



# PROGRESSIVE FARMING

MARCH 2024

A MONTHLY JOURNAL OF PUNJAB AGRICULTURAL UNIVERSITY



*Let's turn farming into a thriving subsidiary enterprise,  
as this is the path to success and building family ties!*

## Kisan Melas

Ludhiana

March 14-15

March 5

Nag Kalan Jahangir  
(Amritsar)

March 7

Ballowal Saunkhri

March 12

Bathinda

March 18

Faridkot

March 20

Gurdaspur

March 22

Rauni (Patiala)

# PROGRESSIVE FARMING

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The Punjab Agricultural University is organizing *Kisan Melas* at its main campus Ludhiana, and Regional Research Stations/*Krishi Vigyan Kendras*, during the month of March. Based on the theme “*Kheti naal sahaik dhanda, parivaar sukhi munafa changa*,” the *melas* will underline the need for adopting subsidiary occupations along with agriculture. These *melas* have become an integral part of the cultural heritage of Punjabi farming families. Farmers and farm women from Punjab and adjoining states attend *Kisan melas* in huge numbers to upgrade their agricultural knowledge and to purchase improved seed/planting material of PAU varieties/hybrids. In *Kisan melas*, besides field demonstrations, an agro-industrial exhibition is also set up and farm produce competitions are held. This year, in March 2024, *Kisan melas* are scheduled to be held on March 5 at Nag Kalan Jahangir (Amritsar), March 7 at Ballowal Saunkhri, March 12 at Bathinda, March 18 at Faridkot, March 20 at Gurdaspur, March 22 at Rauni (Patiala), and March 14 and 15 at Ludhiana campus. Quality seeds and planting material, biofertilizers and farm publications will be sold to the farmers under one roof in addition to showcasing live demonstrations, holding farmers-scientists’ interaction, crop produce and home science competitions.

This issue of Progressive Farming is specifically dedicated to the PAU *Kisan melas* and Cotton cultivation. Cotton (also known as white gold) is one of the traditional crops of Punjab which has lost its ground over a period of time due to multiple reasons. There is an urgent need to increase the area under cotton and revive its old glory. Comprehensive measures are needed to promote cotton cultivation in the state, which otherwise is withering. It is necessary to sustain it as an alternative crop, not only for crop diversification and raising farmers’ incomes but also for the sustenance of cotton ginning, spinning and textile mills and protecting and promoting employment. The PAU research continues to evolve to face such challenges.

Farmers along with their families are invited to these *kisan melas* and seize the opportunities to sow and grow, involve and evolve as well as progress and prosper.

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# Diversify towards subsidiary occupations and value addition for higher incomes

**SATBIR SINGH GOSAL, Vice Chancellor and  
AJMER SINGH DHATT, Director of Research**



**SATBIR SINGH GOSAL**



**AJMER SINGH DHATT**

Globalization, rapid diffusion of digital technologies, increasing incomes in some sectors, and ease of financial transactions have together played a vital role in raising our living standards and have accordingly raised living expenses. Peer pressure and herd instinct have been making big holes in people's pockets. It goes without saying that the challenge needs to be tackled with two-pronged strategy: cutting unnecessary expenses and raising incomes. Both approaches are, however, quite challenging. Feeling a real sense of kinship with farmers and rural masses of the region, Punjab Agricultural University (PAU) had earlier laid emphasis on the first approach of cutting expenses by spreading the slogan of living in a simple way within one's own means – “*Saade viah, Saade bhog, naa karza naa chinta rog*” (Simple weddings and simple religious ceremonies keep debt and worries at bay) through *Kisan Melas* and other outreach programmes. Theme of this *Kisan Mela – Kheti naal sahayak dhandha, parivaar sukhi munaafa changa* (Subsidiary occupations ensure higher profits, hence a blissful family) – shines light on the second prong. About 33 per cent of Punjab farmers are small and marginal ones and about 62 per cent are medium farmers. In agreement with the established principles of economic

development, some rural households have left agriculture for better opportunities in service and industry sectors; and some have left for foreign shores. As a result, a good number of landholdings have become available for leasing out. Many of the small and medium cultivating landholders or landless tenants try to benefit from economies of scale by leasing in land at inflated rates. This has set in an unhealthy lose-lose competition among the tenant farmers and also leads towards exhaustion of natural resources. Although, these farmers play in an MSP-entrenched field but climate change led weather anomalies like floods, excessive rains, heat waves, etc. can sometimes upend their plans all of a sudden and they are made to fend for themselves. When institutional credit is not utilized for generating productive assets but for meeting hefty family commitments of marriages, international education and constructing palatial houses, it ultimately lands poor farmers into the hands of loan sharks. Additional income avenues need to be explored for counter balancing or by passing monetary losses in conventional crop-based agriculture and for meeting family obligations. Practice of creating multiple income sources to counter balance potential losses in a few out of all the enterprises and to derive synergistic benefits is known as portfolio diversification in business language. Climate change and market related challenges necessitate such portfolio diversification at the earliest especially in the case of small and marginal farmers. Allied occupations like dairy farming, beekeeping, mushroom cultivation, etc. are good candidates in this regard. Some of these occupations like dairy farming, poultry farming, mushroom cultivation,

etc. can be integrated into the conventional crop based system as resources can be transferred across various enterprises in a synergistic and in an environmentally advantageous way. Likewise, beekeeping can extend intangible advantages through paced up pollination. Subsidiary occupations also help in efficient utilization of family labour; especially, women folk may engage themselves in an enterprising way and vent their boredom after performing various monotonous household chores.

The PAU pioneered introduction of European honeybee in the country during early 1960s and a sweet revolution was seeded once the technology was successfully established during 1976 in the Punjab state. Having shown the sweet path to the entire country, Punjab with 17 thousand ton honey production stands among top three in the country. Besides, beekeeping has been diversified beyond mere honey production towards royal jelly, bee wax, and other products. The PAU has developed a range of food technologies which substitute honey for sugar. A honey heating-cum-filtration machine has also been developed which provides substantial benefits in filtering in comparison to the conventional muslin cloth based process. We are still into an ideal time of the year for venturing into this occupation as pollen and nectar rewarding flora are available in plenty and weather conditions are suitable for foraging.

In case of mushroom production, Punjab state with 18.5 thousand ton production stands among top five in the country. The PAU has developed cultivation technology packages for five mushroom varieties, namely white button, *dhangri*, Shiitake, milky, and paddy straw mushroom. This enterprise also contributes in its own small way towards

management of crop residue in the state. Mushroom composting modules developed by PAU are generally based on paddy and wheat straw. To provide processing leverage to the mushroom cultivation, the university has also developed technologies for vitamin D<sub>2</sub> fortification and mushroom canning.

Some progressive farmers have found a lucrative vocation in organic farming as organically raised food products invite premium market owing to the prevalent perception of safety and nutrition around such products. However, a host of quality assurance norms are to be complied with for better marketing of these products. Punjab Agricultural University has generated a range of technology packages in this regard. Interested farmers are advised to interact with experts in the School of Organic Farming at PAU where interested farmers can also be provided technical handholding in navigating the challenges in the certification process.

Businesslike approach to agriculture demands that a farmer should try to occupy as many nodes down the value chain as possible. In other words, we need to shrink the distance between producer and consumer, reducing the power of middlemen. Many innovative farmers in our state have scripted success stories in this way, where they have found a direct access to consumer base. This is a win-win situation for both the producer and consumer as middleman's share moderates sale price for the consumer and adds to the profit of producer at the same time. Agro-processing complexes are a pertinent example in this regard. The PAU has provided technical handholding in setting up about 320 agro-processing complexes in the state. Such ventures are important not only as a monetarily productive asset but also as important players in crop diversification, which will ultimately lead to sustainable management of natural resources. Their proximity to the consumer base leads to build up of trust with respect to quality of the product and thus provides strong leverage to marketing. Over the years, our innovative farmer-entrepreneurs have led to a visible

consolidation of some processing niches like pickle and *murabba* based products in Amritsar, *gur* and jaggery in Fatehgarh Sahib, honey in Bathinda, and chilli is taking hold in Ferozepur district.

Start-up ecosystem has gained considerable currency world over. Relatively liberal financial support under various youth oriented schemes has heated up the scene in our country as well. Agri-based startups are getting attracted towards Punjab. The state has good opportunities to excel and our youth should harness these in-house opportunities without further delay. The PAU has been providing vital handholding in this regard and PAU's research can inform these startups considerably.

Previous Kharif season was marked by severe weather disturbances. Heavy and unwieldy floods during July 2023 wreaked havoc on our crops. The predominant crop, rice, was in its infancy. Submerged fields would not drain rapid enough to permit somewhat timely replanting. During those trying times, PR 126 became lifeline of the state contingency plan. We also helped state government in provisioning nursery of this variety. We were also joined by many benefactor farmers in this noble cause. Earlier many farmers had helped state agencies in taming flood waters. These synergies got reflected in more than expected paddy procurement of 185.4 lakh tons (against 182.1 lakh tons during the *kharif* marketing season 2022-23). The PR 126 variety of rice proved its mettle not only as a stopgap, but it also gave a good yield competition and thus replaced certain long-duration water guzzlers in farmers' minds. These trends provided a good validation to PAU technologies. We urge farmers to maintain this healthy trend for the larger cause of sustainability of our natural resources. Besides paddy, spring/summer maize for silage purposes also deserves attention. Our data show that unless raised on drip irrigation, it taxes our groundwater in an equal measure.

Area under direct seeded rice could not pick up the expected pace despite monetary incentive announced by the government.

However, Fazilka and Sri Muktsar Sahib districts stood out. Hopefully, these regions will help to demonstrate the technology on the frontline. *Basmati* growers were able to enjoy a relatively bullish market. However, we need to tread carefully and stay alert to the fragile balance between *Basmati* acreage or production volume and its market.

Since the time we met during the last *Kisan Mela* during September 2023, PAU has developed a number of varietal and complementing production-protection and processing technologies. In case of varieties, Punjab Cheena 1 (proso millet), GBL 5 (Bajra for grains), Punjab Mithas (watermelon), and Punjab Amrit (muskmelon) need mention. Salient production technologies include new cropping systems like sorghum multicut-*berseem* and maize (cobs/fodder)-potato-onion, *Basmati* rice-late sown wheat – cowpea, summer moong-DSR-wheat, intercropping of cucumber in paired row trench planted sugarcane, row spacing of summer mungbean, package of practices for ginger cultivation, plastic mulch in roundgourd, sapota grafting and pond water quality testing. Major protection technologies comprise: knot based mating disruption technology for pink bollworm control in cotton, fall armyworm management in maize with Bt based biopesticide, controlling rice planthoppers in *Basmati* with neem-based products, bio-intensive integrated management of guava fruit borer, and PAU stored grain protection kit. The PAU also developed and recommended a remotely controlled paddy transplanter for the ease of paddy growers. Chief value-addition and processing technologies included: baker's yeast for dough fermentation, high protein soy powder for beverage and food applications, and fig and jamun based value added products.

Dear farmers, PAU Kisan Melas are known all over the world for providing a kind of largest interface between scientists and farmers. It will be ingrate of us if we do not acknowledge your vital role in shaping PAU's research programmes. Please participate freely in this unique two-way process of learning so that this partnership may grow stronger day by day.

# Farmers must avail the modernized extension services of PAU amid scientific agriculture

**MS BHULLAR**

*Director of Extension Education*



**MS BHULLAR**

The revolution in means of information and communication has transformed the scenario of every service sector, including the agricultural sector also. The use of latest means of communication has reformed agricultural extension services. Amid era of social media, Punjab Agricultural University (PAU) has also taken a lead by modernizing methods of communication so that the latest and instant information is delivered to farmers and other stakeholders. Though the University uses traditional methods such as radio, television, newspapers, magazines or other such mediums to transfer agriculture related information to farmers and farm women, yet it has adopted modern means also to convey recent and prompt information. The University is putting in mammoth efforts to provide timely information about all agricultural and allied aspects for the benefit of farming community.

## Information through Electronic Media

In today's electronic era, the University is providing information through every social media platform. For the service and support to farmers, it is committed to deliver complete and instant information regarding agricultural and allied aspects. The social media platforms such as PAU Website, Facebook, X (formerly Twitter), PAU Kisan App, Instagram and YouTube

**The Punjab Agricultural University is organizing the Kisan Melas at PAU, Ludhiana and other parts of the Punjab in March with the theme "Kheti Naal Saahaak Dhanda, Parivaar Sukhi Munafa Changa" (Integration of subsidiary occupation with agriculture enhance income and comfort of family). Farmers and their families, and other stakeholders are cordially invited to participate in these Kisan Melas to avail the technical expertise, and get new seeds, seedling, farm literature, fruit plants, etc.**

channel are available for dissemination of information and knowledge about varied agricultural aspects. Farmers and other stakeholders can download these social media platforms run by the University on any smart phones to get instant and latest information. The weekly Facebook live programme which answers farmers' queries and shares the 'need and time' based technologies is running very successfully. This programme is being telecast at 11.00 am every Thursday on University Facebook page and YouTube channel. Farmers can send their queries or suggestions related to any crop including field crops, vegetables, fruits and other crops at mobile number 82880-57707 or e-mail at [adcomm@pau.edu](mailto:adcomm@pau.edu). Farmers can also send photos of any problem in crops through WhatsApp at the given number for proper solution of the problem. For obtaining any information on agriculture,

farmers can log on to 'Farmer Portal' on PAU website ([www.pau.edu](http://www.pau.edu)). Moreover, farmers can also download 'Kisan App' on their smart phones to see technical information at any time and place. Apart from these, small reels regarding problems related to different agricultural aspects and their solutions are being created and posted on Twitter (X), Facebook and Instagram to provide in-time information for time specific interventions. The University has taken an initiative in sending messages and imparting technical knowledge to farmers through 'PAU Kheti Doots'. Farmers having internet facilities can enroll themselves as 'PAU doots' by providing e-mail to nearby *Krishi Vigyan Kendra* (KVK) or Farm Advisory Service Centre (FASC) office and can further disseminate information to fellow farmers in their villages. The University brings out a digital newspaper

'Kheti Sandesh' on every Wednesday, and for its subscription, farmers can give a missed call on the above mentioned mobile number. In the recent years, weather variations and climate change have resulted in adverse effects due to emergence of new pests and diseases. Under changing climate scenario, the University issues weather based agro-advisory for the management of crops, and presently, thousands of farmers are availing this facility. Moreover, the University has also developed a decision support system based on weather based information to protect potato crop from blight and this system is displayed at the University website.

### **Information through telephonic conversation**

The subject matter specialists are always available for the service of farming community. The mobile numbers of subject-wise experts are mentioned in PAU publications as well as at University website. Farmers can also contact experts, working in KVKs and FASCs, at any time. The direct contact with the University can be made through PAU *Kisan* helpline number 0161- 2401960-extension 417 for queries regarding crop production, availability of seed, fruit plants, biofertilizers, etc.

### **Farm literature**

To disseminate technical information on each and every aspect of crop production, the University publishes Package of Practices for Cultivation of *Rabi* and *Kharif* Crops, Fruits and Vegetables; and many other bulletins/booklets. Monthly magazines '*Changi Kheti*' and '*Progressive Farming*' are published for promotion of scientific agricultural information and current operations in agriculture. Many other bulletins are also published on different crops and topics. All these publications are available at bookshop at University Gate No. 1, Ludhiana; and various KVKs, FASCs and Regional Research

Stations (RRSs).

### **Direct meetings with Agriexperts**

Farmers can meet experts to get knowledge about field crops, vegetables, fruits, subsidiary occupations and other information at 'Plant Clinic' at Gate No. 1 of the University. The PAU has established Agricultural Technology Information Centre (ATIC) at Farmers' Service Centre, PAU, Ludhiana with a view to serve farmers under one roof. This centre caters to the needs of farmers in respect of advisory and diagnostic services for different crop disorders. For detailed information, farmers can meet subject matter experts of any related department during working hours of the University.

### **Extension centres of the University**

The KVKs and FASCs are playing a leading role in serving farmers in different districts of the state. Besides providing the technical, vocational and in-service trainings on different agricultural and subsidiary occupations, these extension centres also transferring the latest and instant information and knowledge through WhatsApp groups and even sharing it in WhatsApp groups of other development departments, such as State Agriculture Department, State Horticulture Department, Cooperative Departments, Village Clubs and Panchayats, to disseminate the knowledge extensively.

The short messages and short films of technical aspects of agriculture are prepared and disseminated to farming community. The FASCs are playing an important role in advising the farmers regarding the new and improved techniques, and presently, 15 districts of Punjab have such centres. Farmers are being advised regarding crop production, plant protection techniques and optimum utilization of farm resources, so that they are able to take higher yields of crops, fruit and vegetables with minimum cost of production. Subject matter specialists

of FASCs always remain available to guide farmers and provide solutions to their problems. Farmers can contact these experts telephonically or through social media to avoid travelling and save time.

### **Farmers' training courses**

Training courses for farmers and farm women are being conducted at various KVKs and Skill Development Centre at PAU, Ludhiana. The detailed information and the training schedule of different courses are always available at University website, PAU *Kisan* Portal and in the University monthly magazines, *Changi Kheti* and *Progressive Farming*. Besides these, farmers can get information regarding training courses through telephone numbers given in various publications of the University.

Keeping in view the current scenario of social media, the University intends to intensify and modernize the ways of information dissemination to each and every farmer. The Punjab Agricultural University is organizing the *Kisan Melas* at PAU, Ludhiana and other parts of the Punjab in March with the theme "*Kheti Naal Saahaaik Dhanda, Parivaar Sukhi Munafa Changa*" (Integration of subsidiary occupation with agriculture enhance income and comfort of family). Farmers and their families, and other stakeholders are cordially invited to participate in these *Kisan Melas* to avail the technical expertise, and get new seeds, seedling, farm literature, fruit plants, etc.

Dear farmers, in the coming month, wheat harvesting will start and I humbly request you not to burn the leftover straw, after combine harvesting. Besides environmental pollution, burning of wheat straw results in loss of nutrients, biodiversity and microorganisms also. At the end, I again appeal to farmers to adopt short duration rice varieties and follow the University recommended practices for saving of each drop of underground water.

# Let us celebrate *Kisan Mela* with zeal and fervor

DHARMINDER SINGH AND KULDEEP SINGH

*Department of Extension Education*

Present day agriculture is knowledge intensive and ill-informed farmers face a lot of agricultural problems. The Punjab Agricultural University, established at Ludhiana in 1962, acts as a light house of agricultural knowledge for the whole farming community of the nation. Scientists of this University were instrumental in realizing the dream of 'Green Revolution' by developing high yielding varieties of wheat and rice. The contemporary researchers are still putting in their enduring efforts to continue the legacy. Punjab is a land of agriculture and festivals. Many religious and cultural fairs are celebrated with great spirit and fervor in the state. The Punjab Agricultural University organizes *Kisan Melas* at Regional Stations, Amritsar and Patiala; *Krishi Vigyan Kendras*, Ballowal Saukhri, Gurdaspur, Faridkot and Bathinda; and main campus at Ludhiana every year for dissemination of improved farm technologies. These farm fairs draw great response and are attended by lakhs of farmers and farm women.

The Punjab Agricultural University played a vital role in ushering in of scientific agriculture in the state. It has developed and recommended a number of improved varieties in different field crops, vegetables, fruits and flowers. These varieties are not only high yielding but also resistant to attack of many diseases and insect-pests. However, the yield potential of such varieties solely depends on the quality of seed. Substandard seeds bought from unreliable sources may not able to achieve potential yield of recommended varieties. Moreover, poor quality seeds may harbor many diseases and insect-pests,

resulting into higher expenses and lesser profit. Due to these reasons, quality seed of new varieties has always remained the main attraction for the farmers at these *Kisan Melas*. Besides, farmers can also buy vegetable seed kits, seasonal nursery, and fruit plants at these *Kisan Melas*.

Exploitation of natural resources such as water, air and soil is creating several environmental problems. The groundwater table in the Central Plain Zone of the state is receding continuously. Paddy straw burning is contributing to the air pollution at fast rate. Indiscriminate use of agrochemicals and fertilizers not only pollutes our environment but also increases the cost of cultivation. *Kisan Melas* provide an opportunity to the farmers to learn new techniques from the scientists regarding judicious use of water, agrochemicals and other farm inputs. Field demonstrations and exhibitions put up by different departments of the University are also centre of attraction for the farmers. Such techniques when practiced at farmers' fields certainly help to reduce the unwanted expenses and increase the profitability. Farmers can also get their soil and water samples tested in the *melas*. Besides, they can also gain knowledge about new farm machinery from agro-industrial exhibitions.

Time has arrived to get acquaintance on market strategies of farm produce. The PAU scientists has always stressed upon the regular maintenance of farm records on ledger, mentioning incomes and expenditures. Farmers should adopt the marketing strategy, which is best suited to their own resources. This will provide necessary guidance in taking



farm decision in future. In these *melas*, farmers are also apprised of various subsidiary occupations to enhance their farm income. The enterprises like beekeeping, mushroom cultivation, seed production, agro-processing; and diary, poultry, piggery, etc. can easily be taken up by young farmers and farm women as a source of regular income.

Farm women can seek advice from the scientists on home management skills and different entrepreneurial activities like tailoring, stitching, embroidery, tie and dye, fabric painting, pickle making, squash, jam, nutrition recipes, soft toy making, etc. Besides, farm women are also imparted tips on maintaining family health. Exhibition stalls of successful women entrepreneurs showcase the example for the others. Agro based products are also put up for sale by the Self-Help Groups of farmers and farm women.

The University scientists are eager to share information on farm technologies during technical session, question-answer session and interaction at exhibition stalls. Besides, live demonstrations on new farm technologies are also arranged for the visiting farmers. Farmers can also purchase farm literature and quality seeds from the *melas*. Farmers can also avail the cloak room facility at *Kairon Kisan Ghar* in PAU to deposit their purchased seed and other belongings and enjoy the *mela* freely.

Besides meeting our livelihood security, we are entrusted with responsibility of maintaining purity and vitality of environment for the future generations. So let us make a pledge to use our natural resources judiciously and wisely to make a better living world around us.

• Dharminder Singh: 98726-12124

# Availability of seeds of field and vegetable crops during PAU *Kisan Melas* in March 2024

**RAJINDER SINGH, GAURAV KHOSLA AND DEEPAK ARORA**

*Office of Director (Seeds)*

The Punjab Agricultural University, Ludhiana is instrumental in developing high yielding and disease resistant varieties of various field and vegetable crops. Huge demand for the seed of these varieties is witnessed among the farmers of the state. One of the reasons for high demand of PAU varieties is that PAU is supplying the high quality seed of these varieties at a nominal cost. Moreover, quality seed of PAU varieties is available at seed sale counters in all the districts of the state. The seeds produced at various PAU seed farms conform to the Indian Minimum Seed Certification Standards (IMSCS) for various quality parameters including genetic and physical purity, germination, vigor, uniformity in sizes, freedom from seed-borne diseases, and any other factors that may affect seed performance in the field. Seed is a vital input in crop production as through

quality seed only the investment made on other inputs like fertilizers, pesticides, irrigation and crop maintenance can be realized. On an average, quality seed alone can lead to about 15-20 per cent increase in the total production of crop and it can be further increased with efficient management of other inputs. All the operations regarding seed production, cleaning grading and packing are carried out by the seed production specialists of the University under the supervision of Punjab State Seed Certification Authority. The seed, thus, produced is then got tested for germination and purity from the State Government Seed Testing Laboratory. The seed that meets the IMSCS is then packed into properly labeled seed bags and offered for sale to farmers. Seed bags contain information regarding class of seed, name of crop and variety, packing date, minimum germination percentage,

etc. To meet annual requirements of a small family, farmers can grow pulses and oilseeds in the nutrition garden. The Punjab Agricultural University, Ludhiana is preparing Pulses and Oilseeds Kits comprising *moong*, *mash*, soybean, groundnut and *til* to cater to the needs of pulses and oilseeds of a small family. Similarly, for small dairy farmers, Fodder Seed Kit is being prepared comprising fodder maize, *bajra*, sorghum, cowpea and guinea grass seeds. These 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*, Farm Advisory Service Centers and Regional Research Stations of the University. This year also, the seed of the following crops will be made available during the March 2024 *Kisan Melas*:

Variety	Average yield (q/acre)	Packing size (kg)	Rate (Rs/pack)
<b>Paddy</b>			
PR131	31.0	8, 16, 24	500
PR130	30.0	8, 16, 24	400, 800, 1,200
PR129	30.0		1,200
PR128	30.5		
PR126	30.0		
PR121	30.5		
PR114	27.5		
PR113	28.0		
<b>Basmati</b>			
Punjab Basmati 7	19.0	4	300
Pusa Basmati 1121	13.7	8	600
Pusa Basmati 1509	15.7	24	1,800

Variety	Average yield (q/acre)	Packing size (kg)	Rate (Rs/pack)
<b>Summer Moong</b>			
SML 1827	5.0	6	900
		12	1,800
<b>Summer Mash</b>			
Mash 1137	4.5	2	300
Mash 1008	4.2	4	600
<b>Kharif Moong</b>			
ML 1808	4.8	4	600
ML 2056	4.6	8	1200
<b>Kharif Mash</b>			
Mash 883	4.2	2	300
Mash 114	3.6	4	600

Variety	Average yield (q/acre)	Packing size (kg)	Rate (Rs/pack)
<b>Arhar</b>			
AL 882	5.4	2	240
PAU 881	5.1	6	720
<b>Soybean</b>			
SL 958	7.2	2	120
		15	900
		30	1,800
<b>Spring Maize</b>			
PMH 10 (Hybrid)	31.5	5	1,000
<b>Kharif Maize</b>			
PMH 13 (Hybrid)	24.0	5	1,000
JC 12	18.2	5	300
JC 4	13.0	5	300
<b>Fodder Maize</b>			
J 1007	168 q green fodder	15	900
J 1006	165 q green fodder	30	1,800
<b>Fodder Bajra</b>			
PCB 166	282 q green fodder	2	130
PCB 165	234 q green fodder 12.8 q grains	4	260
FBC 16	230 q green fodder		
<b>Sorghum</b>			
SL 45	271 q green fodder	2	150
		4	300
<b>Sesame (<i>Til</i>)</b>			
Pb. Til No. 2	2.8	0.2	30
		1	150
<b>Desi Cotton</b>			
LD 1019	8.6	3	240
LD 949	9.9		
FDK 124	9.28		
<b>Cotton</b>			
F 2228	7.4	3.5	280
F 2383	7.9		
<b>Bt Cotton</b>			
PAU Bt 2	10.0	2(including refuge)	300
PAU Bt 2	10.2	4(including refuge)	600

Variety	Average yield (q/acre)	Packing size (kg)	Rate (Rs/pack)
Pulses and Oilseed Kit S. moong 0.70 kg S. mash 0.30 kg Soybean 0.35 kg Groundnut 0.40 kg Sesame 0.08 kg	-	1 Pkt	300
Fodder Seeds Kit F. Maize 2.00 kg <i>Bajra</i> 0.60 kg Sorghum 1.00 kg Cowpea 0.20 kg Guinea Grass 0.04 kg	-	1 Pkt	300

Besides these, seed of newly released basmati variety Pusa Basmati 1847 will also be made available during these *Kisan Melas*

Apart from these, summer vegetable kits for kitchen gardening, summer vegetable seeds in small packets and turmeric seed will also be available during these *Kisan Melas* as detailed below:

Crop	Variety	Packing size (g)	Sale rate (Rs/packet)
Bottlegourd	Punjab Komal Punjab Barkat	25	20
Sponge gourd	Punjab Nikhar	20	20
Cucumber	Punjab Naveen	20	30
Muskmelon	MH-27	20	200
Muskmelon	Punjab Sunehari	33	50
Okra		100	30
	Punjab Suhawini	500	150
Bitter Gourd	Punjab 15	25	20
Summer Squash	P CK 1	25	20
Pumpkin	Pb Samrat	20	20
	PPH 1	10	60
	Punjab Magaz Kadoo	10	20
Tinda	Punjab Tinda 1	25	20
Turmeric	Pb Haldi 1	2.5 kg	100
Vegetable kit	-	1 Number	100

\* Seed of potato is available for sale at University Seed Farm, Ladhawal, Naraingarh and Khanaura; KVK, Nurmahal and KVK, Kapurthala

For detailed information regarding crop cultivation, please refer to the 'Package of Practices for Crops of Punjab' being published twice a year by Punjab Agricultural University.

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# Important tips to keep in mind before sowing of cotton

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Cotton cultivation in the South-Western region of Punjab. Cotton cultivation in the South-Western Punjab region presents lucrative opportunities for cotton farmers, but demands careful attention to several key factors to ensure sustainable yields. During the past several years, cotton productivity has been adversely affected due to various pests, diseases and adverse weather conditions. Therefore, successful cotton cultivation in the South-Western Punjab region requires a holistic approach that integrates sound agronomic practices, efficient resource management, and proactive pest and disease control strategies.

## Selection of seed and variety

Farmers are advised to sow varieties recommended by Punjab Agricultural University, Ludhiana. Of the recommended varieties, farmers may choose those varieties which have shown potential of high yield and resistance against sap-sucking insects and leaf curl disease. It should also be ensured that the seeds are purchased from a reliable source with a bill. In no case, the seeds of unreciprocated varieties from other states should be sown, because those varieties have shown high insect-pests and disease infestation in recent past.

## Sowing time

Farmers should aim to sow seeds at the recommended spacing and depth, taking into account local climate conditions and soil moisture levels. Timely sowing typically between April and May is advisable to capitalize on favorable weather conditions and ensure robust crop establishment. Early and delayed cotton sowing reduces the yield, and increases the insect-pest incidence. The best suitable cotton sowing time is from April 1 to May 15. In any

case, ensure sowing of cotton crop before May 15. It has been observed that cotton is affected more with whitefly infestation in the fields where cotton sowing is delayed. For better seed germination, pre-sowing irrigation with good quality water is very important. It is recommended to use 900 g seed per acre of Bt-cotton hybrids.

## Precautions during field preparation and sowing

Adequate soil preparation is essential to create an optimal seedbed for cotton sowing. During the last few years of surveys, it has been observed that in many fields the root of the plant does not develop properly due to the formation of hard layers in the soil. In such fields, there is a need of deep ploughing (45-50 cm deep) using tractor-driven chisel plow on both sides at a distance of one meter. Those farmers who do not have shortage of water can also use mould board plough or chiseler before applying *rauni*. Do not use mould board plough or chiseler after applying *rauni* as the field dries up very quickly due to hot weather which adversely affects seed germination. Utmost care should be taken that the field is in proper moisture condition at the time of sowing. Keep the speeds of the tractor slow while sowing and the depth of the drill should be uniform. If the seed is sown too deep or too shallow, it will adversely affect the seed germination and therefore, plant population will decrease. It is important to achieve at least 7,850 cotton plants per acre. For emergency conditions, cotton nursery (by filling 4" x 6" plastic envelopes equally with soil and farm yard manure) should be raised to ensure adequate number of plants. Three weeks old nursery can successfully be transplanted in the field to fill the gaps.

Weed problem is very common in sparse crop. In flat sowing method, crop is sown in rows 67.5 cm apart with a tractor-driven drill. The plant-to-plant spacing of 60 cm (for non-Bt) and 75 cm (for Bt-hybrids) is recommended. If after sowing of the crop, there occurs stagnation of water in the field due to heavy rains, then re-sow the crop. The critical period of crop-weed competition in cotton is considered to be 20-60 days after sowing. The presence of weeds in the field during this period adversely affects the growth and yield of the cotton. To keep the crop free from weeds at the initial stage, pre-emergence herbicide application of Stomp 30 EC (pendimethalin) at 1.0 litre/acre using 200 liters of water within 24 hours of sowing is recommended. Spray should be done only in the morning or evening hours.

## Fertilizer application

The underground water in ~40% of South-Western Punjab is of poor quality, which significantly affects the growth and yield of the crop. The amount of soluble salts in the soil and irrigation water greatly reduces the effect of chemical fertilizers applied to the soil. Therefore, if the recommended dose of phosphorus (55 kg DAP/acre) is applied to the wheat crop, then there is no need to apply phosphorous to cotton crop. In sandy soils, 20 kg Muriate of Potash and 10 kg zinc sulphate heptahydrate (21% zinc) or 6.5 kg zinc sulphate monohydrate (33% zinc) per acre should also be applied at the time of sowing. Apply urea in two equal splits (at thinning and at flowering) (45 kg urea/acre each). If the soil fertility is low, apply first half dose of nitrogen fertilizer (45 kg urea/acre) at the time of sowing.

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# Successful cultivation of cotton

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Cotton is one of the most important commercial crops of Punjab cultivated in South-Western zone. Farmers need to follow the recommended production technologies given by PAU 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. The PAU has also recommended the following varieties:

American cotton Bt Varieties	American cotton varieties (non-Bt)	Desi cotton varieites
PAU Bt 2	F 2228	LD 1019
PAU Bt 3	LH 2108	LD 949 FDK 124

In addition to above said, 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 start of sowing season.

## Tillage operations

Cotton fields having problem of hard pan or poor infiltration rate require subsoiling for higher yield. Cross subsoiling at  $1.0 \times 1.0$  m spacing at 45–50 cm depth before normal ploughings/plankings can be done by tractor drawn sub-soiler (*chiseler*). 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.

## Time of sowing

All hybrid/varieties of American cotton (*narma*) and *desi* cotton should be sown from April to May 15.

## Seed rate

Nowadays, non Bt refuge seed is already mixed with Bt seed in the packet. The recommended seed rate for Bt cotton variety (PAU Bt 2 and PAU Bt 3) is 4 kg/acre along with 1.0 kg/acre non Bt (refuge). The seed rate for American cotton (*narma*) varieties like F 2228 and LH 2108 is 3.5 kg/acre and for *desi* cotton varieties such as LD 1019, LD 949 and FDK 124, it is 3.0 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 a tractor driven drill keeping row to row distance at 67.5 cm and by maintaining plant to plant distance 45 cm in case of PAU Bt 2 and PAU Bt 3. All the varieties of American cotton should be sown at  $67.5 \times 60$  cm and *desi* cotton varieties at  $67.5 \times 45$  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 spaing 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"  $\times$  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 nitrogen (65 kg urea) to all non Bt varieties, 37 kg nitrogen (80 kg urea) to Bt varieties (PAU Bt 2 and PAU Bt 3), and 42 kg 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 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 phosphorus (75kg SSP or 27 kg DAP) to all the varieties and hybrids per acre basis at the time of sowing. Where ever 27 kg DAP is applied, reduce the urea dose by 10 kg. Apply 25 kg magnesium sulphate as basal dose at the time of sowing.

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 its excessive application may cause toxicity.

### Foliar nutrient application

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. To prevent reddening of leaves in cotton, give two sprays of 1% magnesium sulphate per acre at 15 days interval at full bloom and boll development stage.

### Weed management

*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 it 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. Give one hoeing/interculture around 45 days after sowing to control the weeds emerged after herbicide application.

Post-emergence application of Hitweed Maxx 10 MEC (pyrithiobac sodium 6% + quizalofop ethyl 4%) at 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/inter culture, especially, during rainy season, apply Gramoxone 24% SL (paraquat) @ 500 ml per acre or Sweep power 13.5% SL (glufosinate ammonium) @ 900 ml per acrein 100 litres of water as a directed spray using protective hood between the crop rows at 6-8 weeks after sowing,

when the crop height is about 40-45 cm.

### 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.

### Irrigation and drainage

Give first irrigation 4-6 weeks after sowing and the subsequent ones at interval of two or three 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.

### Water stress management

Sometime cotton faces water stress due to the closer of canal channels or delayed monsoon periods. Such short-term water stresses can be managed to some extent with foliar sprays of osmo-protectants. To minimize loss of cotton yield owing to water stress (due to no rainfall or sudden canal closures), dissolve 12.5 g Salicylic acid in 375 ml of Ethyl alcohol and then add it to 125 litres of water for spraying crop per acre on stress appearance.

### 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 months, respectively at 7 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 drippers 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 months, respectively at 5 days interval. For fertigation, apply 100 kg urea/acre in 10 equal splits at 7 and 5 days interval in surface and sub-surface drip, respectively. Start fertigation 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% (Ethepron 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. Prefer to spray on sunny days.

### 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 yield 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 evident. All cotton stalks should be used for fuel purpose by 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 also be used for *in situ*-residue incorporation of cotton stalks and wheat sowing in one go.

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# Irrigation and nutrient management strategies for cotton

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Often termed as ‘White Gold’, the cultivation of cotton has a unique place in farm economy of South-Western Punjab. However, judicious use of irrigation water and balanced use of nutrients are essential for its optimum growth and development in order to maximize economic returns. In soils irrigated with saline water (EC upto 10 dS/m), application of 16 quintal per acre of rice-residue biochar reduces adverse effect of salinity and increases seed cotton yield.

As per recommendation, apply 90 kg urea per acre to Bt and non Bt hybrids sown under medium soil fertility level, whereas for PAU Bt 2 and other varieties, apply 65 kg urea per acre. Further, under light textured soils, split application of urea may maximize benefits. Therefore, apply urea fertilizer in two equal splits - half after first irrigation or at the time of thinning and the other half at the time of flower initiation. Apply 25% higher urea fertilizer to cotton sown under saline soil as compared to medium fertile soil.

The soil with low organic matter content has low available nitrogen content. Therefore, 25% more urea fertilizer should be applied in these soils as compared to medium fertile soil. In this case, apply 110 kg urea per acre for Bt and non Bt hybrids, whereas PAU Bt 1 and other varieties, apply 80 kg urea per acre. Apply urea fertilizer in three equal splits – one-third at the time of sowing, one-third after first irrigation or at the time of thinning, and the remaining

one-third at the time of flowering.

Wherever feasible, under drip irrigation, start fertigation of 100 kg urea (45 kg N) /acre at 35 days after sowing and complete in 110-120 days in 10 equal splits at 7 days interval. Soil salinity also affects crop functionality as well as fertilizer efficiency. Based on soil test report, gypsum application in sodic soils improves soil structure, enhances water retention and gaseous exchange in root zone, thereby, leading to proliferation and aeration of roots. A major problem of the cotton belt, frequent shortage of canal water at the time of sowing forced the farmers to use underground water, which is, otherwise of poor quality and hampers the germination of costly seed.

Apply 75 kg single superphosphate or 27 kg DAP per acre at the time of sowing to supplement phosphorus in moderately fertile conditions. When 27 kg DAP is to be used, reduce urea by 10 kg. Under low available phosphorous conditions, apply 25% more phosphorus than that of medium fertile soils. Omit the phosphorous application during *kharif* season in soils with high phosphorus content. If preceding *rabi* crop has received recommended quantity of phosphorous fertilizer, then do not apply phosphorous to cotton crop.

Potassium plays a crucial role in cotton production. Its deficiency hampers fiber quality as well as seed yield. Apply 20 kg Muriate of Potash at the time of sowing in low to medium fertility soils.

In light texture soils, micronutrients,

especially zinc deficiency, can also restrict crop growth. Apply 10 kg zinc sulphate (21%) or 6.5 kg zinc sulphate (33%) per acre at the time of sowing to meet the zinc requirement of crop.

Use 4 kg borax per acre in calcareous soils (where calcium carbonate content is more than 2% and boron content is less than 0.5 kg/acre). Seek expert advice before its application as unnecessary use of boron can be harmful to plants and soil as well.

In early July, when the plant is in full bloom, the need for nitrogen and potassium rises. Due to inadequate supply of nutrients, the leaves turn yellow and fall off; stunted growth, shorter flower stalks, dropping of flower buds and bolls, and smaller size of bolls cause yield loss. During this phase, excessive use of urea fertilizers may lead to higher incidence of pests and diseases. Instead, apply four sprays of 2% potassium nitrate (13: 0: 45) (dissolved 2 kg of KNO<sub>3</sub> per 100 liters of water) at weekly interval.

Onset of rainy season may cause reddening of cotton leaves and fall off. It is due to magnesium deficiency and Bt hybrids are more prone to it. To prevent this, give two sprays of 1% magnesium sulphate (1 kg per 100 liters of water) during full bloom and boll development stages at fortnight interval.

Hence, the balanced nutrient management strategies not only help to obtain higher yield of quality cotton but also ensure the improvement in soil health.

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# Krishi Vigyan Kendras : The lighthouse for farmers

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The Krishi Vigyan Kendra (KVK) also known as “Farm Science Centre” is a flagship concept, established by the Indian Council of Agricultural Research (ICAR) on the basis of technology transfer from the laboratory to the farmer’s field in agriculture, horticulture, animal husbandry, poultry, beekeeping, mushroom cultivation and other related fields.

Currently in India, there are about 732 KVKs, which are under the control of State Agricultural Universities (SAU), Central Agricultural Universities (CAU), ICAR Institutes, Non-Governmental Organizations (NGOs), State Governments, Public sector institutions and other educational institutions. There are a total of 11 advanced centres/zones in the country to monitor these, which are known as Agricultural Technology Application Research Institute (ATARI). The ATARI, Zone-1, Ludhiana has a total of 72 KVKs in 5 states (Himachal Pradesh, Jammu and Kashmir, Ladakh, Punjab and Uttarakhand), out of which, there are 22 KVKs in Punjab, which are linked with government institutions of Punjab (details are given in Table 1).

The KVKs are extension education institutions for the convenience of farmers at the district level. The KVK is 100 per cent funded by the Central government. Different initiatives are taken up by each KVK and each centre has one Deputy Director/Associate Director and six Scientists posts. Crop Scientist, Fruit/Vegetable Scientist, Soil Scientist, Plant Protection, Agricultural Engineer, Animal Scientist/Fish Scientist and Home Scientist are working on these posts as per the

agricultural needs of the district.

**Mandates of KVKs:** The mandate of KVKs is experimentation and capacity building through technology refinement and demonstrations. To fulfil this purpose, 5 main activities have been adopted at KVKs:

- On-farm testing to assess the location specificity of agricultural technologies under various farming systems.
- Organized Frontline Demonstrations to establish production potential of technologies on farmers’ fields.
- Capacity development of farmers/ farm women and extension personnel to update their knowledge and skills on modern agricultural technologies.
- To work as knowledge and resource centre of agricultural technologies for supporting initiatives of public, private and voluntary sector in improving the agricultural economy of the district.
- Sharing agricultural information through traditional and advanced communication technologies.

## Testing and Modification of Agricultural Techniques

New technologies are developed through scientific research in agriculture and animal husbandry. But not all techniques necessarily give the same results in every type of farming system/farm. Differences in agriculture and animal husbandry systems including soil, environment, crops, farm machinery, animal breeds and feed can be seen within the boundaries of a district. Due to this

difference, the technical requirements of the farmers are also different. Keeping this in mind, On-Farm Trials (OFTs) are conducted to test different technologies with the help of farmers under the supervision of KVK. Based on these experiences, recommendations are sent to the concerned institutions regarding modification of farming techniques. Farmers can see these experiments and their results for themselves by visiting the research units.

## 2) Frontline Demonstrations

To prove the production capacity of crops, fruits, vegetables, seeds, agrochemicals, fertilizers, livestock/poultry/fishes, etc. recommended by research institutes, the scientists of KVK conduct Frontline Demonstrations in the fields of local farmers. Under this demonstration, seeds/chemicals/machinery/fertilizers/animal feed etc. are provided by the KVK to the farmers free of cost. Farmers in the vicinity are periodically invited to self-assess various stages of crop development. Attendees can learn hands-on-use of the technology being demonstrated during the demonstrations. In this way, the farming families are motivated to adopt new technology and improve their agricultural/animal husbandry practices.

## 3) Developing Knowledge and Skills

Various trainings are provided at KVK to enhance the knowledge of farmers/farm women and extension personnel. These include vocational training course, short duration/one-day training course,

skill development training course, in-service training course and sponsored training course.

Apart from dairy farming (10 days course), other vocational training courses are of seven days duration, during which scientists impart basic training to the trainees in agriculture, animal science, home science, horticulture and other agricultural subsidiary-based occupations. Trainees are given hands-on-experience during training. After completing the training, the trainees are given a training certificate. The major vocational training courses conducted by the KVKs are listed in Table 2.

One-day training course is organized every month for the convenience of farmers, in which scientists discuss to find solutions to the problems of farmer families. In-service training course is also organized for capacity building of extension functionaries. Skill development training course lasts for a long time, giving detailed information about the occupation. In addition, colleges and government departments can organize sponsored training courses for students and farmer groups at KVK by paying a fixed amount.

Farmers can also visit demonstration units/plots of crops/livestock/poultry/mushrooms/fruits/vegetables/beekeeping, etc. at KVK to enhance their knowledge. Farmers can also contact the KVKs to get training on a particular subject by forming a group.

#### **4) Act as a Focal Point of Knowledge and Resources**

Materials and literature prepared by Agricultural and Veterinary Universities are also sold at KVKs for the convenience of farmer families. Farmer families can purchase all these materials from the nearby KVK at the fixed price by the universities. All goods are provided on a first come, first serve basis. A description of the material available from the KVK

Subject	Vocational Training Course	Available Material
Animal Science	Dairy farming Goat farming Pig farming Poultry farming	Mineral mixture (cattle), mineral mixture (pig), bypass fat, uromin lick, California Mastitis Test (CMT) Kit, Milk Adulteration Test Kit and Animal husbandry related books.
Agriculture	Seed production Use of agricultural machinery	Punjab Agricultural University, Ludhiana recommended seeds of wheat, paddy, pulses, oilseeds, fodder, etc.  Machinery Bank: Super Seeder, Smart Seeder, Happy Seeder, Chopper/Mulcher, Rotavator, Zero till drill, Lucky Seed Drill.
Agricultural subsidiary occupations	Mushroom production Beekeeping	Vegetable seeds, vegetable seedlings, fruit seedlings, oilseed-lentil kits, organic fertilizers, mushroom bags and agriculture related books.
Horticulture	Vegetable production Fruit production	
Home Science	Preparation of value added products from jaggery Sewing embroidery Preparing dishes	Solar cookers, solar dryers and home science related books

is given in Table 2. During the last few years, "Machinery Banks" have been set up at several KVKs for paddy stubble conservation and direct sowing of wheat under Crop Residue Management (CRM), the details of which are given in Table 2. Farmers can use this machinery as per the conditions of KVK. Soil and water testing facility is also available at KVKs.

Every year one or more villages are adopted by KVK for the expansion of scientific techniques. In these villages, ventures are undertaken for the development of agriculture and animal husbandry through the use of methods such as training, *kisan gosthi*, demonstration plots, method demonstrations, etc. Villagers can contact the Deputy Director/Assistant Director of the KVKs (details given in Table 1) for adoption of their village.

The KVK also takes suggestions through Scientific Advisory Committee (SAC) meeting every year to improve its

performance. A *Kisan Club* has also been formed at the KVK and by becoming a member of this club, one can take advantage of the facilities provided by the KVK.

#### **5) Sharing Information Related to Agriculture**

The scientists of KVK continue to convey new information to farmers through telephone, TV, radio, WhatsApp, Facebook, YouTube, publications (newspapers and magazines), etc. Apart from this, *Kisan Melas* are also organized at KVKs (Amritsar, Bathinda, Faridkot, Gurdaspur and Patiala) and farmers also keep sharing their experiences with scientists through these mediums. With this sharing of information, scientists continue to draw new research experiences and farmers continue to increase their businesses by taking advantage of new technology.

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# PAU Food Industry Business Incubation Centre: Objectives and activities

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Punjab is a prominent state in the production of agricultural products like cereals, pulses, fruit and vegetables; and is known as the “Food Bowl of India”. Punjab’s strong agricultural base and desire for entrepreneurship holds a significant potential for the food processing industry. During the seasonal gluts of raw produce in the state, the price of crops crashes significantly. To address this timely processing and value addition of their produce is the only panacea to tide over the current crisis.

The Food Industry Business Incubation Centre (FIBIC) at the Punjab Agricultural University (PAU), Ludhiana, was established in the year 2015 in the Department of Food Science and Technology, with the technical guidance of the Ohio State University. The FIBIC is a dynamic hub that fosters innovation, entrepreneurship, and growth within the food industry with the help of university extensive resources, expertise, and research in agriculture and food technology. This synergy creates an optimal environment for aspiring entrepreneurs, providing them with unparalleled access to knowledge, facilities, and mentorship. The centre offers a diverse range of support services tailored to the needs of farmers, new food business startups and industry. Collaborative workspaces, state-of-the-art laboratories,

and pilot-scale processing units enable entrepreneurs to refine their concepts and develop scalable prototypes.

The primary objectives of Food Industry Business Incubation Centre are:-

- To conduct short courses and trainings for the development of entrepreneurship skills.
- To develop and upscale technologies for processing and value addition of agricultural produce.
- To provide incubation facilities to the food industry, young entrepreneurs and farmers.
- To develop linkages between PAU, farmer and food industry for the development of food processing industry in the region.

The FIBIC provides hands-on trainings and incubational facilities so that farmers can process their produce and analyse the market potential before commercialization. The Centre is well equipped with state-of the art facilities for the processing of different food products. It covers entire range of food processing technologies with special emphasis on fruits, vegetables and grain and milk based products, and are all included in the centre’s incubator facilities.

Facilities available at Food Industry Business Incubation Centre are:

- Minimal Processing
- Heat Processing
- Frozen Processing
- Juice and Beverage Processing
- Canning and Retort Processing
- Extrusion Processing

- Pasta Processing
- Bakery Processing
- Soy and Milk Processing
- Drying Technologies
- Packaging Technologies

These facilities are available for farmers and young entrepreneurs at minimal cost and also on custom hiring basis for industry personals.

Incubational facilities have been provided to different stakeholders and farmers for preparation of pulp, juices, squash, pickles, purees, candies, preserves, porridges, cookies, and freezing of fruits and vegetables. In addition to its incubation and research initiatives, FIBIC is committed to capacity building and skill development within the food industry. The Centre has conducted various trainings for farmers, farm women, rural youth and entrepreneurs. Whether it is enhancing food safety practices, improving quality assurance measures, or exploring market access opportunities, FIBIC’s training initiatives empower progressive farmers and young entrepreneurs to stay ahead of the curve.

In summary, the Food Industry Business Incubation Centre at the Punjab Agricultural University, Ludhiana, stands as a testament to the University’s commitment to innovation, entrepreneurship development, and excellence in the food industry. Through its multifaceted approach, FIBIC not only supports the growth and development of food-related businesses but also fosters an entrepreneur business for the farming community of the Punjab.

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# Summer pulses – A boon for soil and human health

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Pulses are among the most extensively used foods in the world. These have been an important source of plant based protein in developing countries where animal based protein is lacking. They are also rich source of dietary fiber, complex carbohydrates, starch, and minerals such as iron, zinc, selenium, phosphorus and potassium. Pulses are also particularly abundant in B vitamins including folate, thiamin, niacin; and contain a range of potentially bioactive nutrients which might improve glycemic control, and protect against hypercholesterolemia, cancer and type 2 diabetes.

The Indian Council of Medical Research suggests eating 52 g of pulses per capita per day. An approximate estimate of Punjab's annual pulse need is five lakh tonnes, however, the state currently produces just about thirty thousand tonnes of pulses. Punjab's pulse crop acreage has significantly decreased due to the dominance of rice-wheat cropping system. Therefore, Punjab must increase

the area under pulses. The best choice for expanding the area under pulses is to grow short-duration pulses, such as summer *moong* and summer mash. About one-third of the nitrogen applied to the next rice crop can be saved by incorporating *moong* after pod picking. Pulses have nodules on their roots, which have the special ability to fix nitrogen from the atmosphere, and enhance soil health and productivity. When summer pulses are grown instead of spring maize, a significant amount of irrigation water can be saved. Furthermore, pulses contribute significantly to nutritional security. To meet our needs, we should promote the cultivation of pulses. Therefore, there is a significant opportunity to boost summer pulse production and area by encouraging farmers in Punjab state to grow improved varieties and follow agronomic practices.

## Climate

Summer *moong* requires hot climate

and is considered to be the hardest of all pulse crops. Summer mash can be grown in the central and sub-montaneous tracts of state.

## Soil type

Summer pulses can be grown on well drained, non-saline/alkaline loamy to sandy loam soils.

## Land preparation

Field can be prepared by doing two-three ploughings followed by planking to get it free from clods and obtain a good tilth for ensuring good seed germination.

## Seed inoculation

Seed inoculation improves grain yield of summer pulses. 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*

*contd on page 19*

## Improved varieties

To obtain good yield from crop, grow only recommended improved varieties of summer *moong* and summer mash as mentioned in the table given below:

Crop	Variety	Important plant features	Days to maturity	Average yield (q/acre)
<i>Moong</i>	SML 1827	Erect plant type with medium stature, resistant to yellow mosaic disease, grains are shining and medium sized.	62 days	5.0
	SML 832	Erect plant type with medium stature, grains are shining and medium sized.	61 days	4.6
	SML 668	Erect plant type with short stature, and grains are bold sized.	60 days	4.5
<i>Mash</i>	Mash 1137	Recommended for sub-montaneous zone of Punjab state, compact plant with short stature, and resistant to yellow mosaic disease.	74 days	4.5
	Mash 1008	Compact plant with short stature, fairly tolerant to yellow mosaic virus and leaf crinkle virus.	72 days	4.2

# Plantation of evergreen fruit plants during spring season

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Fruits act as a protective food for the maintenance of human health and prevent a lot of diseases and physiological disorders. Fruits contain a lot of vitamins (A, B<sub>1</sub>, B<sub>12</sub>, C and E), minerals and antioxidants which help to boost the immunity system of the human health. According to the Indian Council of Medical Research (ICMR), the daily requirement of fruit is 120 g/capita/day but there is availability of only 83 g/capita/day. There is a need to grow and plant fruit plants to meet the daily requirement of the diet. Nowadays, the rural and urban people utilize the free space at the backyard of home for the growing of fruits plants. Plantation of fruit tree is a long-term investment. Orchardists can prevent many risks by adopting appropriate orchard establishment practices like planning, site selection, soil and water sampling, provision of irrigation channels, paths and roads, buildings and plantation at suitable spacing, procurement of healthy nursery

plants, etc. Spacing between row to row and plant to plant within a row depends on the selection of fruit plant as well as on the choice of variety. Evergreen fruit plants like citrus, *sapota*, *ber*, *jamun*, guava, etc. can be planted in February-March (spring season) and August-September (rainy season). Layout is helpful for the systematic distribution of fruit plants, easy supervision of an orchard, maximum accommodation of number of plants ha<sup>-1</sup> and sufficient available space for proper tree growth and development. Similarly, orchard operations viz. weeding, irrigation, spraying, manure and fertilization; intercropping and harvesting can also be performed easily.

## Selection of nursery plants and transportation

Healthy plants, free from diseases and insect-pests should be obtained from a reliable nursery. Always purchase plants of known pedigree which are medium in height and grown on the recommended

rootstock. A long *khurpa* (plant lifter) is used for digging the nursery plants. Evergreen fruit plants should be lifted with well sized earth balls. After digging the plants from nursery, one-fourth foliage is removed to maintain proper root/shoot ratio and earth ball is covered with wrapping material. Spread cushioning material such as *parali*, dried grass or sand in the vehicle before loading the plants. Place the plants carefully during transportation and water should be sprinkled on the foliage. Evergreen plants are planted in rainy season so that nursery plants can establish themselves very soon and grow vigorously. The best planting time for air layered litchi plants is end of September due to availability of moderate temperature and high atmospheric relative humidity.

## Selection of evergreen fruit plants

The selection and knowledge of fruit plants and their promising cultivars play a vital role in growing of fruits plants. If selection is not properly done, it makes the garden unfruitful. Therefore, it is suggested to grow the fruit plants and their cultivars,

**Table 1: List of recommended cultivars of different evergreen fruit plants**

Fruits	Recommended cultivars
Mandarins	PAU <i>Kinnow</i> -1, Daisy, W. Murcott and <i>Kinnow</i>
Sweet orange	Valencia Sanguino, Early Gold, Valencia, Musambi, Jaffa and Blood Red
Grapefruit	Star Ruby, Red Blush, Marsh Seedless, Duncan and Foster
Lemon	Punjab Baramasi lemon, Punjab Galgal, PAU Baramasi Lemon-1 and Eureka
Lime	Kagzi
Guava	Punjab Apple Guava, Punjab Kiran, Punjab Safeda, Shweta, Punjab Pink, Arka Amulya, Sardar, Allahabad Sufeda
Mango	Alphonso, Dusehri, Langra, Gangian Sandhuri, GN-19, GN-1, GN-2, GN-3, GN-4, GN-5, GN-6 and GN-7
Ber	Wallati, Umran and Sanaur-2
Litchi	Dehradun, Calcutta and Seedless Late
Banana	Grand Naine
<i>Sapota</i>	Kali Patti and Cricket Ball
Papaya	Red lady 786, Punjab Sweet, Pusa Delicious, Pusa Dwarf and Honey Dew
Loquat	California Advance, Golden Yellow and Pale Yellow

## Spacing of evergreen fruit plants

Fruit trees	Spacing (feet)	Number of fruit trees acre <sup>-1</sup>
<b>Square system</b>		
<i>Mango/Sapota</i>	30 x 30	49
<i>Litchi/Ber</i>	25 x 25	72
Loquat	22 x 22	90
<i>Citrus/Guava/</i> <i>Kinnow</i>	20 x 20	110
Banana	6 x 6	1,230
<i>Papaya/Phalsa</i>	5 x 5	1,760
<b>Rectangular system</b>		
<i>Kinnow</i>	20 x 10	220
Guava	20 x 17	132

recommended by the Department of Fruit Science, PAU, as per the planting distance given in table 1. A complete sketch of the orchard should be drawn on a paper before the execution of final layout in the field. In Punjab, farmers commonly follow square system and rectangular system (high density) for plantation of fruit trees. The spacing and number of plants per acre are illustrated in table 2.

### Digging and filling of pits

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

### Planting and care of young plants

Plant the fruit plant in the center of the filled pit with the help of a planting board. It should be taken in consideration that bud union of the plant remains about nine inches above the ground level. After pressing the soil firmly around the plant with feet, apply water immediately. Staking should be done to keep the plant erect. In addition, excessive rainwater should not be allowed to stand in the orchard. The standing water can suffocate the roots due to lack of oxygen supply, resulting in mortality of the plants. Papaya is most sensitive to water logging. So, proper drainage system must be ensured in the orchard with no water stagnation during the rainy season. To control white ants, apply half liter chloropyriphos per acre followed by light irrigation. Regularly remove the sprouts and off shoots if arisen after the plantation, and keep regular check for insect, pest and disease incidence in the newly established orchard. The recommended doses of fertilizers should be applied and follow the spray schedule for insects, pests and diseases in the successive years.

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### *Summer pulses – A boon....contd from page 17*

culture (LUR 6) per acre should be inoculated at the time of sowing. For doing inoculation, moisten the seed with culture by using minimum quantity of water and then dry in shade. Sow the seed within one hour of inoculation. The biofertilizer is available at PAU Seed Shop, Gate no.1 Ludhiana and *Krishi Vigyan Kendras*/Farm Advisory Service Centres in different districts.

### Seed rate and spacing

A seed rate of 15 kg for SML 668, and 12 kg for SML 1827 and SML 832 for summer *moong*, whereas 20 kg seed per acre for summer mash varieties is sufficient. *Moong* should be sown at a row spacing of 17.5-22.5 cm, and mash are sown at a spacing of 22.5 cm apart in rows by keeping plant to plant distance of about 7 cm in summer *moong* and 4-5 cm in summer mash.

### Sowing time 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 March 20 to April 10, and of summer mash is March 15 to first week of April. Sowing of summer *moong* can be extended upto third week of April though there is a risk of pre-monsoon showers at maturity.

**Sowing with zero-till drill:** Summer *moong* can be sown timely without any preparatory tillage with zero-till drill, without any preparatory tillage after the harvest of wheat if there is no wheat straw lying in the field, or with PAU Happy Seeder in the presence of straw, after combine harvested wheat crop.

**Sowing on raised beds:** Summer *moong* sowing can also be done on raised beds 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. Irrigation to bed planted *moong* should

be applied in such a way that beds are not over flooded. Raised bed planting of summer *moong* saves 20-30 per cent of irrigation water. Raised bed sowing requires same quantity of seed, fertilizers and following cultivation practices as in flat sown crop.

### Fertilizer application

Apply 11 kg urea and 100 kg single superphosphate per acre to summer *moong*, and 11 kg urea and 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

Weed control at the right time helps in getting good yield from crop. In pulses, weeds can be controlled manually through hand weedings. Summer *moong* crop requires two hand weedings, 4 and 6 weeks after sowing and summer mash requires one hand weeding at 4 weeks after sowing. After this, the crop covers the ground properly and does not allow the weeds to grow.

### Irrigation

Depending on sowing time, soil type, and duration and intensity of rainfall, generally 3-5 irrigations are required by summer pulse crops. For obtaining synchronous maturity and high yield of the crop, last irrigation should stop at 55 and 60 days after sowing in summer *moong* and mash, respectively.

### Harvesting

The crop should be harvested when about 80 per cent of pods mature. The pulse crops should not be uprooted as their roots improve the fertility of soil.

Farmers should adopt above mentioned improved varieties and cultivation practices to get maximum benefit from summer pulse crops.

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# Importance of soil testing before plantation of orchards

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Orchard plantation is a long-term process and needs a lot of care during the initial stages of growth. Ignorance during plantation cannot be corrected later on. For the successful cultivation of fruit orchard, soil should be in good condition. Soil for fruit plants should be deep, well drained, loamy, fertile and free from hard pan upto depth of 2 meters. Water table should be below 3 meters and not fluctuating. Water logged, marshy and salt affected soils are generally not suitable for fruit growing. Soil testing is important for assessing the suitability of a selected site for fruit crop plantation. The growth and development of fruit plants is generally dependent on the plant type, soil type, climate, bearing capacity, orchard management as well as soil fertility. Excessive fertilizers application may cause imbalance in the nutrient status of soil along with increased production cost and less profit. Fruit plants are long duration crops with deep roots as compared to field crops. Therefore, knowledge about various soil characteristics of the field, in which orchard is to established, must be known by the farmer for getting good quality fruit and better returns. For this reason, soil testing should always be done prior to planting as this is the best tool to judge the suitability for orchard plantation. Soil testing before orchard plantation gives an idea to incorporate necessary need-based soil amendments.

## Method of soil sampling

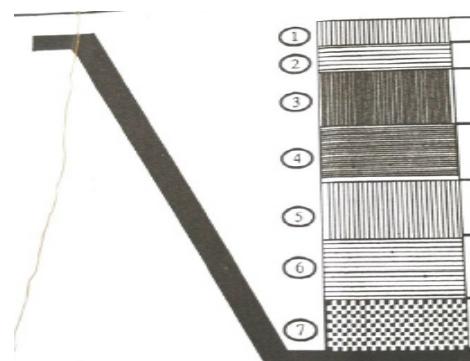
- Soil sampling prior to orchard plantation is carried out up to a depth of 6 feet (2 meters app.). Seven soil samples should be collected starting

from the surface to the depth of 15 cm, 15-30cm, 30-60cm, 60-90 cm, 90-120 cm, 120-150 cm and 150-200 cm. There will be two soil samples for 30 cm soil depth intervals which must be mixed, if samples have to be taken with the help of Augar.

- Samples from different soil depths are collected by using auger or exposing a soil profile with the help of Khurpa or spade.
- If any hard pan or concrete layer is present, its sample should be collected separately. The depth and thickness of this hard pan or concrete layer must be noted at the time of sampling.
- About half kg of soil sample from each depth should be taken. After collecting the soil sample, put them in clean cloth bag along with label inside and outside having information regarding the complete address of the farmer, field number, depth of soil, etc.
- The label should be written with pencil/pen.

Samples should be sent to the nearby soil and water testing laboratory. Samples should be sent to the soil and water testing laboratory of the Department of Soil Science, Punjab Agricultural University, Ludhiana and Citrus Estates of the State Horticulture Department at Hoshiarpur, Badal (Sri Muktsar Sahib) and Abohar for testing and analyzing various soil parameters preferably one month before plantation of orchards as there are two main seasons for plantation i.e. February-March and September-October.

Soil testing gives information about soil pH, Electrical Conductivity (EC), available phosphorous, potassium and organic carbon (OC) status of soil,



**Figure 1: Method of soil sampling from different depths for orchards**

indicating amount of organic matter present in soil. Fruit plants benefit greatly from organic matter as it helps in nutrient availability by improving soil structure, moisture retention and serves as a nutrient reservoir. Soil pH is one of the critical factors in the nutrient management. The pH of the soil reveals reaction of the soil that is acidic, alkaline or highly alkaline. Most of the fruit plants perform well in soil having pH from 6.5 to 7.5, as most of nutrients are available in this range. The citrus plants thrive best in soils having slightly acidic reaction with a pH range of 5.5 to 7.5. If soils have high acidic or alkaline nature, citrus do not grow well and there is limited absorption of nutrients from soils. The pH of the soil should not be more than 8.5 for successful cultivation of citrus. Some plants of citrus species, peach, pear and mango cannot survive in alkaline soils. On the other hand, some fruit plants like ber, dateplam, guava and amla can perform well in soils having pH 9. Depending on tolerance of fruit plants to alkalinity, they are divided into three groups. (Table1)

*Contd on page 22*

# Opt for profitable high yielding multi-cut napier bajra hybrid

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India is gifted with the largest livestock population in the world. However, deficiency in feed and fodder has been identified as one of the major constraints in achieving the desired level of our livestock production. In the case of small dairy farms, feed is the most important limitation and farm animals are forced to subsist on dry stalks and straw with low nutritive value, especially, during lean periods. Since feeding alone accounts for 60-70 per cent of the total cost of milk production, availability of adequate nutritious fodder coming from cheaper sources assumes greater importance.

The increasing trend in future consumption of animal products will give rise to a huge demand of animal feed. Meeting this demand will be a challenge, given the scarcity of natural resources such as land and water. Through the use of high yielding forage crops with improved technologies of cultivation, the requirements of green fodder from a limited area available could be fulfilled. The Punjab Agricultural University has recommended a number of forage crops and their varieties with very high yielding potential. Among these, Napier bajra hybrid is one of the high fodder yielding multi-cut *kharif* fodder crops. The green fodder production of this fodder crop is more than that of single-cut crops. It contains 7-10% crude protein, 28-30 % crude fibre and 10-11.5 % ash on dry matter basis. Hence, combined characters of high productivity and good palatability makes Napier bajra hybrid an ideal fodder crop for round the year fodder production. Napier bajra hybrid is therefore, recommended for intensively managed small holder crop - livestock farming systems and also is well suited for varying soil and climatic conditions.

Napier bajra hybrid is a result of hybridization between bajra and elephant grass. This hybrid has more number of tillers and it is a perennial fodder. After plantation, it gives fodder continuously upto 2-3 years. It can be cultivated on various soils but gives best results when grown on heavy soils having high nutrient fertility. It requires hot and moist climate, and it is tolerant to mild salinity. However, avoid waterlogged soils.

In spring season, all Napier bajra hybrid varieties sprout and till the onset of winter, remains in vegetative growth. Napier bajra hybrid varieties are leafy with long, smooth, non-hairy and broad leaves.

**PBN 342:** It yields 877 quintals of green fodder per acre.

**PBN 346:** It yields 715 quintals of green fodder per acre. And is best for making good quality silage.

**PBN 233:** It yields 1100 quintals of green fodder per acre.

Under irrigated conditions, optimum time for planting is from last week of February to May. For rainfed areas, sowing can be done from June to August. Seeds of Napier bajra are very small, so for commercial planting it is propagated vegetatively with the help of stem cuttings (having two- three nodes) or root slips (approximately 30 cm long). For planting one acre, use 11,000 slips or stem cuttings. A small part of the stem cutting or root slip is allowed to remain exposed and the rest of the slip is buried in the soil. For good growth and yield, spacing of 90 cm x 40 cm or 60 cm x 60 cm is recommended.

Napier-bajra hybrid is quick growing, very responsive to nitrogen fertiliser and yields heavily. At the time of field preparation,

add well decomposed farm yard manure @ 20 ton/acre. Fifteen days after sowing, add nitrogen@ 30 kg/acre in the form of urea @ 66 kg/acre. After each cutting, repeat this nitrogen dose. Apply Phosphorus @ 40 kg/acre in form of SSP @ 240 kg/acre in two equal splits, first dose in spring and second dose in monsoon.

Early weed control is necessary before the plants are established and grow vigorously. To control weeds, do two hand hoeings at 21 and 42 days after planting.

Planting in February or March requires about two irrigations for establishment. During the summer season, regular irrigation at fortnightly interval is very important. Irrigation every third week may be required after the rainy season to increase the production. In order to save irrigation water, after planting apply 4 tonnes of paddy straw mulch.

Harvesting should be done after 50 days of sowing. Subsequent cuttings are taken when the crop reaches height of one meter. Do not allow the crop to grow for more than 2 meters height as it will lead to reduction in nutritional value of the fodder. Such fodder is not easily digested by the animals as it becomes more lignified and causes constipation in animals.

## Conservation

Dairy animals require round the year fodder-based feeding system to sustain livestock production. The adequate fodder supply becomes difficult during lean periods and scarcity. In months when there is large quantity of surplus fodder available which is frequently the excess of need, then the fodder can be profitably preserved either as silage or hay. The non-legume Napier bajra fodder grown could be conserved as

silage as it contains high concentrations of soluble sugars and carbohydrates, and is low in protein in the green stage, which makes it most fit for preservation as silage. The optimum time of harvest for silage making is when the crop is 1 meter tall and at this stage of the harvest the nutrient contents are at their peak stage with the desired dry matter content. The harvested crop needs to be kept for drying to reduce moisture content for at least one to two days to have dry matter in the range of 30 to 35 per cent, and can be tested by taking a small bundle of the fodder and wringing with two hands; if no moisture comes out, it is ready to ensile. Silage is a material produced by controlled fermentation of nutrients under an anaerobic condition. Therefore, harvesting at the optimum stage results in desired dry matter content and a crop with 30-35% dry matter conserves into a high-quality silage. The colour of prepared/matured silage should be bright, light green yellow or green brown in colour. The lactic acid odour and softer material with firm texture should be there. The moisture should be in range of 65-70 per cent with pH ranging between 4.0-4.2. The three necessary conditions for silage making are: cut and ensile the fodder quickly, pack very tight to avoid pockets of air in the trench/pit and seal appropriately. Make sure water or air does not enter the trench/pit either from the rain or groundwater.

### Silage making procedure

- Dig a trench/pit for storing silage and the size of the trench/pit depends on the quantity of silage needed. One cubic meter space/silo can store 500-600 kg of green fodder.
- Cover the floor and sides of the trench/pit with plastic.
- Harvest at 30-35 per cent dry matter (DM) stage and chop the fodder material into pieces (about 3-5 cm). Wilt the harvested fodder to bring down DM to 30-35 per cent, if required.
- Put the chopped fodder material into the trench/pit in layers while you

compress it.

- Pack and compress every layer till the trench/pit is filled. Filling and pressing should be completed as fast as possible.
- Use additives during filling of fodder in the silo, if required.
- Cover the trench/pit when it is full, first with plastic and then a layer of soil to make it air tight.
- Open the silo from one side for feeding, minimum after 45 days, as per need and close properly after taking out the silage. It can stay for over a year, if it is not opened.
- Silage can be taken out as per requirement. Initially, silage can be fed @ 5 kg/animal to adjust the animals on silage feeding.

### Advantages of silage making

- It lowers the field losses particularly of leafy portion which is relatively rich in protein and minerals. The probability of damage due to rain and leaching of nutrients is lower, making it an ideal technology for conservation.
- Silage, if properly packed under optimal ensiling conditions, can be stored for longer period. The forage crops when converted into silage become soft and better utilized by the stock.
- It provides more succulent cheap feed to livestock at a lower expense and is easily marketable.
- The crop from given area can be stored in lesser space as silage than as dry fodder.
- Moreover, the use of silage makes it possible to keep more animals on a certain area of land.
- Many undesirable things present in a fresh crop are eliminated after ensiling.
- Napier bajra hybrid fodder can be a boon for the dairy farmers as it provides not only good fodder for the livestock but also a source of subsidiary income through the sale of stem cuttings.

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*Importance of soil testing...contd from page 20*

**Table 1: Groups of fruit plants depending on their tolerance to alkalinity**

Tolerant fruit plant	Semi tolerant fruit plant	Sensitive fruit plant
Date palm, ber, amla and guava	Pomegranate, phalsa, jamun, grapes and pear	Citrus, peach, papaya, plum and mango

The electrical conductivity, which is an index of salt buildup, should be less than 0.5 mmhos per centimeter for cultivation of citrus and peach, and be less than 1.0 mmhos per centimeter for other fruit plants. The calcium carbonate and lime concretion should not exceed 5 and 10 percent, respectively for cultivation of citrus and peach, and below 10 and 20 for other fruits.

**Table 2: Suitability limits of soil for plantation of fruit plants**

Character	Citrus and peach	Other fruit plants
i Conductivity (mmhos/cm)	<0.5	<1.0
ii Calcium carbonate (%)	<5	<10
iii Lime concretion	<10	<20
iv pH	<8	Upto 8.7 Upto a depth of 60 cm only in the lower layer, however, the pH may go upto 9.0

The selection of fruit plants based on the soil type, nutritional status and other conditions of soil and sub soil layers, by the orchardist is the first and significant step while planning for an orchard, which leads to high fruit high productivity, more profit and good soil health management. Therefore, soil testing must get done before plantation of orchards based upon which selection of fruit crops for particular soil can be assessed, as this is long term investment and orchards planted without soil testing may not grow due to presence of hardpan/concrete layers, and there will be loss of farmers' money and wastage of efforts put into getting better yield from fruit crops.

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# Basics of beekeeping for beginners and beyond

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Honey bees popularly known as ‘shehad diyan makhija’ are the keystone species that are primarily managed for honey and other hive products. Impressive financial returns coupled with a rainbow of accompanying rewards bring this enterprise into focus as a potentially rewarding career for rural masses.

## Getting Started

**Formal training:** Hands on training is generally organized twice a year during February-March, and September-October by *Krishi Vigyan Kendras*.

**Site selection:** When selecting a site, it is important to consider whether the site has year-round availability of flora, sunlight, shade, clean water, ventilation, transportation facilities, and road connectivity, among other factors.

**Bee flora:** Berseem, *sarson*, sunflower, cucurbits, eucalyptus, sheesham, litchi, *ber*, and citrus plants are all important bee floral crops that provide bees with nectar and pollen.

**Honey bee colonies:** Purchase colonies with at least 6-8 bee frame strength. These bee frames must have an adequate population of worker bees, eggs, sealed and unsealed brood, honey, and pollen, etc. Most importantly, the queen bee should be fresh and newly mated.

**Apiary tools/equipment:** Langstroth hive with ten bee frames, comb foundation sheets, bee veil, hive tool, smoker, uncapping knife, honey extractor, etc. are the few basic requirements to begin with.

**Arrangement of bee colonies in apiary:** Maintain 6-8 feet between bee hives and 10 feet between the rows. Sunlight, shade, ventilation, shelter from strong winds and rainwater, road connectivity,

and neighbourly responsibilities are some other considerations while architecting the apiary.

**Colony migration:** In areas where year-round availability of bee flora is a challenge, migration of bee colonies is essentially the only solution. Always migrate bee colonies at night time after closing the hive gates with wired strips (in summer), or wooden strips (in winter), ensuring minimal jerks and queen bees' safety during transit.

## Seasonal management of bee colonies

**Spring season:** It is the best season to start beekeeping as the bee colonies multiply at a much faster rate due to favourable weather and abundant floral resources.

- Remove the winter packing and clean all the dirt material from the bottom board.
- Provide new comb foundation sheets in the hive for growth and avoid swarming.
- Provide stimulative feed (two parts water and one part sugar).
- Replace >3 years older combs and >1.5 years older queens.
- Keep a check on the brood mites and diseases.

**Summer season:** High temperatures, hot winds, shade, shelter, and the availability of clean water are some important factors to consider when managing a bee farm in the summer season.

- Slowly shift the colonies under the shade before the onset of hot summers.
- Make arrangements for proper ventilation in the hives and freshwater, nearby.

- Give more space in the colonies and reduce the population of drone bees.
- Protect bee colonies from mites and diseases.

**Rainy season:** During the long rainy season, honey bees find it hard to survive due to the adverse impact of rain, cloudy weather, and high moisture on their foraging activity as well as in-hive tasks.

- Examine the colonies and clean the bottom board.
- Provide supplementary feed of sugar (one part sugar and one part water) and pollen/pollen substitute.
- Suitably manage the colonies to avoid damage from wax moths, yellow wasps, black ants, green sparrow, external parasitic mites, diseases, and robbing.

**Autumn season:** This is the second-best season to start beekeeping.

## Winter season

- Shift the colonies under sunlight well before the onset of severe winters.
- Unite the weak colonies with strong ones well in time.
- Make provision for inner and outer packing of bee colonies.
- Provide concentrated supplementary feed of sugar (two parts sugar and one part water) and pollen/pollen substitute.

Beekeeping as an enterprise has an inherent ease of adoption, as it does not require any special or elaborate infrastructure, labour, land, initial investment, or recurring costs. With these attractive attributes, beekeeping holds great potential for self-entrepreneurship and economic upliftment of rural youth.

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# Tips to produce healthy and quality wheat seed for the next crop season

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**H**ealthy and quality seed is the foundation for a bumper wheat crop. Farmers can produce quality and healthy seed at their farms to cut the cost of wheat cultivation. For this, they should procure the foundation/certified/truthfully labelled seed of recommended varieties from the PAU/State Department of Agriculture/PUNSEED/National Seed Corporation in one crop season. The selection of variety, seed rate and seed treatment are the initial important steps in this regard. In the current season, these choices have already been made by the farmers and cannot be amended at this stage of the crop. But still, there are certain simple practices as listed below which can ensure the production of healthy and quality seeds.

## Monitoring of the field

The inspection of the crop should be done regularly and carefully to remove the off-types, diseased plants, and weeds. While inspecting the crop, one should avoid facing the sun; this will facilitate better detection of off-type plants. We must monitor the crop at least thrice in a crop season. i.e. the monitoring of the wheat crop should be done before ear emergence, at ear emergence, and the ripening stage.

At the vegetative /pre-flowering stage, monitoring should be done to rogue out all the off-type plants, volunteer plants, diseased plants (Flag smut), weeds, etc., by carefully inspecting the seed plot. The Flag smut-infected plants must be uprooted and destroyed by burning. The fields having an incidence of stripe

rust and powdery mildew infection must be sprayed with the fungicides recommended by Punjab Agricultural University, Ludhiana. For stripe rust infection, spray the crop with 200 g Cavit 25 WG (tebuconazole) or 120 g Nativo 75 WG (trifloxystrobin+tebuconazole) or 200 ml Ampect Xtra 25.5 SC (azoxystrobin+cycloconazole) or 200 ml Opera 18.3 SE (pyraclostrobin+epoxiconazole) or 200 ml Custodia 320 SC (azoxystrobin +tebuconazole) or 200 ml Tilt 25 EC/Shine 25EC/Bumper 25 EC/ Stilt 25 EC/Compass 25 EC/Markzole 25 EC (propiconazole) in 200 liters of water per acre as soon as the disease is noticed. For powdery mildew, spray the infected crop with 120 g Nativo 75 WG (trifloxystrobin + tebuconazole) in 200 liters of water per acre.

At the flowering stage, the loose smut-infected ears should be cut carefully with the help of a scissor and put into a polythene bag. These infected ears should be destroyed properly. Along with it, this is the appropriate time to give protection to the crop against Karnal bunt disease. For this, farmers are advised to spray their crop with Tilt 25 EC @ 200 ml/acre in 200 litres of water at the heading stage.

At maturity, off-type plants not detected earlier can be easily identified from ear color and should be carefully removed.

## Harvesting of the crop

Harvesting of the crop should be done at optimum maturity. Precautions must be taken to avoid admixture during harvesting and threshing. The harvested seed should be dried in the sun to bring down the moisture level of the seed to

less than 10 per cent. Higher moisture in the seed increases the chances of infestation by stored grain pests and pathogens. It also reduces the germination of the seed and sometimes leads to the rotting of the seed.

## Storage of the seed

Before storage, we can ensure the complete elimination of loose smut disease from the seed by solar heat treatment. For this, soak the wheat seed in ordinary water from 8 am to 12 noon on any calm and sunny day during May/June. After four hours of soaking, spread out the moist seed in the sun in a thin layer on the cemented floor (*pucca*), on *tarpaulin* or sheets of cloth. Dry the seed completely and store it in a dry place till sowing. Likewise, inspect the seed lot properly for Karnal bunt disease before seed storage. This is done by soaking a handful of seeds in ordinary water for a few minutes, taking them out, and spreading them on white paper. If a few (4-5) seeds are found KB infected, please do not keep this seed for the next growing season. Farmers can either store the seed from the KB-free lot or replace the infected seed with a disease-free seed. The labelling of the seed should be done properly when two or more varieties are being stored. The seeds should be protected from stored grain pests by following the recommended control measures. The seed produced and stored in this way will help the farmers to reduce the cost of wheat cultivation, thus, benefitting them.

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# Management of seasonal weeds in summer season vegetables

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Manging seasonal weeds in summer season vegetable crops is a critical aspect of agricultural practice aimed at ensuring optimal crop growth and yield. Due to high water requirement of vegetable crops and their sowing in widely spaced rows, the problem of weeds is more prevalent in vegetable crops. The most common weeds in summer vegetable crops are *itsit*, *madhana*, *makra*, *dila/motha*, *khabbal grass*, *takri grass*, *tandla*, *bakra*, *chulai* and *dodhak* etc. Their effective management is considered essential to mitigate competition for nutrients, water, and sunlight, which can significantly impact crop health and productivity.

Some weeds also invite and provide shelter to pests and diseases on crops. The reduction in crop yield depends on the type and weed count and the stage of crop growth. Most often, the loss caused by weeds is usually higher in slow growing vegetable crops. Therefore, it is very important to control weed infestation at the right time to harvest good quality produce.

## Mechanical method

Mechanical methods of weed control in summer season vegetable crops involve the use of various tools and techniques to physically remove weeds from the cultivated areas. Hand weeding involves manually pulling out weeds by hand or using hand tools such as hoes or weeders. This method is labor-intensive, but highly effective, especially for small-scale vegetable production. Mechanical cultivation techniques, such as plowing, harrowing, or rotary tilling, are used to

disrupt weed growth and uproot existing weeds. Cultivation helps to bury weed seeds, break up weed roots, and create a favorable seedbed for vegetable crops. In widely spaced vegetable crops like pumpkins, chillies, brinjals, etc. weeds can effectively be managed by tractor-driven implements.

## Cultural methods

Cultural methods are an integral part of integrated weed management strategies. Weed infestation in vegetable crops can significantly be reduced by changing the sowing time, selecting fast growing crops, reducing the line-to-line and plant-to-plant spacing, applying chemical fertilizers in right place, mulching and irrigation water management. For example, summer vegetables such as vegetables with vines should be cultivated only by making beds so that water is given to them only in furrows. Likewise, excessive irrigation causes serious problems of weeds in summer season vegetable crops. Alternately, by applying organic or synthetic mulch materials, such as straw, plastic film suppresses weed growth by blocking sunlight and preventing weed seed germination. Mulching also helps conserve soil moisture, regulate soil temperature, and reduce erosion. Applying organic mulch materials, such as straw, hay, or compost, around summer vegetable crops helps suppress weed growth, conserve soil moisture, and regulate soil temperature. Mulching also provides a physical barrier that inhibits weed seed germination and reduces weed competition with crop plants.

Adjusting crop density and spacing

can help optimize light, water, and nutrient availability while reducing weed competition. Planting summer vegetable crops in dense stands or using wide row spacing can shade out weeds and suppress their growth, limiting their impact on crop yields.

## Chemical methods

Chemical methods of weed control in summer season vegetable crops involve the use of herbicides to selectively target and eliminate weed species, while minimizing damage to the cultivated crops. The chemical method of weed control is becoming popular among the farmers nowadays. It involves a low cost weed control measure and has been the most effective method. However, the excessive use of these chemicals (herbicides) could lead to increased tolerance and the emergence of new weed types, besides causing environmental pollution. Therefore, these chemicals should appropriately be applied and at the right time as required. The following are the recommended weed control measures for summer season vegetable crops.

**Tomato:-** To control weeds in the crop, Sencor 70 WP @ 300 grams should be sprayed using 200 liters of water per acre 3-4 days before planting in a well prepared and moist field.

**Chilli and capsicum:-** The problem of weeds is very common in the space between the lines of chillies and capsicum. Seasonal weeds can be controlled by spraying with Grammxone 24 SL (paraquat dichloride) 3-4 ml per liter of water by using protected hood. If necessary, 2-3 sprays can be done. Utmost care should

be taken that herbicides do not fall on the vegetable plants.

**Kharif onion:-** Due to the hot and rainy weather at the time of sowing of the crop, there is a lot of weed problem in the initial stage of the crop. Therefore, for the control of weeds, Goal 23.5 EC (oxychlorophene) 380 ml per acre dissolved in 200 liters of water should be sprayed in the field within a week of planting and one hoeing 90-100 days after planting.

In general, mechanical methods of

weed control play a vital role in managing weeds in summer season vegetable crops, offering environmentally friendly alternatives to chemical herbicides and promoting sustainable agricultural practices. By integrating mechanical weed control techniques into crop management strategies, farmers can effectively suppress weed populations and maintain healthy, productive vegetable crops throughout the summer season. By incorporating cultural methods into weed management strategies, farmers can effectively control

weeds in summer season vegetable crops while promoting sustainable agricultural practices. Chemical methods of weed control play an important role in managing weeds in summer season vegetable crops, providing farmers with effective tools to reduce weed competition and maximize crop yields. Integrating chemical weed control methods with other weed management strategies can help optimize weed control efforts while minimizing the risks associated with herbicide use.

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# Taste Buds

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Winter season is full of coloured vegetables and fruits viz. carrot, cauliflower, green leafy vegetables, apple, papaya, etc. They are store house of vitamins and minerals like Vitamin A, C, iron, iodine and anti-oxidants. These can be eaten in off-season also in the form of pickles, chutney, preserve, etc. Let's learn to prepare mix vegetable pickle and carrot preserve at home this season!!

## Sweet and Sour Mixed Vegetable Pickle

Cauliflower, carrot and turnip	1 kg
Salt	25 g
Red chilli powder	10 g
Black pepper powder	10 g
Mustard seeds (coarsely ground)	50 g
Garam masala (coarsely ground)	10 g
Mustard oil	250 g
Onion	100 g
Ginger	25 g
Garlic	20 g
Rattanjot leaves	2-3
Vinegar	60 ml
Jaggery/jaggery powder	100 gram

**Method:** Thoroughly wash and clean cauliflower, carrots and turnip. Cut all the vegetables in medium size pieces. Shallow fry the vegetables in mustard oil. Put *rattanjot* leaves in remaining oil and remove them when they leave red colour in oil. Now sauté coarsely cut garlic, ginger and onion in oil till light brown. Add all the spices except mustard seeds. Now mix all the vegetables in *masala* and again sauté for 2 minutes. Remove from fire and let them cool. Then mix coarsely ground mustard seeds. Make syrup with jaggery and vinegar, and mix in vegetables after it gets cooled. Then fill the pickle in already sterilized glass jars.



## Carrot Preserve

### Method:

Carrots	1.25 kg
Sugar	1 kg
Citric acid	5 g
Sodium Benzoate	2 g
Water	½ kg

Wash, peel and cut into 2-3" pieces. Take 1½ kg water in a pot and boil it, and add carrot pieces in it and cook for 5 minutes. Remove the carrot pieces from water and prick with fork. Dissolve sugar and water, and add citric acid in the syrup. Sieve it from muslin cloth and put carrot pieces in it. Cook till one boil. On the second day, remove carrot pieces from the syrup and make one-thread consistency. Then put carrot pieces in the syrup and cook till one boil. On third day, repeat the same procedure and make two-thread consistency of the syrup and boil the preserve till one boil. Put sodium benzoate in a little of syrup and then mix in the whole preserve. Cool the preserve and fill in already sterilized glass jars.



# Soy processing and value addition for income generation

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**S**oybean is rightfully called as “Golden bean” or “Miracle bean”. It is a significant source of dietary protein and oil, and has become popular across the globe.

## Nutritional benefits

Soybean is well-known for its nutritional value. It contains about 40 per cent protein and about 20 per cent oil. It is an affordable source of high-quality protein and contains all essential amino acids. It is also called the “vegetarian’s meat”. Soybean oil is composed mostly of unsaturated fatty acids such as linoleic acid and linolenic acid which play an important role in human nutrition and maintaining good health. Apart from these, soybean is a rich source of dietary fibre. Soybean also contains vitamins, minerals and phytochemicals such as isoflavones and phytosterols.

## Soymilk

Soy milk is a lactose-free beverage made from soybean. It is entirely free from cholesterol, gluten and low in fat. The protein content of soymilk is nearly the same as cow milk. Moreover, it also contains fibre, minerals and vitamins. Flow diagram for preparation of soymilk is given as Figure 1.

## Tofu

*Tofu* is coagulated soy product that resembles *paneer* in color, body and texture. *Tofu* is an excellent source of plant protein, unsaturated fats and fibre. It is also a good source of vitamins B1 and B2, sodium and iron. The general steps for *tofu* preparation are given in

Figure 1.

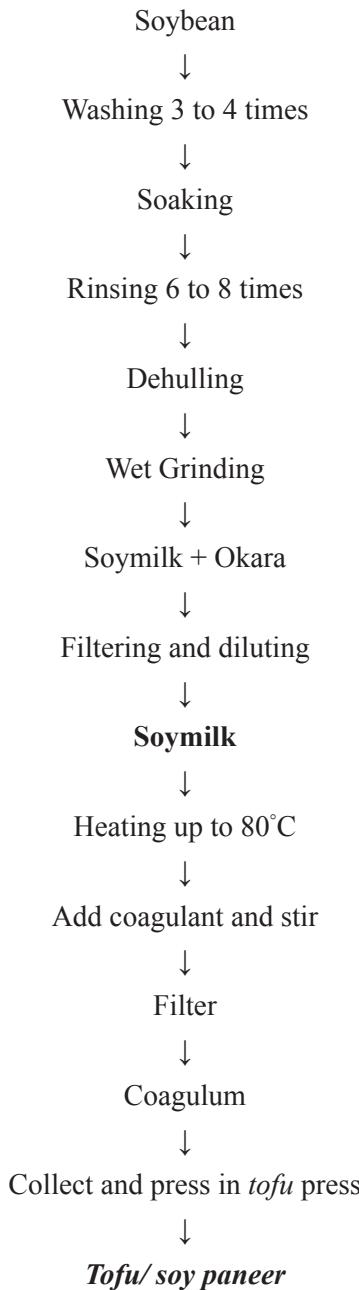


Figure 1: Process flow chart for preparation of soymilk and *tofu*

## Soy nuts

Soy nuts are a healthy and delicious crunchy snack prepared from soybean. They are rich in protein, fibre and isoflavones. Soynuts are prepared by soaking soybean in water for 1-2 hours and then roasting/baking at about 190 °C in oven or sand, till they get crispy, give a pleasant roasted flavour and light brown colour.

## Set-up of small-scale unit on soy processing

Soy processing can easily be integrated with farming for attractive additional income of the farmers. A processing plant for soymilk and *tofu* has immense potential to earn profits even at a small scale. Further the machinery for pressing of *tofu*, baking of soynuts and packaging of the products is also available. Soy processing is a profitable venture. By designing a product with an appealing flavor, innovative packaging and marketing skills in either retail outlets or directly to consumers at farmers' markets, one can fetch greater profits. Technical guidance for manufacturing of these products and many novel products from soybean is available in the Department of Food Science and Technology, Punjab Agricultural University, Ludhiana. Soybean holds excellent potential for inclusion in healthy food formulations, and for adoption as high protein diet by the predominantly vegetarian population of India. This will help in increasing farm income, besides enhancing value addition of this important legume crop and promoting its cultivation.

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# Unlocking the nutritional potential: The importance of proper pre-treatments for millets

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Millets are rich in essential nutrients, including fiber, protein, vitamins (such as B-complex vitamins), and minerals (such as iron, magnesium, and phosphorus), contributing to a well-rounded and nutritious diet. Additionally, millets often contain antioxidants and have a lower glycemic index and high satiety index compared to some other grains.

Millets have an amount of antinutrients namely; phytic acid (found in the outer layer of millet grains, phytic acid can bind to minerals like iron, zinc, and calcium, reducing their absorption), tannins (interfere with iron absorption), oxalates, enzyme inhibitors (affect protein and carbohydrate digestion), etc. The antinutrients and hard cellulosic husk need to be removed by mechanical means or Pre-treatment to enhance the availability of nutrients and make millets edible and safe for human consumption.

Pre-treatment prior to dehusking of millets is crucial for releasing of anti-nutrients, optimizing the dehusking process, improving yield, minimizing breakage, and enhancing the nutritional quality of the final product. Here are some key reasons for the need of pretreatment:

**Hardness reduction:** Millet grains often have a hard outer layer or seed coat. Pretreatment, such as conditioning with water, helps in softening the seed coat.

**Ease of dehusking:** Pre-treatment can make the dehusking process more effective and less energy-intensive.

**Minimizing breakage:** Pre-treatment methods, like adding moisture to the grains, can help reduce the brittleness of the husk and minimize breakage during dehusking.

**Improving separation:** Some millet varieties may have tightly adhering husk layers. Pre-treatment can help in loosening these layers, improving the separation of husk from the edible part of the grain during dehusking.

**Enhancing nutrient bioavailability:** Certain Pre-treatment methods, such as soaking or conditioning, can contribute to changes in the nutrient composition of millets. For example, they may enhance the bioavailability of essential minerals like calcium, iron, and zinc, making them more accessible for absorption during digestion.

**Reducing processing time:** Pre-treatment can lead to a reduction in the overall processing time by preparing the grains for dehusking in a more efficient manner.

Several pretreatments which are performed prior to dehusking or polishing are as follows:

## Soaking

The grains are soaked in ample water for varying durations until they are fully steeped at room temperature. After soaking, the grains undergo a thorough cleaning process with clean water, followed by drying either in an oven at 60°C or under the sun before being subjected to dehusking or polishing.

## Germination

This method brings about alterations in the composition of the grain, elevating its nutritional quality and contributing

to improved digestibility, diversity, and palatability of prepared foods. During the germination process, whole unhusked grains are typically soaked for a period ranging from 2 to 24 hours, and subsequently, they are allowed to undergo natural germination by spreading them on a wet cloth for up to 24 to 48 hours.

## Fermentation

In the fermentation process, grains serve as the substrate for the proliferation of various microorganisms. Typically, millets undergo fermentation at room temperature, lasting from 24 to 72 hours, depending on the specific food product or beverage being produced. Throughout the fermentation process, microbial activity generates several by-products, including organic acids and antibiotics, as they utilize the starch present in the grains.

## Hydrothermal treatment

The hydrothermal treatment process is tailored based on the hardness of the millet seed, and it may include initial soaking of the grains, followed by steaming or wet cooking/boiling. The practice of soaking grains is widely adopted in households, representing a popular and traditional approach aimed at diminishing anti-nutritional compounds, particularly phytates. Parboiling led to a notable enhancement in the decortication yield of millets in comparison to non-parboiled millets. The millets exhibited a substantial 28% improvement in decortication yield, attributed to an increase in the hardness of the kernel and a separation of the hull from the seed's endosperm. Additionally, hydrothermal treatments contribute to an improvement in the palatability of grains.

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# S. Sarbjit Singh: A role model in crop diversification and organic farming

SATWINDERJIT KAUR, RAJWINDER KAUR AND RAVINDER SINGH CHHINA

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Crop diversification and adoption of subsidiary occupations are of utmost importance for economic upliftment of small and marginal farmers. One of the trainees of PAU's *Krishi Vigyan Kendra*, Gurdaspur named Sarbjit Singh, a resident of village Jhanda Lubana, district Gurdaspur is a fine example of such fruitful efforts. Sarbjit Singh is well-educated (BA and B.Ed) and has served in Indian Army for 30 years. After his retirement, he started conventional farming on 5 acres of land. He came in contact with the scientists of KVK, Gurdaspur during various training programs. Being curious about agricultural knowledge, he started reading publications like *Changi Kheti*, and Package of Practices for *Rabi* and *Kharif* crops. With the passion for learning more and more, he started keeping a close eye on organic farming. For the control of crop pests and diseases, he uses methods recommended by PAU such as trichocards, fruit fly traps, *neem* formulations, etc. Apart from this, he also uses sour buttermilk, and other household ingredients like *Akka*, *Datura*, ginger, and green chilli solution.

**Crop diversification:** Sarbjit Singh cultivates *basmati*, turmeric, sugarcane, sesame, green fodder and millets (*kodra*, *kangni*, *raagi*, and *kutki*) in *kharif* season; and wheat, *gobhi sarson*, gram, lentil, linseed, *berseem*, oats, etc. in *rabi* season. He started cultivation of indigenous wheat varieties by borrowing/taking seed from his friend, belonging to Madhya Pradesh, whom he met him at *Kisan Mela* in Delhi.

**Dairy:** Sarbjit Singh is of the view point that organic farming is based on animal rearing and next to impossible without farmers. He attended a basic training programme on Dairy Management at KVK, Gurdaspur in 2016. Afterwards, he got training in advanced knowledge of animal husbandry from Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. Showing keen interest in *desi* cows, he also associated with *Naamdhari Sanstha*, *Divya Jyoti Jagriti Sanstha*, *Gyian Sankhaath Sanstha* and many other progressive farmers, specializing in this profession. Nowadays, he has six *desi* cows and six heifers, of which *Sahiwal* and *Gir* are the main ones. From these, he produces milk for his own domestic use and sells extra milk in the village. Demand for *desi* ghee and milk of *desi* cow is increasing day by day as these products are proving beneficial for human health. He himself packs and labels the products. He sells his products at PAU *Kisan Mela*, district levels camps organized by the Department of Agriculture and Farmers' Welfare, Kisan Hut at Kahnwan, and *Kisan Bazaar* of Gurdaspur and Amritsar. A large number of customers usually purchase products from his house itself.

Sarbjit Singh believes in togetherness and interacts with the like-minded farmers at various platforms. He is specially invited to programmes, organized by KVK and other line departments, to share his experiences with other farmers. He has been a

dynamic member of PAU Kisan Club, PAU Organic Growers Club, Scientific Advisory Committee of KVK, *Kisan* Advisory Committee of ATMA, State Department of Horticulture, Organic Farmer Association, *Kudrat Kheti* Group of Mana Wala Pingalwara, Amritsar and Sugar Mill (Indian Sucrose Limited) committee. Sarbjit Singh has been bestowed with honour for millet cultivation by *Kheti Virasat* Mission and for rearing of *desi* cows by Department of Animal Husbandry at the state level Pashudhan Championship.

Being a nature lover, he has adopted crop residue management practices in his fields and never set fire to wheat and paddy stubbles for the last seven years. He uses Happy Seeder and Super Seeder machines for sowing of wheat. In addition, he has opted for direct seeding of paddy for conserving precious water and also gets the soils of his fields tested from time to time. He has immense love for animals and spends about an hour with them daily by caressing them.

Sarbjit Singh credits this success to his pious wife and other family members, who have supported him through thick and thin. The time when today's young generation of Punjab is much more interested in going to foreign countries for their sustainability, Sarbjit Singh took up farming in the second innings of his life. His habit "Doing by Himself" is an inspiration for the younger generation.

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# Farm operations in April

Last irrigation to wheat sown after December 5, should be given up to April 10. Avoid irrigation on windy/stormy day.

## SUGARCANE

- 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.
- Irrigate the crop at 7-12 days interval for better growth of the crop. Apply 65 kg urea to ratoon crop.
- 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.
- 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.
- Mite feeds on lower side of leaves under fine web. The leaves turn red and later appear to be burnt. Baru (*Sorghum halepens*) is an alternative host plant of mite. So, destroy the weeds, growing near the sugarcane fields.
- Do not ratoon the crop if it is severely affected with red rot or wilt.

## COTTON

- 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.
- 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 bollworm; 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.
- In wilt infested fields, prefer to sow LD 949 and LD 1019 varieties of *desi* cotton.
- At the time of sowing, smear the cotton seed with Gaucho 70 WS (imidacloprid) @ 5 g or Cruiser 30 FS (thiomethoxan) @ 7 g/kg seed for preventing damage by cotton *jassid*.
- 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.
- 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.
- 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.

## SUNFLOWER

- Since the weather is quite hot during this month, apply irrigations at 8-10 days interval. The crop should not be

under stress at flowering, soft dough and hard dough stages.

### 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 2 ml Neonix 20 FS or 1.5 g Seedex 2 DS or 5 g 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 60 kg single super phosphate per acre at planting. Also apply consortium biofertilizer @ 4 kg/acre at planting. Apply 16 kg Muirate 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* fodders, 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. *Kashni* 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 *kollar* 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 upto 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 (*watter*), 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. Disinfest empty godowns or receptacles by spraying 0.05% Malathion emulsion (100 ml Malathion 50 EC in 10 litres of water) on the floors, walls and ceilings or fumigate the godowns using 25 tablets of aluminum phosphide/100 cubic metres of empty space before storing grains. Exposure period is seven days.

### VEGETABLES

#### Tomato

Irrigate the tomato crop once a week to encourage maximum fruit setting and development of fruits. Varieties viz. Punjab Ratta, Punjab Chhuvara, 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 causes 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.

#### Seed Production

Harvest seed crops of pea, carrot, radish and turnip. In order to avoid shattering of seeds of carrot, turnip, pea and radish in the field, start harvesting even when a few topmost pods per branch are yellowish green. Shift immediately to the thrashing floor. After complete drying, thrash, grade and pack the seeds. In carrot, harvest seeds from primary and secondary umbels only.

#### Chilli

Transplant seedlings of chilli in the afternoon keeping ridges at 75 cm and plants at 45-60 cm distance, and apply light irrigation immediately. Apply 20 kg Muirate of Potash, 175 kg single superphosphate and 35 kg urea per acre. After a week, replant into the gaps and irrigate immediately.

#### Garlic

Stop irrigation in the first week, but apply light irrigation prior to harvesting to facilitate the operation and uproot in the last week. Cure in the field for 5 to 7 days. Tie the produce in bundles of a kg each, shift in a cool and ventilated place. Sort out bulbs with dried cloves during storage.

### VEGETABLE PESTS

1. Fruit borer attack in tomato crop can be checked by spraying 30 ml of Fame 480 SL or 60 ml Coragen 18.5 or 200 ml Indoxacarb 14.5 SC in 100 litres of water per acre. Observe waiting period of three days after the spray of Fame and one day after the spray of Coragen.
2. To protect the tomato crop from early blight, spray the crop with Indofil M-45 @ 600 g/acre in 200 litres of water.

### HORTICULTURAL OPERATIONS

1. The temperature rises rapidly and relative humidity gets low during this month. The growers are advised to adopt the measures to save their valuable fruit trees, particularly, newly planted from drought and sun injury. Therefore, apply light and frequent irrigations during this month to young plants. Apply irrigation at 3-4 days interval to peach varieties Partap, Shan-e-Punjab and Florda Prince as the fruits are developing during this period.
2. The fruit trees loaded with fruits such as Shan-e-Punjab and of plum like Kala Amritsari and Sutlej Purple normally need fruit thinning in early days of the month to minimize the danger of limb-breakage, and to improve the marketable size and quality of the fruits.
3. Apply second dose of inorganic fertilizers to the fruit trees of citrus, pear, litchi, plum, grapes, mango, litchi, etc.
4. The stock sprouts emerging from the newly planted young fruit plants below the bud union should be removed/pinched off regularly.
5. In young orchards, summer *moong* can be sown as an intercrop upto first week of this month.
6. The zinc deficiency in citrus can be managed with spray of 0.3 zinc sulphate (3 g/litre of water) solution, without addition of lime, to spring flush.
7. For crop regulation to get better fruiting in winter seasons guava crop, spray urea @ 10% or 600 mg/litre NAA

during April-May when maximum flowers have opened. Pruning of terminal portion of shoots (20-30 cm) in last week of April can also be done to avoid rainy season crop. Also withhold irrigation during this period.

8. Spray 200 ml Crocodile/Confidor 17.8 SL or 160 g Actara/Dotara 25 WG or 6.25 litre Mak H.M.O. per acre in 500 litres of water on citrus crop to control citrus psylla and aphids.
9. Mulching of pear orchards with paddy straw @ 5.5 ton per acre can be done in this month. In addition to weed suppression, fruit yield and quality also improved with paddy straw mulching.

### ORNAMENTALS

#### Annuals

1. Summer annuals like Cosmos, Gaillardia, Gomphrena, Kochia, Zinnia etc. can be transplanted in the prepared beds or pots preferably in the evening followed by light irrigation.
2. Ripened seeds collected from the winter flowering annuals are shade dried, stored and labeled in air tight containers.

#### Permanent plants

Need-based periodic irrigation is required for the permanent landscape plants as the temperature is expected to rise. Division of canna rhizomes can be made for propagation.

#### Chrysanthemum

Periodic pinching of chrysanthemum suckers planted in beds will ensure more bushiness and lateral branches. Regular weeding and irrigation is done to keep the soil moist.

#### Roses

Flowering of the rose will almost be over in this month. Continue removing faded, dried flowers and root-stock suckers. Ensure required soil moisture with timely irrigation.

#### Lawns

Irrigate the lawns through sprinklers for retaining vigor and lush green carpet. Periodically remove the deep rooted

weeds manually with hand hoe. Avoid walking on lawn immediately after irrigation.

### Pot plants

The pots must be periodically irrigated to ensure sufficient moisture. Groom the foliage plants by removing dead and dried leaves. Foliage plants sensitive to hot sun rays should be shifted under partial shady locations.

The Gladioli corms should be harvested, cleaned and dried in shade for 2-3 days before storing in crates or gunny bags in cold storage at 4°C. The summer flowering bulbs of Caladiums, Football Lilly and Tuberose, if not planted during March, should be planted early during this month.

**Marigold:** The healthy seedlings of summer marigold 'Punjab Gainda No.1', if not planted earlier during February-March can be transplanted in the field during evening hours, followed by light irrigation.

### AGROFORESTRY

#### Poplar

1. As the temperature has started rising, 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.

### BEEKEEPING

Bee strength of honey bee colonies during April is about at peak. Manage colonies to prevent and check swarming. Colonies should be provided enough space in the form of raised empty combs

or frames with comb foundations and super chambers to provide space for brood rearing and honey storage. First fortnight of the month is still suitable for queen bee rearing. If drone brood rearing is continued, the stock multiplication can be undertaken either by selectively dividing the colonies or through mass rearing the queen bees. 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. On suspicion of the brood diseases, immediately consult expert and suggested control measures should be undertaken; non-chemical methods should be preferred. Do not use antibiotics. 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. Take all precautions, during and after honey extraction, for preventing robbing in the apiary. Afterwards, commercial beekeepers may migrate their apiaries to sunflower growing areas. For enhancing apiary income, progressive beekeepers can adopt apicultural diversification through production/ collection of other hive products, viz. pollen, propolis, royal jelly and bee venom. Shift the colonies to thick shade.

## MUSHROOM FARMING

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

## 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, protein level in the concentrate mixture needs 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. Vaccinate the chicks of 6-8 weeks of age with *Ranikhet* disease vaccine and fowl pox vaccine at 8-10 weeks of age.
5. Start de-worming the pullets at three months of age and then regularly at one month interval.
6. White wash the poultry shed from outside especially roof. This will help to reflect the sun rays.
7. Provide artificial lights during early morning so that birds can consume feed in cool hours.
8. In order to compensate decrease in feed intake, level of energy nutrients need to be increased which can be achieved adding maize. Provide electrolytes, Vit. C @ 5 g/liter per 100 birds per day.

**Compiled by: Amarjit Singh**

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

# Training Programmes in April

<b>KVK, AMRITSAR (98723-54170)</b>	
April 03	: Soil sampling techniques and judicious use of fertilizers
April 04	: Management of insect-pests and diseases of summer crops
April 05	: Nutrient and weed management in organic farming
April 09	: Diet plans and recipes to manage lifestyle diseases
April 15	: Preparation of vermicompost and effect of its use on the soil health
April 18	: Summer management and feeding of dairy animals
April 19	: Blood transfusion in animals
April 22-25	: Garment enrichment through painting techniques
<b>KVK, BATHINDA (0164-2215619)</b>	
April 03	: Marketing of crop produce
April 04	: Cultivation of summer pulses/cotton for crop diversification
April 05	: Summer management and feeding of dairy animals
April 09-10	: Personal hygiene and nutrition for adolescent girls
April 12	: Methods of collecting soil and water samples as well as interpretation of results
April 15	: Integrated Pest and Disease Management in <i>kharif</i> crops
April 18-19	: Solar cooker and solar dryer as a renewable sources of energy
April 22-26	: Nursery production in horticultural crops
April 25	: Improved cultivation techniques of <i>kharif</i> crops
April 29-30	: Professional and personal skills training for <i>angadwadi</i> workers to implement non-formal pre-school education
<b>KVK, FARIDKOT (01639-253142)</b>	
April 01	: Improved cultivation techniques of <i>kharif</i> crops
April 02	: Integrated Pest and Disease management in <i>kharif</i> crops
April 03	: Crop regulation in guava
April 04	: Eco-friendly approaches for insect-pest and disease management of fruits and vegetables
April 05	: Methods of collecting soil and water samples and interpretation of results
April 09	: Cultivation of summer pulses for crop diversification
April 10	: Efficient utilization of non-conventional energy gadgets
April 12	: Summer management and feeding of dairy animals
April 15	: Dietary management of lifestyle diseases
April 16	: Green fodder production round the year
April 18	: Management of poor quality irrigation water in <i>kharif</i> crops
April 19	: Custom hiring of agricultural machinery
April 22-26	: Enrichment of garments through printing and painting
April 29	: Formulation of balanced feed using domestic ingredients and <i>azolla</i> farming for livestock
<b>KVK, FATEHGARH SAHIB (01763-221217)</b>	
April 01-05	: Seed production of <i>kharif</i> crops
April 02	: Production techniques of crops under organic farming
April 03	: Management of insect-pests in cucurbits
April 04	: Identification and management of nutrient deficiencies in fruit crops
April 15	: Nutritional security through Integrated Nutrition Garden
April 16	: Integrated management of fruit drop in <i>Kinnow</i>
April 18	: Methods of collecting soil and water samples and interpretation of results
April 22	: Cultivation of milky mushroom and paddy straw
<b>KVK, FEROZEPUR (MALLEWAL) (01632-279517)</b>	
April 23	: mushroom
April 24	: Personal hygiene for adolescent girls
April 25	: Preparation of balanced feed for livestock at home level
April 26	: Improved cultivation practices for <i>kharif</i> crops
April 29	: Integrated Pest and Disease Management in <i>kharif</i> crops
<b>KVK, GURDASPUR (01874-220743)</b>	
April 02	: Efficient utilization of non-conventional energy gadgets
April 04	: Efficient use of crop residue machinery including surface seeding machinery
April 05	: Clean milk production
April 18	: Crop regulation techniques for quality and yield improvement in guava and <i>ber</i> crops
April 25	: Hybrid seed production in vegetable crops
April 26	: Methods of collecting soil and water samples and interpretation of results
<b>KVK, HOSHIARPUR (BAHOWAL) (98157-51900)</b>	
April 09	: Use of renewable energy sources at farm and house hold level
April 04	: Management of <i>Apismellifera</i> colonies during summer and monsoon seasons
April 05	: Improved production technology under organic farming for different crops including millets
April 15	: Integrated training on Piggery, Fishery and Goatry
April 24	: Custom hiring of agricultural machinery
April 30	: Methods of collecting soil and water samples and interpretation of results
<b>KVK, JALANDHAR (NURMAHAL) (01826-292053)</b>	
April 15	: Eco-friendly approaches for insect-pest and disease management
April 10	: Raising mat type nursery for paddy transplanter
April 12	: Summer management and feeding of dairy animals
April 16	: Dietary management for lifestyle diseases
April 18	: Micro-irrigation and fertigation in orchards
April 19	: Improved plant protection practices in <i>kharif</i> crops
April 23	: Preparation of feed for dairy animals
April 26	: Method of collecting soil and water samples and interpretation of results
April 30	: Improved cultivation techniques of <i>kharif</i> crops
<b>KVK, KAPURTHALA (01822-233056)</b>	
April 04	: Direct seeding of paddy/ <i>basmati</i> -A resource conservation approach
April 16	: Micro irrigation, fertigation and weed management practices in orchards
April 18	: Identification and management of insect pests and diseases of vegetables and fruits
April 22	: Machinery for cultivation of <i>kharif</i> and <i>rabi</i> crops
April 24	: Formulation of balanced cattle feed
April 26	: Safe use and handling of spraying equipments and farm machinery
<b>KVK, KAPOOR THALI (01822-233056)</b>	
April 04	: Role of green manuring to enhance soil health
April 05	: Integrated Pest and Disease Management in <i>kharif</i> crops
April 10	: Improved cultivation techniques of <i>kharif</i> crops

<b>April 15</b>	: Safe use and handling of farm machinery	<b>April 26</b>	: Drudgery reduction technologies in household and farm activities
<b>April 16</b>	: Personal hygiene and nutrition for adolescent girls	<b>April 29</b>	: Methods of collecting soil and water samples and interpretation of results <b>KVK, ROPAR.(01881-220460)</b>
<b>April 18</b>	: Cultivation of turmeric	<b>April 01</b>	: Fertilizer management in <i>Poplar</i> and <i>Eucalyptus</i>
<b>April 22</b>	: Recommended machinery for sowing of <i>kharif</i> crops	<b>April 02</b>	: Summer management and feeding of dairy animals
<b>April 26</b>	: Organic Farming	<b>April 03</b>	: Formulation of balanced feed for dairy animals
<b>KVK, LUDHIANA.(SAMRALA).(01628-261597)</b>		<b>April 04</b>	: Improved practices for cultivation of turmeric
<b>April 09</b>	: Improved cultivation practices of <i>kharif</i> crops	<b>April 05</b>	: Methods of collecting soil and water samples and interpretation of results
<b>April 10</b>	: Role of green manuring to enhance soil health	<b>April 09</b>	: Solar cooker and solar dryer as renewable sources of energy
<b>April 15</b>	: Cultivation practices of millets	<b>April 10</b>	: Micro irrigation, fertigation and weed management practices in orchards
<b>April 18</b>	: Food safety and techniques to check food adulteration	<b>April 12</b>	: Cultivation of millets, oilseeds and summer pulses for crop diversification
<b>April 19</b>	: Bio-agents and non-chemical methods for insect pest and disease management	<b>KVK, SANGRUR.(KHERI).(01672-245320)</b>	
<b>April 22-26</b>	: Embellishment of clothes using modern and traditional techniques	<b>April 22-26</b>	: Poultry farming
<b>April 23</b>	: Raising of mat type paddy nursery and mechanical transplanting	<b>April 26</b>	: Cultivation of summer mushrooms
<b>April 26</b>	: Methods of soil sampling for fertilizer application and interpretation of results <b>KVK, MANSA.(01652-280843)</b>	<b>April 29</b>	: Integrated Pest and Disease Management in <i>kharif</i> crops
<b>April 02</b>	: Tips for successful cultivation of fruit plants	<b>April 30</b>	: Management of pink bollworm and whitefly in <i>Bt</i> cotton
<b>April 05</b>	: Dietary management of lifestyle diseases	<b>KVK, SHAHEED.BHAGAT.SINGH.NAGAR</b>	
<b>April 16</b>	: Water saving technologies in agriculture	<b>(LANGROYA).(01823-250652)</b>	
<b>April 18</b>	: Silage making for dairy animals during lean period	<b>April 02</b>	: Small scale agro-industry-A way to become an entrepreneur
<b>April 19</b>	: Management of insect pests and diseases of major <i>kharif</i> crops	<b>April 03</b>	: Dietary management of lifestyle diseases
<b>April 23</b>	: Methods of collecting soil and water samples and interpretation of results <b>KVK, MOGA.(BUDH.SINGH.WALA).(81465-00942)</b>	<b>April 04</b>	: Integrated Pest and Disease Management in <i>kharif</i> crops
<b>April 04</b>	: Cultivation of millets	<b>April 05</b>	: Identification and management of insect-pests and diseases of fruits and vegetables
<b>April 05</b>	: Dietary management of lifestyle diseases	<b>April 18</b>	: Organic manures
<b>April 09</b>	: Small scale agro industry- A way to become an entrepreneur	<b>April 19</b>	: Formulation of balanced cattle feed
<b>April 10</b>	: Nutritional recipes for young children and pregnant/lactating women	<b>KVK., SRI.MUKTSAR.SAHIB.(GONEANA)</b>	
<b>April 12</b>	: Improved plant protection practices in <i>kharif</i> crops	<b>April 03</b>	: Importance of cultural practices to manage whitefly in cotton
<b>April 16</b>	: Methods of collecting soil and water samples and interpretation of results	<b>April 04</b>	: Cultivation of cotton for crop diversification
<b>April 22</b>	: Water conservation techniques in <i>kharif</i> crops <b>KVK, PATHANKOT.(98762-95717)</b>	<b>April 05</b>	: Dietary management of lifestyle diseases
<b>April 04</b>	: Soil health management through organic farming	<b>April 09</b>	: Integrated Pest and Disease Management in <i>kharif</i> crops
<b>April 12</b>	: Efficient use of solar cooker at home	<b>April 10</b>	: Management of stored grain pests
<b>April 22</b>	: Use of renewable energy sources at farm and house hold level	<b>April 18</b>	: Importance and scope of millet cultivation
<b>April 23</b>	: Identification of physiological and nutrient deficiency disorders in fruit and vegetable crops	<b>April 19</b>	: Marketing of <i>rabi</i> crops
<b>April 24</b>	: Awareness and use of mineral mixture in dairy ration	<b>April 22-26</b>	: Techniques of tie and dye
<b>April 29</b>	: Integrated Nutrient Management in <i>kharif</i> crops <b>KVK, PATIALA.(RAUNI).(94642-10460)</b>	<b>April 23</b>	: Improved cultivation techniques of <i>kharif</i> crops
<b>April 03</b>	: Care and management of dairy animals during summer season	<b>April 24</b>	: Summer management and feeding of dairy animals
<b>April 09</b>	: Cultivation of millets, oilseeds and summer pulses for crop diversification	<b>April 25</b>	: Importance of soil and water testing
<b>April 10</b>	: Identification and management of stored grain pests	<b>SKILL.DEVELOPMENT.CENTRE</b>	
<b>April 18</b>	: Improved practices for cultivation of turmeric	<b>April 04</b>	: Vocational and career development programme for school going children
<b>April 22-26</b>	: Embellishment of clothes using modern and traditional techniques	<b>April 09-10</b>	: Cultivation of millets
<b>April 23</b>	: Bio-agents and non-chemical methods for disease and pest control	<b>April 22-26</b>	: Development of entrepreneurial skills in baking and confectionary
<b>April 24</b>	: Cultivation of summer mushrooms	<b>Compiled by: Dr Inderpreet Kaur Boparai and Dr Manoj Sharma</b>	
<b>April 25</b>	: Establishment of agro-processing units		

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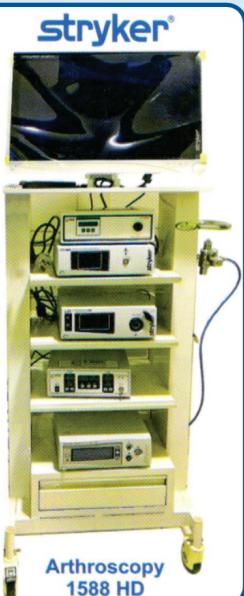
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• Putnam Hospital Centre, New York, USA  
• A.O. Fellow University Hospital, Zurich, Switzerland  
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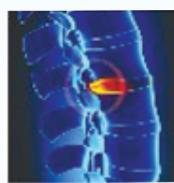


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