400</td>
</tr>
<tr>
<td>Rapeseed and mustard</td>
<td>4,650</td>
<td>5,050</td>
<td>400</td>
</tr>
<tr>
<td>Sunflower seed</td>
<td>5,885</td>
<td>6,015</td>
<td>130</td>
</tr>
</tbody>
</table>

Labour charges to be paid by the farmers

The labour charges to be paid by the farmers for sale of their produce are fixed by the Punjab Mandi Board. Except the unloading and cleaning charges, the farmers have to pay no any other market charge for the sale of farm produce in the regulated markets. The unloading charges for wheat, barley, gram, lentil, rapeseed and mustard having unit sizes of 50, 35, 50, 50 and 40 kgs, respectively are Rs 2.18 per unit of the produce and the power operated cleaning charges are Rs 3.91 per unit of the produce. For 30 kg packaging of wheat, the unloading and power operated cleaning charges are Rs 1.33 and Rs 2.33 per unit, respectively. These charges are likely to increase slightly during the coming marketing season. Therefore, the farmers are advised to confirm these charges from the office of the concerned market committee.
Some other important points

While marketing of the farm produce, the farmers should remain present in the market at the time of auction and weighment of the produce. During auction, if the farmer is of the view that the price offered by the buyer is less, then he has the right not to accept that bid. But if he himself does not remain present at the time of auction, then it may not be possible for him to reject the bid. Similarly, if farmer observes some malpractice during weighment, in such a case, he can use his right to go for test weighment of the produce. The test weighment up to 10 per cent of farmers’ produce is done free of cost in the presence of the officials of the concerned market committee. In case, any discrepancy in weighment is found, the producers are compensated accordingly. There is also a provision of cancellation of the license of concerned weighman along with the imposition of penalty. The farmer should not forget to obtain ‘Form-J’ in which all the details viz. name of produce, name of purchaser, weight of produce, price and total deduction of charges are mentioned. This form is required to avail the opportunity of getting bonus etc. as announced by the government from time to time. It can also be used as documentary proof of income whenever required. Therefore, it is in the interest of the farmer to get ‘Form-J’ from the commission agent.

The farmers must keep in view the above information for efficient marketing of their produce in the forthcoming rabi marketing season.

* Raj Kumar: 81460-96600

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**Date Palm**

Date palm (*Phoenix dactylifera*) is dioecious plant, bearing male and female flowers on separate trees and requires hand pollination for good fruit setting and quality production of dates. For this purpose, identification of male and female flowers is important for date growers. The male flowers are creamy white in colour and female flowers are yellowish. Male spathe (sheath that encloses the flower cluster) is shorter and wider, and contains higher number of strands resembling a broom. The florets of male flowers look like paddy grains. The female spathe is long and comparatively contain less number of strands. Individual flowers of female inflorescence resemble like sorghum seeds. By a single male palm, we can pollinate 10 female plants; for proper pollination, plantation of female and male trees should be done in ratio 10:1. The flowering in date palm starts commonly by about mid-March to the first week of April under Punjab conditions. The anthesis of spathes generally gets completed within 15 to 20 days. Sometimes, the variation in time of flowering is also observed due to temperature fluctuations. The opening of flowers in male trees is generally observed somewhat earlier than female trees. For collection of pollen, matured spathes, just before opening are harvested and shade dried for easy extraction of pollen. For collection of pollens from male spathes swept on the paper, these collected pollens are dried (6 hours in sunlight followed by 18 hours in shade) and stored in air tight glass vials in cool place at normal temperature. The harvested pollen can be stored up to three months at room temperature. When female inflorescence starts opening, the harvested pollens are used for pollination. Hand pollination can be done by several methods of pollination such as dusting of pollen with cotton plugs, the placing of pollen-covered cotton plugs within the female spathes and placing of inverted male strands in female inflorescence. It has been observed that by placing 3 to 4 male strands in an inverted position in the center of each female inflorescence, a good pollination method and quality fruit set can be obtained. This method is considered to be the easiest. Any method of pollination can be used for good quality of fruit set in dates. The female flowers need to be pollinated within 2-3 days on their opening for quality fruit set. If the flowers are not pollinated, fruits will remain of small size, seedless and not attain the maturity. In addition to pollination, for the quality production of dates, nutrient application in dates plants is also important. The date palm trees should be provided nutrition through organic manures as well as inorganic fertilizers; for bearing trees of dates, farm yard manure (FYM) should be applied @ 50 kg/palm/year one month before flowering. For quality production of dates, urea should be applied @ 4.4 kg/palm/year in two split doses, first half before flowering and the remaining in April after fruit set.

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Importance of biofertilizer in crop cultivation

BY PRATIBHA VYAS AND JUPINDER KAUR
Department of Microbiology

One of the main challenges for agriculture in the 21st century is the sustainable crop production. Microorganisms have huge potential in offering an alternative to the use of inorganic fertilizers and chemical pesticides. Integrated use of biofertilizers, organic manures and chemical fertilizers should be followed for higher crop productivity and maintenance of soil health.

Biofertilizers: Biofertilizers contain living strains of bacteria, fungi, actinomycetes or algae, either alone or in combinations for application to seeds, roots, soil or composting area. Biofertilizer application leads to enhanced plant growth and crop productivity, and also results in improved health and quality of soil. They are cost effective, pollution free and eco-friendly inputs for sustainable crop production. The microorganisms present in biofertilizers enhance the nutrient status of soil by various direct and indirect mechanisms including nitrogen fixation, phosphate solubilization, production of phytohormones, ammonia, and siderophores and antibiosis.

Phosphate solubilizers: Phosphorus, the second most important nutrient required for plant growth, stimulates growth and hastens maturity. Its deficiency in plants leads to slow development, wilting of leaves, late maturity and decreased yield. Majority of soils worldwide are poor in available phosphorus as the P applied in the form of chemical fertilizers is fixed quickly in soil as insoluble phosphates of iron, aluminum, and calcium depending on soil type and pH. Microorganisms belonging to genera Bacillus, Pseudomonas, Acinetobacter, Alcaligenes, Burkholderia, Enterobacter, Erwinia, Flavobacterium, Microbacterium, Rhizobium and Serratia have the ability to solubilize insoluble soil phosphates.

Nitrogen fixers: Biological nitrogen-fixation has a great functional significance as the use of nitrogenous fertilizers has been leading to objectionable levels of water pollution. Nitrogen-fixing bacteria are grouped as ‘free living’ including Azotobacter, Beijernickia, Klebsiella, Paenibacillus, Clostridium and Desulfovibrio; ‘symbiotic’ including Rhizobium and Frankia; and ‘associative’ including Azospirillum.

Plant Growth Promoting Rhizobacteria (PGPR): The microorganisms residing in the plant rhizosphere and exerting beneficial effects on plants are known as PGPR. They are able to exert beneficial effects on plants through phytohormone production, ACC-deaminase activity, production of siderophores, ammonia and hydrogen cyanide, etc.

Consortium biofertilizer: A mixture of two or more beneficial microorganisms known as ‘Consortium biofertilizer’ improves plant growth and crop productivity by various mechanisms. Thus, consortium biofertilizer is better than single bacterial biofertilizer.

Biofertilizer application leads to enhanced plant growth and crop productivity, and also results in improved health and quality of soil. They are cost effective, pollution free and eco-friendly inputs for sustainable crop production. The biofertilizers are available in the Department of Microbiology and PAU Seed Shop at gate no. 1, Ludhiana campus as well as at Krishi Vigyan Kendras (KVKs) located in different districts of Punjab.
2. Soil treatment: Mix the biofertilizer with 10 kg of soil/farm yard manure and broadcast it equally in one acre of field or apply the biofertilizer to furrows before sowing of the crop.

3. Seedling treatment: Prepare a suspension of biofertilizer in 100 litres of water. Dip the roots of the seedling in this suspension for 45 minutes before transplanting into the fields.

Precautions

- Always use recommended biofertilizer for a particular crop.
- Check expiry date of packet before use.
- Keep the packets of biofertilizer away from direct sunlight or heat, preferably in a cool and shaded place.
- Do not keep biofertilizer treated seeds in sunlight.
- Sowing should be done immediately after treatment.
- Do not mix biofertilizer with chemical pesticide.

Availability of biofertilizers: The biofertilizers are available in the Department of Microbiology and PAU Seed Shop at gate no. 1, Ludhiana campus as well as at Krishi Vigyan Kendras (KVKs) located in different districts of Punjab. These biofertilizers are also available at every Kisan Mela organized by PAU. Training camps are also organized to create awareness among farmers about beneficial effects of biofertilizers.

*Jupinder Kaur: 95925-03631*

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**Table 1: Biofertilizers recommended by Punjab Agricultural University, Ludhiana**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Biofertilizer Description</th>
<th>Dose per acre</th>
<th>Mode of application</th>
<th>Price per acre</th>
<th>Increase in yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>Consortia biofertilizer</td>
<td>500 g</td>
<td>Seed application</td>
<td>40</td>
<td>4-6</td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td>1-1.5</td>
</tr>
<tr>
<td>Rice</td>
<td><em>Azospirillum</em></td>
<td>500 g</td>
<td>Seedling application</td>
<td>40</td>
<td>3-4</td>
</tr>
<tr>
<td>Cash crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Consortia biofertilizer</td>
<td>4 kg</td>
<td>Soil application</td>
<td>280</td>
<td>4-5</td>
</tr>
<tr>
<td>Vegetables/Spice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onion</td>
<td>Consortia biofertilizer</td>
<td>4 kg</td>
<td>Soil application</td>
<td>280</td>
<td>2-3</td>
</tr>
<tr>
<td>Potato</td>
<td></td>
<td>4 kg</td>
<td></td>
<td>280</td>
<td>4-5</td>
</tr>
<tr>
<td>Turmeric</td>
<td></td>
<td>4 kg</td>
<td></td>
<td>280</td>
<td>5-6</td>
</tr>
<tr>
<td>Legumes</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Chickpea</td>
<td><em>Rhizobium</em> and PGPR</td>
<td>500 g</td>
<td>Seed application</td>
<td>40</td>
<td>7-13</td>
</tr>
<tr>
<td>Summer moong</td>
<td><em>Rhizobium</em> and PGPR</td>
<td>500 g</td>
<td>Seed application</td>
<td>40</td>
<td>6-7</td>
</tr>
<tr>
<td>Lentil</td>
<td><em>Rhizobium</em> and PGPR</td>
<td>500 g</td>
<td>Seed application</td>
<td>40</td>
<td>10-11</td>
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<tr>
<td>Moong</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>12-16</td>
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<tr>
<td>Fieldpea</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>8-10</td>
</tr>
<tr>
<td>Pigeonpea</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>6-7</td>
</tr>
<tr>
<td>Soybean</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>8-10</td>
</tr>
<tr>
<td>Summer urd</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>3-4</td>
</tr>
<tr>
<td>Urd</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>3-4</td>
</tr>
<tr>
<td>Fodder crops</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Berseem</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>8-10</td>
</tr>
<tr>
<td>Lucerne</td>
<td><em>Rhizobium</em></td>
<td>250 g</td>
<td>Seed application</td>
<td>30</td>
<td>8-10</td>
</tr>
</tbody>
</table>

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**Figure 1: Microorganisms of biofertilizers: A. Rhizobium sp., B. Azotobacter sp., C. Pseudomonas sp. and D. Phosphate-solubilizing bacteria**
Canola rapeseed-mustard oil: Health benefits and nutritional facts

BY SANJULA SHARMA AND HARJEEVAN KAUR
Department of Plant Breeding and Genetics

Oils play an important role in our daily diet by providing dietary fats, required for optimum nutrition and growth. A wide range of edible oils including canola, mustard, sunflower, soybean, groundnut, olive, coconut, sesame, palm, rice bran, safflower, niger, cottonseed, etc. alone or in various blending formulations are available in the market and have their preferences region wise in India. The nutritional composition and health benefits of these edible oils differ widely depending on their fatty acid composition. Among all the edible oils, mustard oil is a popular cooking medium used in many households in North, East and North-Western region of India including Punjab from many years. Kachi ghani mustard (sarson) oil is extracted from the seeds of Indian mustard (raya) using ‘cold press’ method in a mechanical extractor to preserve the natural properties, essential oils and antioxidants in the oil. It is also expected to be rich in flavour and taste. Mustard oil is also useful for treating cold, cough, body pains, congestions due to cold, headache and its massage is good for muscular growth.

The term ‘canola’ was originally derived from ‘Canadian oil with low acid’ developed from rapeseed (gobhi sarson) using traditional plant breeding methods in Canada. It was developed to remove the two unwanted qualities such as erucic acid and glucosinolates of rapeseed. Erucic acid content of more than 2 per cent in oil is considered unsafe for human consumption, whereas glucosinolates >30 μmoles/g defatted meal plays an anti-nutritional role in the seed meal. After the extraction of oil from the seeds, the leftover seed cake is used to feed the livestock and glucosinolates level of more than 30 μmoles is not recommended for the animal feed due to their potential anti-nutritional effects. So, by removing these two factors, new rapeseed plant was created to get one of the superior/healthiest edible vegetable oils – canola and cake, which can be effectively used as a supplement for poultry feed, besides its traditional use as cattle feed. Today, Indian scientists have bred and released ‘canola-grade’ varieties in both gobhi sarson and raya.

Canola oil is a rich source of good fats and scientific research suggests various health benefits associated with this oil such as reduced risk of heart diseases and diabetes. Canola is known to have lowest amounts of saturated fats (< 7%) among vegetable oils and is called as the heart-smart oil. It is also known to reduce the low density lipoprotein (LDL) cholesterol or ‘bad’ cholesterol in the blood. This oil has high amount of beneficial monounsaturated fatty acids (MUFA) such as oleic acid (omega 9) which elevates the high density lipoprotein (HDL) cholesterol or ‘good’ cholesterol levels. Presence of high MUFA also provides this oil a longer shelf life. Moreover, canola is a rich source of health boosters – omega 6 (linoleic acid) and omega 3 (linolenic acid). The nearly ideal balance of omega 6 and omega 3 essential fatty acids (2:1) is present in this oil. It is naturally rich in vitamin E which is beneficial for skin nourishment and hair growth. Another important feature of cooking oil that depicts its quality is its smoke point. The oils having low smoke point...
are preferred for dressings, whereas the one with high smoke point are used for high temperature cooking. Oil from non-canola/canola rapeseed-mustard varieties has high smoke point in the range of 220-255.67°C and hence found very suitable for high temperature cooking with little production of trans fats which are harmful for health. Thus, it is ideal for Indian style of cooking and can be used for cooking, deep frying, roasting, baking and grilling. Olive oil is considered as one of the best edible oils for human consumption but in comparison to canola oil, it has a lower smoke point, higher amount of saturated fats, lower proportion of omega 6 and omega 3 fatty acids, and higher market price. Canola oil is one of the best and versatile oils owing to good balance of essential fatty acids, presence of antioxidants and cheaper price compared to costly olive oil.

Kachi ghani mustard oil has drawbacks of high erucic acid (40-50%) and low oleic acid (12-16%) content. So, various canola type rapeseed-mustard varieties and hybrids have been developed as a substitute worldwide. The Punjab Agricultural University, Ludhiana has developed and recommended various canola rapeseed-mustard varieties/ hybrids in raya – RLC 3 (variety), RCH 1 (hybrid) and gobhi sarson – GSC 6, GSC 7 (varieties) and GSH 1707 (hybrid). Among these GSC 7, hybrid GSH 1707 and hybrid RCH 1 yield approximately 9 quintals per acre. Canola oil, available in the Indian market, is mainly imported from countries such as Canada but there is no difference in the oil quality produced from the above mentioned varieties and hybrids. Thus, farmers are advised to grow canola quality raya and gobhi sarson to procure higher profit from their crop. The leftover seed cake can be used as high protein animal feed. The consumers are also advised to use canola rapeseed-mustard oil for better health benefits and nutritional values.

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Adapt value addition....contd from page 20

solid jaggery maintains the quality and enhances the shelf life for four months when stored in drying-cum-storage bin.

• The coarse jaggery powder can be stored for six months three ply (PET+ Aluminium Foil + PE) packaging material.

• Liquid jaggery (cane honey) is filled in bottles with some added preservatives like 0.1% potassium meta-bi-sulphite and 0.5% benzoic acid to extend the shelf life.

Value addition of jaggery

Jaggery is called as medicinal sugar because of its richness with minerals and vitamins. Value-added jaggery may fetch better market prices and will have great export potential. It has been discovered that combining value added natural spices and herbs with jaggery not only provides health advantages but also improves the taste. There is a huge potential scope for the existing jaggery market to develop interesting, innovative value added products during the time of COVID-19 pandemic, when there is an immediate focus on developing and sustaining immunity systems and adopting better food habits. The value of jaggery can be increased as following:

• Molding the concentrate in desired shape according to purpose for easy consumption. The shape of jaggery varies from place to place; some common shapes preferred are rectangular, bucket shaped, trapezoidal lumps, round balls, lollipop for kids, etc.

• Inclusion of nutritive substances through puffed rice, gram, sesame and various kinds of nuts (cashew and almond), vitamins, iron and taste enhancers like chocolate powder to increase demand for this kind of jaggery.

• The jaggery with 10 per cent of cocoa powder yields a product (chocolate) which is very much acceptable as a substitute for chocolate.

• The incorporation of jaggery with wheat flour increases the protein content and textural properties of jaggery.

• Addition of amla/aolla (Emblica officinalis) after shredding and drying, increases the vitamin C content and thus makes a value added product.

• The nutritive value and palatability can be enhanced by preparing different kinds of jaggery with the addition of puffed rice, gram and groundnut in different proportions of 1:0.75, 1:1, 1:1.25, 1:1.5, 1:1.75 (jaggery patti), mixing with wheat flour in proportions of 90:10, 80:20, 70:30, 60:40, 50:50 and 40:60 (jaggery-wheat flour extruded snacks) and mixing with gram flour (jaggery-besan snacks).

• Value added jaggery can be prepared from neutralized paneer whey (PW) or neutralized cheese whey (CW). An admixture of PW and CW can also be used in 1:1 proportion. Whey jaggery contains more protein and minerals than pure sugarcane jaggery. Utilization of whey, a dairy industry waste containing proteins, lactose and minerals, increases the nutritional and organoleptic quality of jaggery on one side and mitigates the problem of disposal of whey being faced by the dairy industry on the other.

• Jaggery may be value added with different natural flavours (ginger, black pepper, cardamom, lemon, etc.), nutrition (protein, vitamins and phytochemicals), texture (additives) and taste (additives like nuts, spices, cereal and pulses).

The sugarcane growers can earn more profit from their jaggery manufacturing units by improving its quality through value addition and preparing jaggery based products as well as packaging using modern technologies.

• Gurveer Kaur: 86706-70348
Narpinder Singh: A prosperous beekeeper

BY TS RIAR, IQBALPREET KAUR SIDHU AND RAHUL GUPTA
Punjab Agri-Business Incubator

Owing to the continuous efforts of the Punjab Agricultural University, the beekeeping and honey processing have become one of the prominent secondary occupations of the farmers of Punjab. Narpinder Singh, a progressive beekeeper, is a stimulation for the fellow beekeepers. He is engaged in beekeeping for more than a decade. He has obtained trainings in apiculture from the Directorate of Extension Education, PAU and is an active member of the Progressive Beekeepers Association (PBKA), PAU.

One problem which he found common for all the beekeepers was getting the fair price of the mustard honey, as Punjab is having a large amount of mustard honey. He wrote some articles to break the myths regarding honey and to make the beekeepers understand the value of their occupation. With an aim to solve the problems of the beekeepers, he started working on cream honey that is crystallized form of honey. The prize of cream honey is quite high than the mustard honey.

During the monthly meetings of PBKA organized at Skill Development Centre, PAU, he came to know about Punjab Agri Business Incubator (PABI), where he applied under Uddan Cohort programme to expand his business and increase the production of cream honey. Cream honey is made of mustard honey that has been processed to control crystallization, resulting in spreadable, smooth and butter like consistency. Under two-month training programme, he improved his technical, communication and business skills, after which he registered his company with the name ‘Dhaliwal Honey Bee Farm Pvt Ltd.’ Thereafter, he got registered on Startup India Portal as a startup.

During the training programmes on beekeeping and agri startups at PAU, he has been invited as a resource person to explain the opportunities in beekeeping and honey processing, and share his inspirational success story. In addition to delivering lectures, he has also guided the trainees regarding the setting up of an agribusiness. During Startup Talkies, a zoom series of talks by PABI’s successful startups, he shared the importance and market scope of pollen and how to convert pollen into products to sale directly in the market.

In the pandemic, he is producing and selling the cream honey on a large scale, using the marketing skills he learnt at PABI and the grant-in-aid he received from Rashtriya Krishi Vikas Yojna - Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR). Some cosmetic companies have also approached him for being a supplier of cream honey. His success is evident from the fact that he has received a Canadian order of cream honey, worth 25 lakh. He has been working in collaboration with co-incubates at PABI to supply honey and expand his product range.

Narpinder Singh was conferred with ‘Pandit Deendayal Upadhyay Antyodaya Krishi Puruskar’ on July 16, 2020 for his excellent efforts for ensuring positive change towards sustainability and clean environment. He was also felicitated with ‘Innovative Farmer Award’ at Pusa Krishi Vigyan Mela, held in New Delhi from March 5-7, 2019.

• TS Riar: 98142-10269

Narpinder Singh, a progressive beekeeper, is engaged in beekeeping for more than a decade. In the pandemic, he is producing and selling the cream honey on a large scale, using the marketing skills he learnt at Punjab Agri-Business Incubator (PABI) and the grant-in-aid he received from Rashtriya Krishi Vikas Yojna - Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR).
Profitable subsidiary occupations for rural youths in Punjab

BY GURDEEP SINGH AND KARAMJIT SHARMA
Krishi Vigyan Kendra, Mansa

Agriculture and agro-based occupations have made a significant contribution in the development and progress of the country. The economic and social structure of the country rests on them. Agriculture is still a risky business in India where the annual income depends on the climatic conditions. Due to the growing problem of marketing and rising costs of farming, profits in agriculture have plummeted. The sharp rise in farm costs has made small scale farming unprofitable. In addition, climate change has further exacerbated the problems of farmers. The risk of crop damage due to unseasonal rains has also increased significantly. Allied occupations can play a significant role in increasing the income of a farmer. If these subsidiary occupations are adopted in an integrated manner, then the youth of our villages can increase their annual income significantly.

Animal husbandry: Animal husbandry is an integral part of our agriculture. As most of the population of our country is vegetarian, it depends mainly on milk and milk products for its protein requirement. Agriculture and dairy are interdependent. From animals, we get organic manure for crops and from agriculture, we get fodder, straw, etc. for dairy animals. Taking up the profession of dairy in integration with agriculture is very beneficial as the labour and the support laid down for agriculture is put to good use. Although farmers are constantly earning income from this profession, yet the business of animal husbandry can be made more profitable by adopting scientific lines. The high cost of feed (65-70%) in the dairy business can be easily reduced by preparing homemade feed. There are four main things to keep in mind to run a successful dairy business: good breeding practices, balanced diet, proper maintenance and health care. Animals should be fully vaccinated from time to time. Self-marketing of milk and milk products such as yoghurt, lassi, cheese, ghee, etc. can significantly increase profits. To facilitate farmers, the government has launched a number of schemes for the youth of the village.

Poultry farming: Poultry farming is one of the important occupations, which can be done in the form of broilers or layers. Its main objective is to provide meat and eggs for the nutritional security of the country’s population. Poultry farming is a great way to reduce unemployment as well as increase the nutrition of the country. Nowadays, non-vegetarians as well as vegetarians are consuming eggs. The benefit of poultry farming is that it does not require much space. If work is to be started from 2,000 broilers, only 2,000 square feet of space is required. Hens start laying eggs after five months, while broilers are ready in 6-7 weeks. Nowadays, poultry rearing techniques have been greatly improved which has made this profession even more profitable.

Rural youths, who do not want to take high risk, can adopt contract system in poultry farming. Many reputed companies are contracting in poultry farming. The chicks are provided by the company, and marketable birds are procured by them at a pre-arranged price. In this way, the problem of marketing is also solved. Feed is also provided by the same company. The farmer just needs to build the shed and take care of the chickens.

Goat farming: Till now, goat rearing has only been seen in association with the poor. But now even the educated farmers are more inclined to adopt goat farming. Because of its easy management and usefulness, some call it a mobile bank and some a mobile refrigerator as its guardian can sell it at a good price whenever he wants to meet the domestic needs in case of crop failure. Due to its small size, children and women can easily manage it. Goats are hardy animals and less susceptible to diseases than other animals. Goats have the ability to survive even in bad conditions. Goat meat is in high demand due to its high fat content. Moreover, goat’s milk is highly recommended for children, the elderly, and the sick because of the very fine fat particles in its milk. Although goat’s milk is very nutritious, yet most of the goat rearing is done for meat production. A look at the economic aspects of

Allied agri-occupations such as animal husbandry; poultry, goat, fish and pig farming; mushroom cultivation and beekeeping can play a significant role in increasing the income of a farmer.
agriculture and goat rearing shows that it is a very lucrative business for the farmers. The average annual income of a farmer engaged in conventional farming with 10 acres of land is about Rs 4.0 lakh. But to raise a herd of 100 goats, only two canals of land is required and from this unit, the farmer can get a net annual income of around Rs 2 lakh. In Punjab, beetle breed of goat is recommended due its adaptation to climatic conditions of the state. The benefit-to-expenditure ratio of goats in Punjab is 1.49 which is higher than that of cows.

Mushroom production: Most of our population is vegetarian. Mushrooms are a great source of protein, vitamins and minerals for vegetarians. Demand for mushrooms has increased significantly as more and more people are becoming aware of the nutritional value and medicinal use of mushroom. In recent times, there has been a significant increase in people’s interest and ability to buy mushrooms. So mushroom production can be a profitable business. To produce mushrooms, we need straw which we have in abundance. Along with grain, millions of tonnes of straw are also produced, which can be used for mushroom cultivation. Small farmers, landless labourers and other poor people can reap huge benefits by adopting this profession. In Punjab, five varieties of mushroom i.e. button mushroom, straw mushroom, dhingri, milky mushroom and Shiitake mushroom can be cultivated. Button mushroom is in high demand in Punjab, which is why it accounts for 90 per cent of the total production. From one square meter area, 8 to 12 kg of mushrooms are produced. One kg of button mushroom costs about Rs 38.5 per product, and it is sold in the market for Rs 75 per kg. In this way, one can earn up to Rs 292-538 per square meter from mushroom production.

Fish farming: Fish farming is a very simple and profitable occupation. The net profit per 2.5 acre is 3-4 times higher than that of conventional farming. Farmers can also use the fish pond as a water storage tank for agriculture and other purposes. Farmers can use their barren, salt affected and waterlogged areas for this occupation. Fisheries can be combined with other occupations such as dairy, poultry, piggy, etc. Proper use of natural resources and waste products in the fish farming industry is essential to reduce input costs. Existing water sources and animal excreta serve as feed for fish. Silver carp, Rohu, Golden carp, Muras and grass carp varieties are recommended for fish farming. About 6,000 fingerlings per acre are required for fish farming. It produces about 2,000 kg of fish per year. A kilo of fish costs around Rs 12-18/- which can be sold in the market for Rs 80-100/- per kg. Subsidy facility is also available at the rate of about Rs 60,000 per acre for setting up of fish ponds. In waterlogged areas, the subsidy is up to 90 per cent, which means Rs 90,000 per acre is provided by the government institutions. In addition, a subsidy of Rs 20,000 is also available on feed. In the South-Western districts of Punjab, where the groundwater is saline, prawn farming can be adopted. For this, the Fisheries Department, Punjab is providing subsidy for shrimp farming under Pradhan Mantri Matsya Sampada Yojana.

Beeskeeping: Keeping honey bees in a wooden box with hive is called beeking. This is mainly done for honey but wax, royal jelly, pollen, propolis, etc. can also be obtained from it. Punjab is the leading state in beekeeping in the country but there is a lot of potential for further growth of this profession as Punjab has an abundance of flowers. The government is also providing financial assistance to the Horticulture Department, Punjab for the promotion of this profession. Beekeeping is an agri-based business. Due to increasing demand for honey and its products, beekeeping is becoming a lucrative business. Beekeeping requires less time and less capital investment. That is why this profession is very suitable for landless, unemployed and economically weak small farmers. Beekeeping is a supportive occupation that every small and big farmer, midwife and young generation can adopt. The management cost in case of honey bees is negligible. There are four types of honey bee species and among them Italian bee can be raised very easily. By keeping colonies of honey bees around fields, 15-20 kg of honey per colony can be collected annually from which an additional annual income of about Rs 1,500-2,000 can be obtained. The farmer can double his income by getting about 35-40 kg of honey by adopting migratory system of honey beekeeping.

Pig rearing: Pig rearing is a business which has low cost and high profit. Although this business is generally considered as a backward class business, nowadays many educated youths have opened pig farms. This business is also being adopted in conjunction with the fisheries business in which by the use of pig feces as the food of fish farm, the profit can be further increased due to reduction in food costs of the fish farm. Large white Yorkshire breeds are recommended in pig rearing on scientific lines and are fed a clean balanced diet. If a pig farm of 10 pigs is made, then the annual income can be up to Rs 15,000. Very little space is required for pig rearing. A pig can farrow two times a year and can produce up to 12-24 piglets a year. Pigs become ready for meat purpose in 6-8 months. During this time, the weight of pigs reaches 70-80 kg and we can sell meat at around Rs 80 per kg.

Apart from the above occupations, farmers can also earn more profit by adopting occupations like seed production, nursery production and crop processing. But before taking up any profession, one must get training in this profession. Visiting and interacting with progressive farmers’ units can greatly enhance knowledge. Higher profits are possible only if marketing is done by oneself.

Gurdeep Singh: 88722-00121
WHEAT
Last irrigation to wheat sown after December 5th, should be given up to 10th of April. Avoid irrigation on windy/stormy day.

SUGARCANE
1. Fields infested with dila, post-emergence application of 800 g per acre 2, 4-D sodium salt 80 WP in 200 litres of water is recommended. Do not sow moong/mash as inter crop, if sugarcane has been sprayed with herbicide.
2. Irrigate the crop at 7-12 days interval for better growth of the crop. Apply 65 kg urea to ratooon crop.
3. Apply paddy straw or rice husk or sugarcane trash @ 20-25 q/acre between the rows of sugarcane to reduce soil temperature and moisture loss.
4. The incidence of black bug in this crop can be checked by spraying 350 ml of Dursban/Lethal/Massban/Goldban 20 EC in 400 litres of water per acre with manually operated sprayer. Direct the spray material into the leaf whorl.
5. Mite feeds on lower side of leaves under fine web. The leaves turn red and later appear to be burnt. Baru (Sorghum halepens) is the alternative host plant of mite. So, destroy the weeds, growing near the sugarcane fields.
6. Do not ratooon the crop if it is severely affected with red rot or wilt.

COTTON
1. Start sowing of recommended varieties/ hybrids of cotton including Bt cotton or desi cotton during this month. Sow seeds in polythene bags to fill gaps in cotton. Give deep ploughings in paddy fields, where puddling was done continuously for longer periods as the hard layer developed due to puddling adversely affects the deep penetration of roots. Apply heavy pre-sowing irrigation with good quality water for better germination and crop stand.
2. To reduce the attack of leaf curl disease, avoid growing American cotton in citrus orchards and adjoining bhindi crop. Avoid growing bhindi, moong, castor and arhar in the cotton crop and as border rows in order to reduce the incidence of American and spotted ballworm; jassid and whitefly. But, control such insect pests on these crops grown in the vicinity of cotton fields properly in order to check their migration to the cotton crop.
3. In wilt infested fields, prefer to sow LD 949 and LD 1019 varieties of desi cotton.
4. At the time of sowing, smear the cotton seed with Gaicho 70 WS (imidacloprid) @ 5 g or Cruiser 30 FS (thiometoxan) @ 7 g/kg seed for preventing damage by cotton jassid.
5. Sow both American cotton and desi cotton varieties in rows at 67.5 cm apart with plant to plant distance of 60 cm for American Cotton and 45 cm in case of Desi Cotton but for Bt cotton hybrids it should be 75 cm.
6. Drill 75 kg single superphosphate or 27 kg DAP per acre at the time of sowing. If cotton succeeds wheat, which received recommended dose of phosphorus, omit its application to cotton. In coarse textured soils, half dose of nitrogen (33 kg urea/acre to varieties and 45 kg urea/acre to hybrids and Bt cotton) may be applied at the time of sowing. Use PAU–LCC for need based urea application. Apply 20 kg muriate of potash in soils low in available potassium. Also apply 10 kg zinc sulphate heptahydrate or 6.5 kg zinc sulphate monohydrate to cotton in zinc deficient soils.
7. For controlling weeds, spray Stomp 30 EC (pendimethalin) @ 1.0 litre/acre as pre-emergence application in 200 litres of water. At the time of spray, there should be sufficient moisture in the soil. For controlling itsit which emerges with first irrigation, Stomp @ 1.0 liter per acre can also be applied after first irrigation.

SUMMER PULSES
Try to complete the sowing of sathi moong and sathi mash during the first week of this month.

SUMMER GROUNDNUT
Groundnut variety SG 99 / M 522 can be sown during the end of this month under irrigated conditions. Treat the kernels before sowing with 2ml Neonix or 1.5g Seedex or 5g Thiram (75%) or 3 g of Indofil M-45 (75%) per kg kernels. Neonix treated seed also give protection from attack of White grub and termite.

TURMERIC
1. Start planting turmeric from the end of this month.
2. Planting of turmeric should be done in rows 30 cm apart by keeping plant to plant distance of 20 cm. Six to eight quintal of rhizomes are sufficient for sowing one acre.
3. Apply 10-12 tonnes of well-rotten Farm Yard Manure before planting and 60kg single super phosphate per acre at planting. Also apply consortium biofertilizer @ 4kg/acre at planting. Apply 16 kg muriate of potash in soils low in available potassium.
4. Spread uniformly 36 q/acre paddy straw over the entire field for weed control.

FODDERS
1. For early kharif fodder, sowing of bajra, maize, cowpea etc. may be carried out after harvesting rabi crops. Cowpea is a very quick growing leguminous fodder which can be sown as a mixture with maize or bajra.
2. Take last cutting of berseem which is to be kept for seed during this month. Berseem crop for seed production should be frequently irrigated. Kashtni and other weeds should be rogued out.
3. Stop irrigation to lucerne after full blossom to arrest vegetative growth for better seed production.
4. Grow perennial fodders on some area. For this purpose, guinea grass and napier bajra can be sown in April.
RECLAIMING SALINE AND ALKALI SOILS
For reclamation of kallar soils, follow the steps given below:
1. Get the salt-affected soil tested from PAU or nearest soil testing laboratory. For this, take four samples up to 1 metre depth from 0-15 cm, 15-30 cm, 30-60 cm and below 60 cm.
2. Prepare strong bunds around the field.
3. After levelling and ploughing the field, apply heavy irrigation with good quality tubewell water or canal water so that excess salts leach down.
4. When the field comes into field capacity (water), if recommended, apply gypsum according to soil test report.

STORE GRAIN INSECT PESTS
1. Store new grains in clean godowns or receptacles. Plug all cracks, crevices and holes in the godown thoroughly. Disinfect empty godowns or receptacles by spraying 0.05% Malathion emulsion (100ml Malathion 50 EC in 10 litres of water) on the floors, walls and ceilings or fumigate the godowns using 25 tablets of aluminium phosphide/100 cubic metres of empty space before storing grains. Exposure period is 7 days.

VEGETABLES
Tomato
Irrigate the tomato crop once a week to encourage maximum fruit setting and development of fruits. Varieties viz. Punjab Ratta, Punjab Chhuhara, PNR-7 and Punjab Upma as well as hybrid TH-1 and PTH-2 start ripening during this month. Harvest the red turning and red ripe fruits regularly to catch distant and local markets, respectively. While harvesting the fruits, every precaution should be taken to minimize injury and disturbance to the natural canopy of the plants.

Brinjal, Capsicum, Chilli and Cucurbits
These vegetable crops sown under low-tunnel or poly net house conditions start giving fruits. Harvest fruits twice a week in the afternoon except bottle gourd where harvesting should be done in the morning. All the crops are pollinated by insects and human movement at flower opening and pollination time disturbs pollinators and cause serious setback to fruit-setting and yield. Irrigate these crops once a week.

Onion
Take care of kharif onion nursery sown in March and irrigate regularly after 5-7 days intervals.
Pot plants
Pot plants must be watered carefully as the growth has been resumed in this month.

Bulbous plants
The Gladioli bulbs should be taken out from the soil, cleaned and dried in shade for 2-3 weeks and are then packed and stored in cold storage at 4°C. The summer flowering bulbs of caladiums, Football Lilly and Tuberose may be planted early this month.

Marigold: Summer marigold Punjab Gainda No.1 can be transplanted in the field during this month, if the seedlings are ready. Just give light irrigation after transplanting for summer season flower production.

AGROFORESTRY

Poplar
1. As the temperature has started rising, thus irrigate the poplar plantations at 7-10 days interval instead of fortnightly.
2. Turmeric and sugarcane can be sown in poplar having less than three years of age. In the plantations of more than three years age, fodder crops should be raised.
3. The attack of Poplar leaf defoliator and leaf webber starts in this month. Control the insects by collecting and destroying infested leaves.

Eucalyptus
Keep on irrigating the Eucalyptus plantations at 15 days intervals during April.

BEE KEEPING
Bee strength of honey bee colonies during April is about at peak. Keep vigil of swarming in the colonies and manage to prevent and check swarming. Colonies should be provided enough space in the form of raised empty combs or frames with wax foundations and super chambers to cope-up with brood rearing and honey storage. The early part of the month is still suitable for queen bee rearing. If drone brood rearing is continued, the stock multiplication can be undertaken either by dividing the colonies or through mass queen rearing. The progressive beekeepers should prefer the latter method for its well known advantages. Older queen bees may also be replaced, if not replaced as yet during the season, with the new ones raised preferably from the selected good stock following mass queen bee rearing technique. Dust sulphur powder on the top bars of bee combs @ 1.0 g per comb against brood mite (*Tropilaelaps clareae*). Alternatively, fumigation with formic acid (85%) @ 5 ml daily for two weeks may be applied. The latter treatment will also take care of *Varroa* mite. In the case of infestation by *Varroa*, destruction of sealed drone brood comb part, *Varroa* trapping in drone brood and then its destruction and use of sticky papers with *Varroa* bottom board, can also be integrated. Keep vigil of the brood diseases and on suspicion, immediately consult expert and suggested control measures should be undertaken; non-chemical methods should be preferred. Use of antibiotics should be avoided. Proper spacing among the colonies and extraction of honey only from the supers separated from brood chamber with queen excluder help in preventing spread of *Varroa* and brood diseases among the colonies in an apiary. If *Eucalyptus* is in bloom around the apiary and colonies have surplus sealed honey, it should be extracted. All necessary precautions, for preventing robbing in the apiary, must be observed during and after honey extraction. Afterwards, commercial beekeepers may migrate their apiaries to sunflower growing areas. Considering the ensuing summer season, colonies should be managed to be shifted under shade.

MUSHROOM FARMING
1. Make arrangements for procuring wheat straw for cultivation of button and dhingri mushroom for the next season (September-March). Store the procured wheat straw in a dried shady place.
2. Book mushroom spawn for cultivation of summer mushroom varieties (paddy straw and milky mushroom).
3. Start preparing paddy straw bundles for paddy straw mushroom cultivation. From mid-April onwards for its cultivation, wet the prepared paddy straw bundles, prepare the mushroom beds as per recommended technology, add spawn to the prepared beds.
4. Spray water on the spawned beds twice daily. Mushrooms start appearing after 10-12th days of spawning and mushroom harvesting continues for three weeks.
5. For cultivation of milky mushroom, use cooked wheat straw (2kg/bag) as per recommended technology. After complete spawn run, bags will be ready for casing and mushrooms start appearing after 18-20 days of casing.

DAIRY FARMING
1. Summer season is approaching, therefore efforts should be made to protect the animals from summer heat and stress. Keep fresh water available all the time. Provide fans to the animals for better air circulation in the farm.
2. As feed intake is reduced due to effect of high temperature. Hence, protein level in the concentrate mixture need to be increased which can be done by increasing oilseed cakes by 5-7 per cent.
3. Watch the animals for heat symptoms and get the animal inseminated between 12 to 18 hours after the onset of heat.
4. Take adequate steps for calf management and feed colostrum within 1-2 hours of the birth without waiting for expulsion of the placenta.
5. To prevent tick infestation, spray the sheds/barn and animals regularly with Butox liquid @ 2 ml per litre of water and repeat after 10 days.
6. Keep the shed and animal clean.
7. Make sure that all the animals are vaccinated against FMD, if still not, then get them vaccinated immediately, keep their record and repeat after six months.
8. Do not feed excess wheat/ cereals to dairy animals. This can be fatal.

POULTRY FARMING
1. It is the best time to replace the stock. Cull the unprofitable birds to provide sufficient space to young chicks. Brooding in these days can be carried out easily.
2. Reduce the thickness of litter and change the wet litter.
3. Provide cool and fresh water to birds. Provide sufficient number of waterers to avoid excess movement of birds.
4. Vaccination schedule must be followed strictly.
5. Vaccinate the chicks of 6-8 weeks of age with *Ranikhet* disease vaccine and fowl pox vaccine at 8-10 weeks of age.
6. Start deworming the pullets at 3 months of age and then regularly at one month interval.
7. White wash the poultry shed from outside especially roof. This will help to reflect the sun rays.
8. Provide artificial lights during early morning so that birds can consume feed in cool hours.
9. In order to compensate decrease in feed intake, level of energy nutrients need to be increased which can be achieved adding maize.
10. Provide electrolytes, Vit. C @ 5gm/liter per 100 birds per day.

Compiled by: Amarjit Singh
Training Programmes in April

April 01: Formulation of balanced feed for dairy animals
April 04: Management of insect-pests and diseases of major *kharif* crops
April 05-07: Hybrid seed production of tomato, muskmelon and brinjal
April 07: Nutrient management using vermicompost and green manure
April 11-12: Diet plan and recipes to manage lifestyle diseases
April 13: Silage making for dairy animals during lean period
April 18-19: Processing and packaging of turmeric and pulses
April 21-29: Recycling clothes to prepare household products

April 01: Marketing of rabi crops
April 04: Cultivation of summer pulses and cotton for crop diversification
April 05-06: Personal hygiene and nutrition for adolescent girls
April 06: Methods of collecting soil and water samples and interpretation of results
April 07: Summer management and feeding of dairy animals
April 11: Formulation of balanced feed for dairy animals
April 12: Integrated pest and disease management in *kharif* crops
April 18-22: Nursery production in horticultural crops
April 19-20: Solar cooker and solar dryer as renewable sources of energy
April 28: Improved cultivation techniques of *kharif* crops

April 01: Summer management and feeding of dairy animals
April 04: Cultivation of summer pulses for crop diversification
April 05: Methods of collecting soil and water samples and interpretation of results
April 06: Management of fruit drop in citrus
April 07: Green fodder production round the year
April 11: Efficient utilization of non-conventional energy gadgets
April 12: Dietary management for lifestyle diseases
April 13: Eco-friendly approaches for insect-pest and disease management of fruits and vegetables
April 18-22: Enrichment of garments through printing and painting
April 19: Improved cultivation techniques of *kharif* crops
April 20: Integrated pest and disease management in *kharif* crops
April 21: Custom hiring of agricultural machinery
April 22: Management of poor quality irrigation water in *kharif* crops
April 29: Formulation of balanced feed using domestic ingredients and Azolla farming for livestock

April 04: Efficient utilization of non-conventional energy gadgets
April 05: Silage making for dairy animals during lean period
April 06-07: Techniques for cultivation of milky mushroom and paddy straw mushroom
April 07: Eco-friendly approaches for insect-pest and disease management of fruits and vegetables
April 11: Green fodder production round the year
April 12: Personal hygiene and nutrition for adolescent girls

April 13: Organic farming
April 18: Integrated management of fruit drop in Kinnow
April 19: Nutritional security through integrated nutrition garden
April 20: Integrated Farming System
April 21: Improved cultivation practices for *kharif* crops
April 22: Production technology of summer vegetables
April 25: Soil, water and nutrient management for sustainable crop production

April 05: Recommended practices for clean milk production
April 06: Efficient utilization of non-conventional energy gadgets
April 07: Seed treatment- A preventive measure for seed borne diseases
April 11: Integrated pest and disease management in *kharif* crops
April 12: Judicious use of irrigation water in *kharif* crops
April 18-26: Embellishment of clothes using modern and traditional techniques
April 22: Solar cooker and solar dryer as renewable sources of energy
April 25: Crop regulation techniques for quality and yield improvement in guava and ber crops

April 27: Methods of collecting soil and water samples and interpretation of results

April 04-13: Embellishment of clothes using modern and traditional techniques
April 07: Use of renewable energy sources at farm and household level
April 12: Methods of collecting soil samples and interpretation of results
April 28: Methods of collecting soil samples and interpretation of results
April 29: Value addition to pulses and oilseeds

April 18: Integrated nutrient management through green manuring and farm yard manure in *kharif* crops
April 19: Silage making for dairy animals during lean period
April 20: Integrated nutrition gardening for domestic requirement
April 21: Production techniques for crops under organic farming
April 22: Use of renewable energy sources at farm and household level
April 28: Methods of collecting soil samples and interpretation of results
April 29: Value addition to pulses and oilseeds

April 11: Technique of raising mat type paddy nursery
April 12: Methods of collecting soil and water samples and interpretation of results
April 13: Identification and management of insect-pests and diseases in fruits and vegetables

April 19: Complete Blood Count (CBC) interpretation
April 20: Summer management and feeding of dairy animals
April 21: Post-harvest management and handling of fruits and vegetables
April 28: Improved cultivation techniques in *kharif* crops
April 29: Integrated pest and disease management in *kharif* crops

April 12: Post-harvest management of fruit and vegetable crops
April 18: Direct seeding of paddy/basmati- A resource conservation approach
April 19: Identification and management of insect-pests and diseases of vegetables and fruits
April 20: Micro irrigation, fertigation and weed management practices in orchards
April 21: Awareness about immunity boosting foods
April 22: Custom hiring of agricultural machinery
April 25-29: Embellishment of clothes using modern and traditional techniques in dyeing
April 26: Prevention and control of endo and ecto parasites in dairy animals
April 27: Solar cooker and solar dryer as renewable sources of energy
April 28: Methods of collecting soil and water samples and interpretation of results
April 29: Safe use and handling of spraying equipment and farm machinery

KVK, KAPURTHALA (01822-233056) ..................................................
April 07: Improved cultivation techniques of kharif crops
April 12: Safe use and handling of spraying equipment and farm machinery
April 19: Management of insect-pests and diseases of major kharif crops
April 20: Dietary management for lifestyle diseases
April 27: Organic farming
April 28: Methods of collecting soil and water samples and interpretation of results

KVK, LUDHIANA (Samrala) (01628-261597) ..................................
April 07: Role of green manuring to enhance soil health
April 12: Improved cultivation practices of kharif crops
April 19: Bio-agents and non-chemical methods for disease and insect-pest management
April 21-29: Embellishment of clothes using modern and traditional techniques
April 25-29: Agristartup and agribusiness
April 26: Methods of soil sampling for fertilizer application and interpretation of results
April 28: Raising of mat type paddy nursery and mechanical transplanting

KVK, MANSA (01652-280843) ..................................................
April 07: Dietary management for lifestyle diseases
April 18: Control measures for fruit drop in citrus
April 19: Management of insect-pests and diseases of major kharif crops
April 20: Recommended practices for clean milk production
April 22: Methods of collecting soil and water samples

KVK, MOGA (Budh Singh wala) (98142-19099) .................
April 06: Organic farming - Scope and prospects
April 07: Dietary management of lifestyle diseases
April 12: Small scale agro industry- A way to become an entrepreneur
April 18: Improved protection practices in kharif crops
April 19: Green manuring
April 26: Methods of collecting soil and water samples
April 27: Water conservation techniques in kharif crops

KVK, PATHANKOT (98148-30820) .................................
April 04: Cultivation of summer pulses and cotton for crop diversification
April 05: Solar cooker and solar dryer as renewable sources of energy
April 12: Silage making for dairy animals during lean period
April 18-22: Value addition to cereals and pulses
April 19: Identification of physiological and nutrient deficiency disorders in fruit and vegetable crops
April 20: Use of renewable energy sources at farm and household level
April 25-29: Goat farming

KVK, PATIALA (Rauni) (94642-10460) .................................
April 01: Certification of agricultural products under AGMARK/FSSAI: Rules and procedures
April 05: Drudgery reduction technologies in household and farm activities
April 06: Safe storage of food grains
April 11: Processing of milk at domestic level
April 12: Seed treatment of paddy and basmati against seed borne diseases
April 18: Farm management and record keeping
April 20: Rationing use of poor quality irrigation water
April 22: Efficient utilization of non-conventional energy gadgets
April 25-29: Embellishment of clothes using modern and traditional techniques
April 27: Preparation of farmyard manure, compost and green manuring

KVK, ROPAR (01881-220460) ........................................
April 04: Summer management and feeding of dairy animals
April 05: Improved cultivation practices for cultivation of turmeric
April 06: Methods of collecting soil and water samples and interpretation of results
April 07: Nutritional security through integrated nutrition garden
April 12: Fertilizer management in Poplar and Eucalyptus
April 13: Micro irrigation, fertigation and weed management practices in orchards
April 20: Cultivation of summer pulses for crop diversification
April 22: Formulation of balanced feed using domestic ingredients

KVK, SANGRUR (Kheri) (01672-245320) .........................
April 18: Calibration of laser land leveler and its operation in the field
April 19: Methods of collecting soil and water samples and interpretation of results
April 20: Direct seeding of paddy/basmati - A resource conservation approach
April 21: Integrated Pest and Disease Management in kharif crops
April 25-29: Entrepreneurship development programme in eco-friendly cleaning agents and tie and dye

April 27: Cultivation of summer mushrooms

SKILL DEVELOPMENT CENTRE (0161-2401960 Ext 261) ...
April 01: Importance of cultural practices to manage whitely in cotton
April 04: Efficient utilization of non-conventional energy gadgets
April 05: Dietary management for lifestyle diseases
April 07: Identification and management of insect-pests and diseases of fruits and vegetables
April 12: Small scale agro-industry- A way to become an entrepreneur
April 13: Formulation of balanced cattle feed
April 20: Organic manures

KVK, SRI MUKTSAR SAHIB (Goneana) (98556-20914) ...........
April 01: Marketing of rabi crops
April 20: Methods of collecting soil and water samples and interpretation of results
April 22: Management of stored grain pests

SKILL DEVELOPMENT CENTRE (0161-2401960 Ext 261) ...
April 05 : Vocational and career development programme for school going children
April 19: Distress management through market and artificial intelligence
April 25-29: Development of entrepreneurial skills in baking and confectionary

Compiled by: Inderpreet Kaur Boparai and KB Singh
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