

Nomination of Prof.(Dr.) J. S. Bal for Chair of ISHS Working Group Bioregulators in Fruit Production

Membership No. : 77034



- 1. Name** : **Prof. (Dr.) J. S. BAL**
- 2. Date of Birth** : 08-10-1951
- 3. Present Position** : **Dean, Faculty of Agriculture
Prof. & Head, Deptt. of Agriculture
Sri Guru Granth Sahib World University
Fatehgarh Sahib, Punjab-140 406**
- 4. Past Position** : **Former Professor of Horticulture & Head
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7. Academic Qualifications

Name of Degree/ Fellowship	Year	Name of the University/Institution
• B.Sc. Agri.(Hort.)	1973	Guru Nanak University, Amritsar
• M.Sc.(Hort.)	1975	Punjab Agricultural University, Ludhiana
• Ph.D.(Hort.)	1991	Guru Nanak Dev University, Amritsar
• F.H.S.I.	2018	Horticultural Society of India

M.Sc. Thesis Title: Developmental physiology of ber (*Zizyphus mauritiana* Lamk.)

Ph.D. Thesis Title: Effect of growth regulators on maturity, ripening and post-harvest physiology of ber (*Zizyphus mauritiana* Lamk.)

8. Additional Qualifications

Title of Training	Training Period	Training Duration	Place of Training	Duties
Laboratory Techniques in Horticultural Research	2-31 July 1982	30 days	Deptt of Horticulture, PAU, Ludhiana	Biochemical estimation of fruits
National Seminar-cum-Workshop on Grapes for North-West Plains	18-28 June 1990	11 days	Deptt of Horticulture, PAU, Ludhiana	Various aspects of grape cultivation
Orientation, Communication and Extension Methods for Master Trainers	4-10 Dec. 1991	7 days	Extension Education Institute, Nelokheri (at PAU)	Methods for delivering better lecture
Plant Breeding Methodology Today and Tomorrow	6-25 July 1992	20 days	Deptt. Pl. Breeding, PAU, Ludhiana	Plant Breeding Methodology

9. Date of Joining in the University Service : Research Associate (Hort.): 21-09-1977
: Asstt. Prof. of Horticulture: 09-04-1980

10. Details of Teaching/Research/Extension Position held

Post	Pay scale	From	To	Name of the Institution
A. Teaching				
Asstt. Prof. Horticulture	700 – 1600	9-4-1980	8-4-1988	Deptt. of Horticulture PAU, Ludhiana
Asstt. Prof. Horticulture (Senior Scale)	(2200 – 4000) 3000 – 5000 (10000-15200)	9-4-1988	8-4-1993	Deptt. of Horticulture PAU, Ludhiana
Assoc. Prof. Horticulture	3700 – 5700 12000-18300	9-4-1993	8-4-2001	Deptt. of Horticulture PAU, Ludhiana
Professor of Horticulture	12000-18300	9-4-2001	31-10-2011	Deptt of Horticulture PAU, Ludhiana
Professor and Head		8-1-2009	27-7 2009	Deptt. of Horticulture PAU, Ludhiana
Professor of Horticulture	80000/-basic fixed	17-2-2012	30-11-2012	LPU, Jalandhar
----- Dean Faculty of Agriculture & Prof.& Head, Deptt. of Agricul.	70000/- fixed	3-11-2020	Till date	SGGSWU University, Fatehgarh Sahib
B. Research				
Research Associate(Hort.)	Rs. 850/- fixed	21-9-1977	12-3-1980	Deptt. of Horticulture PAU Ludhiana & RFRS Abohar
Asstt. Horticulturist (Garden)	Additional Charge	15-9-1982 20-8-1991	7-5-1984 8-4-1993	College Orchard PAU, Ludhiana
Assoc. Prof. Hort. (Garden)	Additional Charge	9-4-1993	17-8-1998	Deptt. of Horticulture PAU, Ludhiana
C. Extension				
Asstt. Prof. Hort. (Extn.)	Additional Charge	21-5-1980	31-5-1981	Deptt. of Horticulture PAU, Ludhiana
Assoc. Prof. Hort (Extn.)	Additional Charge	17-8-1998	26-5-2000	Deptt. of Horticulture PAU, Ludhiana

11. Administrative Experience : 16 Years

i) Dean, Faculty of Agriculture & Head, Department of Agriculture: 1 Year 4 Months 28 Days

- Dean, Faculty of Agriculture & Head, Deptt. of Agriculture, Sri Guru Granth Sahib World University, Fatehgarh Sahib from 3 November 2020 till date

ii) Head, Department of Horticulture : 7 Months 16 Days.

- Head, Department of Horticulture, PAU officiated from 8 January to 27 July 2009.
- Head, Department of Horticulture, PAU acted from 16 July to 10 August 2007.

iii) Management of College Orchard PAU : 8 Years 7 Months 22 Days

- Asstt. Horticulturist (College Orchard) from 15 September 1982 to 7 May 1984.
- Asstt. Prof. Hort. (College Orchard) from 20 August 1991 to 8 April 1993.
- Assoc. Prof. Hort. (College Orchard) from 9 April 1993 to 17 August 1998.

iv) Warden PAU Hostel No. 2 : 2 Years 2 Months 27 Days.

- Remained Warden PAU Hostel No. 2 from 16 December 2001 to 11 March 2004.

v) **Programme Officer NSS** : 3 Years

- Served as Programme Officer, National Service Scheme, College of Agriculture, PAU from 3 June 1993 to 7 June 1996.

vi) **National Cadet Corps (NCC) Officer** : 1 Month

- NCC Officer, PAU Ludhiana officiated from 26 March to 23 April 1983.

12. Research Contributions

i) **Research Publications** : 210

Research Papers : 163

Symposium Papers : 42

Research Proceedings/Reports : 5

ii) **Field of Specialization**

(a) *Fruit Physiology and Growth Regulators* (b) *Rootstock and Propagation* (c) *Ber and Guava fruits*

iii) **Team Leader:** Team leader and resource person in **ber** crop for 19 years from 1993 to 2011.

iv) **Varieties Developed**

- **Ber (Jujube)**
 - Wallaiti
 - Elongated Dehradun (*Zizyphus mauritiana*) Rootstock
 - Coimbatore (*Zizyphus mauritiana*) Rootstock
- **Guava**
 - Punjab Pink (L-49 x Portugal → F1 x Apple Colour)
 - Arka Amulya
 - Portugal Rootstock

v) **Research Proceedings/Abstract/Report Prepared**

- *Prospects and Problems of Citrus in Punjab* :2011
- *40 Years of Research on Fruit Crops* : 2005
- *Abstracts: National Sem. on Viticulture in Non-traditional, Marginal and Degraded Soils* :2005
- *Research in PAU ~ Abstracts of Theses (1970-1999)* : 2000
- *Draft Report on the Genetic Resources of Ber* : 1983

vi) **Significant Contribution in Horticulture**

1. BER (JUJUBE)

Evaluation of Varieties: Forty two varieties were screened and evaluated for different characters. The fruit size and weight was the maximum in Umran and the minimum in Illaichi. The golden yellow colour of ber fruit seems to be most appealing to the consumer. TSS of different varieties varies between 11.3% in Katha Phul and 19.4% in Sanaur-2. Acidity was found to be the highest in Chinese. All varieties contained good amount of vitamin C ranging between 68-148 mg/100 g of pulp. The average yield of fruit per tree was the highest in Umran (200 kg). The other high yielding varieties are Kala Gola (170 kg), Sanaur-2 (160 kg) and Sanaur-5 (150 kg). The varieties like Sanaur-2, Sanaur-4, Sanaur-5, Golar, Chinese, Katha Phul and Noki were rated as tolerant to powdery mildew disease. The leaf apex was the most dependable character for classification of ber cultivars through vegetative characters. Branching habit was another good index. Leaf shape, leaf base, leaf colour and petiole length were used as tertiary characters. The fruit apex, flesh cavities, fruit shape, fruit colour at maturity, ridges on fruit base and apex and fruit surface were the fruit characters used for classification through fruit characters. The cv. Wallaiti was recommended for growing in Punjab during February 2001. The fruits are medium to large, oval in shape, skin smooth and light golden yellow

to golden yellow at maturity. Pulp soft, sweet with TSS 13.8 to 15.0 per cent. It ripens early during first fortnight of March. The average yield is 114 kg fruit per tree.

Hybridization: Powdery mildew disease in ber appears from September to December in North India. It has become a big menace in ber orchards and if not checked in time, it can wipe out the entire crop. Hybridization work was started in September 1996 between two varieties i.e. Chinese x Sanaur-2. Chinese is resistant to powdery mildew disease whereas Sanaur-2 is a prolific bearer yield about 150 kg fruit per tree and has been found fairly resistant to powdery mildew disease. Hybridization work was carried out from 30 September to 3 October between 7 AM to 10 AM. Ber hybrid (Chinese x Sanaur-2) is free from the attack of powdery mildew disease. The colour of fruits was quite appealing to the consumer due to light red tinge at the tip. On the basis of palatability rating the fruits were rated 'very good'.

Rootstock Evaluation: The cultivar Umran was budded on twelve rootstocks belonging to the genus *Ziziphus*. The stock girth was recorded maximum in plants budded on *Z. mauritiana* (Punjab) followed by *mauritiana* from Dehradun. The *Z. mauritiana* (Coimbatore) had significantly small scion girth and lower volume among *mauritiana* rootstocks. Therefore, this rootstock was recommended as a semi-vigorous rootstock for different commercial cultivars of ber. The highest fruit yield (146 kg/tree) was recorded on *Z. mauritiana* (Elongated Dehradun). It was concluded that the ber should be budded on *Z. mauritiana* (Elongated Dehradun) for higher fruit yield. Ber plants raised on semi vigorous rootstock (*Z. mauritiana* from Coimbatore) can profitably be planted at a closer spacing of 6x6m instead of 7.5x7.5m on vigorous rootstocks.

Floral Biology: The ber inflorescence was auxiliary cyme. The whole period of bud development was divided into 8 stages and took 20.8 to 22 days for passing through various stages of bud development. Flowering started in September and completed in November, thus, entailed 58-79 days in different cultivars. The dehiscence of anthers started just after anthesis and was completed within 4 hours. The pollen viability was ranging between 87.2 to 90.6% and pollen grain germinability between 36.5-47.7% in different ber cultivars. Ber did not set any fruit by self-pollination, thereby showing self-incompatibility.

Propagation: Bud take efficiency in Umran ber was noted highest (84.9%) during June. The higher budding success was also recorded in second fortnight of August and during September.

Pruning of Ber: The fruit set, fruit retention, fruit yield and quality of ber cv. Umran was recorded better with light pruning i. e. removal of all the wood except 60 cm length of shoot. The selective pruning of late flowering branches (21 Oct to 5 Nov) has slightly improved fruit size, weight and palatability rating in Umran ber. TSS and vitamin C content of different ber cultivars showed increasing trend after selective pruning. Pruning of Sanaur-2 should be done during the third week of April when the trees are dormant. Pruning by heading back at 8 buds length of previous year's growth gives higher yield of better quality fruits. Severe pruning after 4-5 years is recommended.

Growth and Development of Ber Fruit: Fruits of Umran reached in ripe stage in 190 days and of Sanaur-2 in 180 days after fruit-set. The fruit growth in ber showed three distinct phases and followed a pattern of 'Double Sigmoid' curve. Ripe fruits of ber contains amino acids like aspergine, aspartic acid, arginine, glutamic acid, glycine, serine, threonine, α -alanine, valine, methionine, leucine and isoleucine. The fruits of Umran ber contained sucrose, glucose and fructose in approximate ratio of 3:1:1. The chlorophyll content of the ber peel reduced to the minimum as the fruit reached maturity.

Irrigation Scheduling: In young ber plants for initial establishment and better production, application of 8-11 irrigations on the basis of climatological approach irrigated at 100 and 75 mm CPE during the entire cropping season is recommended. The flowering intensity was significantly higher in plants irrigated at CPE 100 mm due to mild stress conditions. Maximum fruit set 11.7 to 13.7 per cent was attained in plants irrigated at 75 mm. The minimum protein and a significantly high amount of proline accumulated in plants under water deficit conditions CPE 150 mm. The higher water use and water use efficiency was found in plants irrigated at CPE 100 mm. The better absorption and utilization of source-sink relationship leads to maximum yield from plants irrigated at CPE 75 mm. Leaf nitrogen and phosphorus content increased with availability of soil moisture but no effect on potassium content. Soil N, P and K content was not affected under different irrigation regime. Leaf iron content increased with increased water stress conditions but

other micro nutrients like Zn, Mn and Cu were not affected with available soil moisture

Mulching in Ber Orchard: On the basis of vegetative, fruiting and fruit yield characters and quality parameters of fruits, black polythene is the ideal choice for ber orchards. The available soil nitrogen in both the soil profiles and soil moisture content was observed maximum in black polythene mulch. It also reduced weed growth in terms of count and weight by cent per cent. Paddy straw was found to be the best natural mulch for ber orchards.

Weed Management: Pre-emergence application of Hexuron 80 WP (diuron) at 3 kg/hectare can be made during the first fortnight of August when field is free from growing weeds and stubbles. Glycel 41SL (glyphosate) at 3 l/hectare or Gramoxone 24 WSC (paraquat) at 3 l/hectare as post-emergence should be sprayed when the weeds are growing actively preferably before weeds flower and obtain a height of 15-20 cm. The herbicides are dissolved in 500 litres of water per hectare to give complete coverage of weeds. Glycel and Gramoxone should be sprayed during the calm day to avoid spray drift to the foliage of the fruit trees.

Biochemical Constituent Variation in Fruit: Total soluble solids were estimated highest in the stylar end of the fruit in Sanaur-2 and Sanaur-4 cultivars. TSS in Umran cultivar found maximum in the upper portion of fruit. Acidity was estimated maximum in the lower portion of the fruit and decreased progressively towards the upper portion. Reducing sugars were recorded maximum in the lower portion and total sugars in the stalk end and upper portion of the fruit. Ber skin has maximum content of total phenolics.

Checking Fruit Drop in Ber: NAA 20-30 ppm proved the most effective treatments in reducing fruit drop in Kaithli which was 8.8 to 9.0 per cent less than the control. The per cent fruit drop in cv. Wallaiti was less by 10.2% in 20 ppm and 10.0% in 30 ppm. Spray application of NAA at 30 ppm proved effective in checking fruit drop in Umran ber. Two sprays of NAA at 30 ppm once in second fortnight of October and again in second fortnight of November effectively control physiological fruit drop in Umran cultivar.

Uniform and Early Ripening: Ethephon (400 ppm) at colour break stage i.e. in the first week of March advanced ripening of Umran ber by two weeks and produced attractive, uniform, better quality and deep golden yellow with chocolate tinge coloured fruits. Early ripened ber with ethephon fetch higher price in the market. By adopting this practice, one can earn an additional Rs.15000 per hectare of ber plantation.

Ber Harvesting and Marketing: The best indices for judging the maturity are that specific gravity should be less than 1 with golden yellow colour of the fruits in Umran. The optimum harvesting time of Umran is around first week of April in South-Western districts of Punjab. The growers can net an income of about Rs. 78000 per hectare or more by growing selected varieties and following latest research findings.

Grading of Ber Fruits: Highest distribution of ber fruit (Umran) was recorded in grade B (33%) which was closely followed by grade A (27%). The extent of C and D grade fruits was 21% and 19%, respectively. The fruits belonging to A and B grades which accounted for 60% has deep golden yellow colour are more acceptable to the consumers. On the basis of organoleptic evaluation, fruits belonging to A and B grades were adjudged "Excellent". The fruits were rated 'good' in grade C and 'fair' in grade D. The highest palatability rating was noted in deep golden yellow and chocolate tinge coloured fruits and were rated as "Excellent". Such fruits were considered suitable for table purpose and could fetch higher price in the market.

Ripening of Ber Fruits: Ber fruits harvested at early maturity (15 March) ripened unevenly in most of the treatments. Ethephon (2000 and 3000 ppm) and hot water dip regardless of stage of maturity enhanced the ripening percentage and developed the best colour of fruits after ripening. Delaying the picking of fruits to later maturity stages resulted in higher TSS, vitamin C, total sugars and PME activity and lower acidity and total phenolics. Ber fruits should be picked up to 29 March for distant markets and April 5-12 for local markets.

Packaging of Ber Fruits: The fruits of ber cv. Umran were harvested at optimum maturity and were packed in LDPE bags (100 gauge), HDPE bags (0.1 mm), PPP (polypropylene) bags, paper bags and CFB cartons and stored in commercial cold storage at temperature 0-3.3°C and RH 85-90%. The results showed that ber fruits packed in CFB cartons had best consumer acceptance upto 30 days in cold storage.

Storage of Ber Fruits: The shelf life of fruits can be enhanced upto 10 days in Umran and 12 days in Sanaur-2 at ambient temperature and up to 30 days in Umran and 40 days in Sanaur-2 by storing them in perforated polythene bags of 100 gauge thickness in the commercial cold storage (0-3.3°C temperature and

85-90% RH) after treating with 6% wax-emulsion. The shelf-life of Umran ber can be extended upto 30 days in cold storage by spraying ethephon 400-500 ppm at colour break stage and storing the fruits in paper bags.

Effect of pre-harvest spray of ethephon, SADH and TIBA on pectin methyl esterase (PME) activity of ber fruits during cold storage showed increase in activity with the advancement of storage period. TIBA (10, 25, 50 ppm and SADH (1000, 2000, 3000 ppm) resulted in significantly higher activities than morphactin (10, 25, 50 ppm) and ethephon (300, 400, 500 ppm). The PME activity was higher in fruits in polythene bags than those stored in paper bags. Ber fruits cv. Umran retained their original colour up to 20 days and there was least browning percentage up to 30 days in cold storage (temp. 0-3.3°C, RH 85-90) with GA₃, 25 and 50 ppm and CFB carton packing.

Utilization of Fruits: The ber fruit can be utilized profitably for the preparation of several delicious products. The ber variety Umran is suitable for sun drying and dehydration. Fully mature unripe fruits of ber can be used for the preparation of murabba, candy, pickle and chutney. The juicy varieties can be converted into pulp to serve as base material for ready-to-serve (RTS) beverage, squash and nectar. The fully mature fruits of ber can be canned in sugar syrup. Fruits of Sanaur-2, Sanaur-3, Sanaur-4 and Nalagarh were harvested at early ripe stage and were dried in a mechanical drier at 65±2°C for 31 hours. Organoleptically, all the varieties were acceptable on 6 months storage as ber dry dates (Chhuharas).

Rejuvenation of Old Ber Trees: Ber trees need to be rejuvenated after the age of about 25 years. This can be done by heading back the main limbs to about 30 cm during second fortnight of May. The trees start giving commercial crop with higher yield of excellent fruit quality during the third fruiting season.

2. GUAVA

Varietal Evaluation: Guava is second important fruit crop of Punjab after citrus. The major impediments in the expansion of area and productivity under guava can be checked if superior varieties are made available through germplasm evaluation. Performance of seventeen different genotypes of guava was studied in the New Orchard of PAU, Ludhiana to identify promising and high yielding cultivars. The fruit size was recorded maximum in Hisar Safeda and Sardar. The fruit yield was found higher in Red Fleshed and Hisar Safeda. TSS content in fruits was noted higher in Hisar Safeda, Sardar 4/12 and Sardar 4/10 genotypes. Vitamin C content in fruits was estimated higher in Sardar 4/12 and Sardar 4/10 genotypes. Arka Amulya – a variety of guava was recommended for general cultivation in Punjab during 2003. The trees of Arka Amulya are somewhat dwarf with compact globose, round crown, drooping branches with dense foliage. The fruit is large in size, round, glossy with white flesh. The average yield of rainy and winter season crop is 144 kg per tree. Total soluble solids in fruits ranged from 9.3 to 10.1.

Hybridization: Hybridization work in guava was started in May 1996 and crosses were made between L-49 x Portugal → F1 x Apple Colour, at Fruit Research Station Bahadurgarh (Patiala). Seedlings of hybrids were transplanted in the field in September, 1997. The grafted plants of hybrids were planted in 2002. “Punjab Pink” a new guava hybrid was released by PAU in December, 2009. The trees of hybrid are vigorous with dropping branches. The fruit is medium to large in size with attractive red coloured skin in some fruits in summer and golden yellow in winter. The flesh is red having pleasant flavour. TSS ranged from 10.50 to 12.00 per cent. It is a prolific bearer and annual yield is 150 kg per tree.

Rootstock Evaluation: Allahabad Safeda and Sardar were budded on ten rootstocks belonging to genus *Psidium*. Portugal gave scion/stock ratio close to one with smooth bud union without any bud union crease and bark splitting wilt like symptoms. Red Fleshed and Behat Coconut rootstocks produced severe bark splitting symptoms resulting in decline of the plant. The highest fruit yield of both the scion cultivars was recorded on Portugal. Maximum TSS (9.9%) was recorded in Allahabad Safeda /Portugal combination. Portugal also improved the uptake of N in both scion cultivars. Thus it may be inferred that Portugal being tolerant to wilt like symptoms is the ideal rootstock for Allahabad Safeda and Sardar scions under Northern Indian conditions. Portugal rootstock was recommended by PAU in 2008.

Use of Gamma Rays on Buddlings: The buds were given treatment of gamma rays at the dose of 1-5 kR. The variability for plant height, internodal length, length of leaves and stem diameter was observed maximum in 2 kR treatment.

Closer Spacing: Three different spacings viz. 6x4m, 6x5m and 6x6m were tested with regard to tree

growth, fruit yield and quality of Sardar. The stock girth, scion girth, tree height, tree spread and tree canopy were the maximum at medium spacing. The fruit yield per tree and yield efficiency were the maximum in closer spacing followed by medium spacing. On the whole, the medium spacing (6x5m) has shown better results. Guava plants cv. Sardar can profitably be planted at a closer spacing of 6x5 m instead of 6.5x6.5 m. With closer spacing 132 plants can be accommodated in one acre.

High Density Planting: Guava cultivars Sardar and Allahabad Safeda were planted under high density planting system. The plantation was made at the distance of 6x2m, 6x3m, 6x4m and 6x5m. The plants were pruned at 10 and 20 cm level during April. After pruning, paclobutrazol and ethephon @ 500, 1000 ppm each were sprayed on the trees to get dwarfing effect. The planting density of 6x4m and 6x5m with the use of paclobutrazol at 500 ppm and 10 cm pruning can be exploited for higher yield and better quality fruits. The planting distance of 6x2m is not economical and can be pertinently rejected.

Weed Management: Glycel at 4 l/ha (second fortnight of March and September) found most effective to reduce weed population followed by Hexuron at 4 kg/ha (first fortnight to March and second fortnight of September) from 30 days to 150 days of weed count during both rainy and winter season crops. Glycel at 3 and 4 l/ha was found the best to reduce the uptake of nutrients (NPK) during both rainy and winter season. Higher fruit yield and better quality fruits were obtained where Glycel @ 4 l/ha was sprayed.

Grading of Guava Fruits: Highest distribution of fruits was recorded in grade B (60% in Sardar and 58% in Allahabad Safeda). The fruits belonging to A and B grades which accounted for 72% in Sardar and 68% in Allahabad Safeda has better fruit quality and are more acceptable from marketing point of view. The total soluble solids in Sardar were the highest in grade A (11.00%). Medium sized fruits contained more vitamin C as compared to large and small sized fruits. The acidity was found lower in large sized fruits. From the marketing point of view, medium and large sized fruits (68-72%) were the best.

Storage of Guava Fruits: The shelf life of guava fruits cv. Sardar can be enhanced up to 14 days in commercial cold storage (temp 0-3.3°C and RH 85-90%). Calcium nitrate 0.5%, 1.0%, calcium nitrate 0.5% and benlate 500 ppm and GA₃ 75 ppm proved effective in terms of maintaining fruit firmness, palatability rating and total sugars. Vitamin C was retained better with benlate 500 ppm. The reduction in physiological loss in weight and spoilage during storage period was noted less with benlate 500 and 1000 ppm and calcium nitrate 0.5 and 1.0% treatments.

Pest Infestation: The damage from fruit fly increased as the diameter and maturity of the fruit increased. Size and maturity did not affect castor capsule borer incidence. The fruit fly incidence on white fleshed guava cultivars damage fruits from 37 to 54 per cent. The coloured genotypes of guava had the lowest castor capsule borer damage.

3. KINNOW

Rootstocks and Fruit Maturity Studies: The growth of fruits in terms of length, diameter and weight increased rapidly up to 30 January on Jatti Khatti and Kharna Khatta rootstocks and 20 January on Troyer and Carrizo rootstocks. Thereafter, a slight decrease in fruit growth was observed. The highest palatability rating score was given to the fruits with Brix-acid ratio 12:1 to 13:1. The best harvesting time of Kinnow on Jatti Khatti and Kharna Khatta fall between 20th January to 9th February and on Troyer and Carrizo on 20th January to 30th January.

Tree Location and Fruit Quality: Kinnow fruits exposed in the sun had more total soluble solids, vitamin C and better colour development resulting in their early ripening of fruits. The fruit located inside the tree contains less total soluble solids and acidity.

Grading of Kinnow Fruits: The fruits should be graded into four categories viz. big, medium, small and very small for getting higher return, Out of total 1844 harvested fruits from the tree, maximum number (44.75 %) belonged to grade B. Peel thickness and vitamin C content were found to increase with fruit size. Higher solid/acid ratio, juice content and TSS were obtained in medium sized fruits belonging to grade B.

Weed Management: Hexuron 80 WP (diuron) at 4 kg/hect during first fortnight of March or Glycel 41 SL (glyphosate) at 4 l/hect during second fortnight of March followed by Glycel 41 SL (glyphosate) or Gramoxone 24 WSC (paraquat) at 3 l/hect during second fortnight of July in 500 litres of water can effectively control the weeds in kinnow orchards throughout the year. The quantity of chemical in no case should be exceeded especially in lighter or sandy soils.

4. LOQUAT

Evaluation of Varieties: Six varieties were screened and evaluated for fruit size, yield and quality characters. The fruit size was recorded maximum in Tanaka. The fruit weight was observed highest in Pathankot and Tanaka varieties. The fruit yield was recorded higher in Tanaka (43 kg/tree). Total soluble solids were recorded highest in Improved Golden Yellow and Golden Yellow. On the basis of fruit size, yield and quality, Tanaka and Loquat Selection were considered better varieties.

5. MANGO

Weed Control in Mango Nursery: Simazine and atrazine at 5 kg/hect during first fortnight of October was found effective in checking dicot weeds. Glyphosate @ 4 and 5 l/hect during second fortnight of October was most effective in checking broad spectrum of weeds. Diuron @ 4 kg/hect during first fortnight of October was also found effective in checking monocot and dicot weeds. No toxic effect was observed with any herbicide on the mango seedlings.

6. PAPAYA

Induced Ripening: Papaya fruits cvs.Co1 and Co2 having greenish and greenish yellow colour were picked on 6 December and treated with 400,500 and 600 ppm ethephon to induce ripening. The fruits were ripened and attained golden yellow colour after 4 days of treatment with 500 ppm ethephon. The highest palatability rating, total soluble solids and sugars were obtained with 500 ppm ethephon treatment. The vitamin C content increased with the increase in ethephon concentrations

7. PEAR

Quantitative Variation in Fruit Metabolites: Total soluble solids were higher in the calyx end of the fruits in Patharnakh and LeConte pear cultivars. TSS was estimated more in the upper part of the receptacle. Acidity was noted maximum in the lower receptacle and increased progressively towards upper receptacles. Total phenolics were significantly higher in the stem end and least in the lower receptacle regions of the fruit

Weed Management in Orchard: Weeds can be effectively controlled by spraying Hexuron 80 WP (diuron) at 4 kg/hect as pre-emergence herbicide during first fortnight of March after thorough cultivation so as to remove the established growing weeds/plant debris. Glycel 41 SL (glyphosate) at 3 l/hect or Gramoxone 24 WSC (paraquat) at 3 l/hect should be sprayed as post-emergence herbicides when the weeds are growing actively and to a height of 15-20 cm. The herbicides should be dissolved in 500 litres of water per hectare so as to give thorough coverage to the weeds/field. In case there is emergence of weeds during/after rainy season, another spray of Glycel/ Gramoxone at the same rate may be done.

Weed Control in Nursery: Hexuron at 2.5l/hect or glycel at 2.5 l/hect in first week of March followed by glycel at 2.0 l/hect in the last week of March and glycel at 1.5 l/ha[ect in first week of October proved effective in checking weeds in pear nursery. The treatment also improved the vigour of grafted plant.

8. PLUM

Pollination and Fertilization: Kala Amritsar cultivar is self fruitful but its yield improved upto 23 % when pollinated with Titron. In Kataru Chak yield improved upto 13 % if pollinated with Kala Amritsar. Pollen variability and germinability ranged from 30-90% and 30-70% respectively in different cultivars. The stigma become receptive one day before anthesis and remained so till 3 days after.

Growth and Development of Fruits: The fruit reaches ripe stage in 12 weeks after fruit-set. The rate of growth of the fruit can be divided into three distinct phases: rapid phase followed by slow growth and swelling stage. Plum fruits develop the best dessert quality on the tree. When it is to be consumed locally, it should be allowed to ripen on the trees. When required to be sent to distant markets, the fruits have to be picked a few days in advance of proper maturity.

Plum Storage: The fruits of Kala-Amritsari plum could be stored upto 40 days in the commercial cold storage after treating with 3-6% wax-emulsion and storing in perforated polythene bags of 100 gauge thickness. The fruits of Kala-Amritsari stored fairly for 55 days and of Satluj Purple for 30 days in cold storage when treated with 10 ppm GA and 500-1000 ppm CCC.

9. PEACH

Growth and Development of Fruits: Peach cv. Flordasun took eleven weeks to reach the stage of harvest maturity from the time of setting. The fruit growth showed three rapid growth phases: (i) up to 28 days (ii)

between 35 and 56 days and (iii) 63 days and onward and two slow growth phases i.e. (i) between 28 and 35 days and (ii) between 56 and 63 days.. The fruit colour changed to pinkish with red tinge at harvest stage. The stone development proceeded at a fast pace up to 44 days and increase was almost negligible till fully ripe stage. TSS in the pulp was found to increase with a corresponding decrease in acidity. No specific trend in ascorbic acid content observed during fruit development. The general increase in the percentage of both total and reducing sugars has been found to be similar.

10. GRAPE

Weed Management in Vineyard

Pre-emergence application of Hexuron 80 WP (diuron) at 3 kg/hect (first fortnight of March) after thorough cultivation or Glycel 41 SL (glyphosate) or Gramoxone 24 WSC (paraquat) at 4 l/hect in 500 litres of water as post-emergence when the weeds attain the height of 15-20 cm can check the weeds in vineyard.

vii) Recommendations in Package of Practices of Punjab Agricultural

University, Ludhiana: 17

Ber (Jujube)

1. Early Ripening Variety of Ber 'Wallaiti'

Fruits of Wallaiti are medium to large, oval in shape, skin smooth and light golden yellow to golden yellow at maturity. Pulp soft, sweet with 13.8 to 15.00 per cent TSS. It is an early variety and ripens during first fortnight of March. The average yield is 114 kg fruit per tree. Moderately susceptible to powdery mildew disease.

2. High Yielding Rootstock for Ber

The ber should be budded on *Ziziphus mauritiana* (Elongated Dehradun) for higher fruit yield.

3. Semi-vigorous Rootstock for Ber

Ber plants raised on semi-vigorous rootstock *Ziziphus mauritiana* (Coimbatore) can profitably be planted at a closer spacing of 6x6 m.

4. Uniform and Early Ripening in Ber

Ethephon 400 ppm at turning stage (1st week of March) advance ripening by two weeks in 'Umran' ber and produce uniform, better quality and deep golden yellow with chocolate tinge coloured fruits.

5. Pruning of Ber Trees

Pruning of Sanaur-2 should be done during the third week of April when the trees are dormant. Pruning by heading back at 8 buds length of previous year's growth gives higher yield of better quality fruits. Severe pruning after 4-5 years is recommended.

6. Rejuvenation of Old Ber Trees

Ber trees need to be rejuvenated after the age of about 25 years. This can be done by heading back the main limbs to about 30cm during second fortnight of May. The trees start giving commercial crop with higher yield of excellent fruit quality during the third fruiting season.

7. Weed Control in Ber

Pre-emergence application of Hexuron 80 WP (diuron) at 1.2 kg/acre can be made during the first fortnight of August when field is free from growing weeds and stubbles. Glycel 41 SL (glyphosate) at 1.2 l/acre or Gramoxone 24 WSC (paraquat) at 1.2 l/acre as post-emergence should be sprayed when the weeds are growing actively preferably before weeds flower and attain a height of 15-20 cm. Dissolve the herbicides in 200 litres of water per acre to give complete coverage of weeds/field. Spray Glycel or Gramoxone during the calm day to avoid spray drift to the foliage of the fruit trees.

8. Grading and Packaging of Ber Fruits

The grading should be done before the fruit is marketed. Sorting should be done to remove culled, undersized, under-ripe, over-ripe, misshapened, cankered and bird-damaged fruits. The fruits should be graded into four grades namely, A-grade – Large sized; B grade – medium sized; C grade – small-sized and D grade – under-ripe, over ripe, deformed, misshapened and cankered fruits. Highest distribution of fruits is found in grade B (33%), closely followed by grade A (27%). The extent of C and D grade fruits is 21% and 19%, respectively. The fruits of Umran belonging to A and B grades which accounted for 60 per cent of the total crop have deep golden yellow colour are more acceptable to the consumers and considered the

best for marketing. The fruits should be packed properly in Corrugated Fiber Board cartons, wooden crates, polynets, wooden baskets and gunny bags of convenient sizes on the basis of grades.

9. Control of Fruit Drop in Ber

Spray application of 30 ppm NAA once in the second fortnight of October and again in the second fortnight of November effectively check physiological fruit drop in Umran cultivar.

Guava

10. Punjab Pink Guava Hybrid

It is a hybrid between Portugal x L-49 → F1 x Apple Colour. The trees of this variety are vigorous with dropping branches. The fruit is medium to large in size with attractive red coloured skin in some fruits in summer and golden yellow in winter. The flesh is red having pleasant flavour. TSS ranged from 10.50 to 12.00 per cent. It is a prolific bearer and annual yield is 150 kg per tree.

11. Arka Amulya - A Variety of Guava.

The trees of Arka Amulya are somewhat dwarf with compact globose, round crown, drooping branches with dense foliage. The fruit is large in size, round, glossy with white flesh. The average yield of rainy and winter season crop is 144 kg per tree. Total soluble solids in fruits ranged from 9.3 to 10.1

12. Portugal – a Wilt Resistant Rootstock for Guava

Portugal rootstock of guava is most suitable for Sardar and Allahabad Safeda varieties and it improves fruit yield and weight. It also imparts vigour and wilt resistance to these scion varieties.

13. Closer Spacing in Guava

Guava plants cv. Sardar can profitably be planted at a closer spacing of 6 m x 5 m instead of 6.5 m x 6.5 m. With close spacing 132 plants can be accommodated in one acre.

14. Weed Control in Guava

Pre-emergence application of Hexuron 80 WP (diuron) at 1.6 kg/acre can be made during first fortnight of March for rainy season crop and during first fortnight of September for winter season crop when field is free from weeds and stubbles. Glycel 41SL (glyphosate) @ 1.6 l/acre as post-emergence should be sprayed when the weeds are growing actively, preferably before weeds flower or attain a height of 15-20 cm i.e. during second fortnight of March for rainy season crop and during second fortnight of September for winter season crop. Dissolve the herbicides in 200 litres of water to give complete coverage on weeds in one acre. Spray Glycel during the calm day to avoid spray drift to the foliage of the trees.

Kinnow

15. Weed Control in Kinnow

Spray Hexuron 80 WP (diuron) at 1.6 kg/acre during first fortnight of March or Glycel 41 SL (glyphosate) at 1.6 l/acre as post-emergence (second fortnight of March) followed by Glycel 41 SL (glyphosate) or Gramoxone 24 WSC (paraquat) at 1.2 l/acre (second fortnight of July) in 200 litres of water. The quantity of chemical in no case should be exceeded especially in lighter or sandy soils. Spray during calm days to avoid drift of weedicide.

Pear

16. Weed Control in Pear

Weeds can be effectively controlled by spraying the herbicides namely Hexuron or Glycel or Gramoxone. Spray Hexuron 80 WP (Diuron) at 1.6 kg/acre as pre-emergence (first fortnight of March) after through cultivation so as to remove the established growing weeds/plants debris. Glycel 41 SL (glyphosate) at 1.2 l/acre or Gramoxone 24 WSC (paraquat) at 1.2 l/acre should be sprayed as post-emergence when the weeds are growing actively and to a height of 15 to 20 cm. Dissolve the herbicides in 200 litres of water per acre so as to give through coverage to the weeds/field. In case there is emergence of weeds during/after rainy season, another spray of Glycel/Gramoxone at the same rate may be done. Spray Glycel/Gramoxone during calm day so as to avoid spray drift to the foliage of the fruit tree.

Grape

17. Weed Control in Vineyard

Pre-emergence application of Hexuron 80 WP (diuron) at 1.2 kg/acre (first fortnight of March) after through cultivation to remove the established weeds or Glycel 41 SL (glyphosate) or Gramoxone 24 WSC (paraquat)

at 1.6 l/acre in 200 litres of water as post-emergence when the weeds attain the height of 15-20 cm can check the weeds in vineyard.

viii) Research Projects Handled

- Development of improved cultivars in ber
- Crop regulation in ber
- Rootstock trial in ber
- Development of improved cultivars in guava
- Rootstock trial in guava
- High density planting studies in guava
- Development of improved cultivars in loquat.
- Plant Health Clinic adhoc project funded by National Horticulture Mission.

ix) Special Research Assignment

- Evaluated a draft report on the genetic resources of ber by International Board for Plant Genetic Resources, FAO, Rome during 1983.
- FAO, Rome advised Royal Botanic Garden, KEW (UK) to seek technical guidance on ber germplasm from me.
- Evaluated Research Project “Improvement in Fruit set and Quality of Some Commercially Important Fruit Crops of Kashmir Valley through Application of Calcium and Boron” of J & K State Council for Science and Technology, Jammu in October 2010.

x) Academic Affairs Committee (Research)

- Member, Academic Affairs Committee (Research) in the Department from 1997 to 2000.

xi) Nodal Officer and Director FRS

- Nodal Officer, Fruit Research Station Bahadurgarh (Patiala) from September 2006 to January 2009 to plan and undertake various approved programmes with a view to enhance the output.
- Director, Fruit Research Station Bahadurgarh, Patiala officiated from 8 January to 27 July 2009.
- Director, Fruit Research Station Gangian, Dasuya officiated from 8 January to 27 July 2009.

x) Establishment of Fruit Orchard

- Established 2 acres fruit orchard of pear, peach and plum in December 2020 and 4 acres of kinnow, guava, mango, ber in September 2021 and at Sri Guru Granth Sahib World University, Fatehgarh Sahib.

xi) Meteorological Observatory

- Established Agrometeorology Observatory in the farm land of SGGGS World University in a flat rectangular plot measuring 140 feet in east-west direction and 130 feet in north-south direction. The site is properly wire fenced to a height of about 1.5 meter with gate having locking facility to protect theft of the instruments and entry of the animals. The instruments installed in the meteorological observatory are Pan Evaporimeter, Single Stevenson’s Screen (Eastern side), Sunshine Recorder, Microclimate Observation Post Soil Thermometer, Dew Gauge Post, Self-Recording Rain Gauge, Ordinary Rain Gauge, Single Stevenson’s Screen (Western side), Wind Vane, Cup Anemometer. The data on various meteorological parameters are being recorded morning and evening time that will be used in various research experiments.

xii) Beautification Scheme

- Member Beautification Scheme of Sri Guru Granth Sahib World University, Fatehgarh Sahib from November 2020 for planning and planting flowering and ornamental plants in the campus.

13. Teaching Contributions

i) Courses Taught : 549 Credit hours

A. Undergraduate Courses : 367 Credit hours

Year	Trim/Sem.	Course No.	Title of the Course	Credit hours
1977-78	III Trim	Hort 311	Home Gardening	2+1
1978-79	I Trim	Hort 201	Fruit Growing	3+1
	II Trim	Hort 402	Fundamentals of Fruit Production	3+1
1979-80	III Trim	Hort 405	Commercial Fruits of the Punjab	4+1
		Hort 201	Fruit Growing	3+1
		GTC	Garden Training Class	3 days/ week
1980-81	I Trim	PFT	Practical Field Training	0+2
		Adv Group	Advisory Group	0+1
		GTC	Garden Training Class	3 days/ week
	II Trim	Hort 201	Fruit Growing	3+1
		PFT	Practical Field Training	0+2
		Adv Group	Advisory Group	0+1
		GTC	Garden Training Class	3 days/ week
	III Trim	PFT	Practical Field Training	0+2
		Adv Group	Advisory Group	0+1
		GTC	Garden Training Class	3 days/ week
	Summer	Edu. Tour-II	Education Tour-II	NC
		Hort 201	Fruit Growing	3+1
1981-82	1 Trim	Hort 201	Fruit Growing	3+1
		PFT	Practical Field Training	0+2
		Adv Group	Advisory Group	0+1
	II Trim	Hort 201	Fruit Growing	3+1
		PFT	Practical Field Training	0+2
		Adv Group	Advisory Group	0+1
	III Trim	PFT	Practical Field Training	0+2
		Adv Group	Advisory Group	0+1
1982-83	I Trim	Hort 201	Fruit Growing	3+1
		Edu. Tour (Elec.)	Educational Tour (Elective)	0+2
		Adv Group	Advisory Group	0+1
	II Trim	PFT (Elec)	Practical Field Training (Elective)	0+2
		Adv. Group	Advisory Group	0+1
	III Trim	PFT	Practical Field Training	0+2
		PFT (Elec)	Practical Field Training (Elective)	0+2
		Adv Group	Advisory Group	0+1
1983-84	I Trim	Hort 201	Fruit Growing	3+1
		PFT (Elec)	Practical Field Training (Elective)	0+2
		Adv. Group	Advisory Group	0+1
	II Trim	PFT(Elect.)	Practical Field Training (Elective)	0+2
		Adv. Group	Advisory Group	0+1
	III Trim	PFT(Elect.)	Practical Field Training (Elective)	0+2
		Adv. Group	Advisory Group	0+1
1984-85	I Trim	Hort 201	Fruit Growing	3+1
		Adv. Group	Advisory Group	0+1
	II Trim	Hort 201	Fruit Growing	3+1
		Adv. Group	Advisory Group	0+1
	III Trim	Hort 303	Home Gardening	2+1
		PFT	Practical Field Training	0+2

		Adv. Group	Advisory Group	0+1
1985-86	I Trim	Hort 201	Fruit Growing	3+1
		Adv. Group	Advisory Group	0+1
	II Trim	Hort 201	Fruit Growing	3+1
		PFT	Practical Field Training	0+2
		Adv. Group	Advisory Group	0+1
	III Trim	Hort 303	Home Gardening	2+1
		PFT	Practical Field Training	0+2
		Adv. Group	Advisory Group	0+1
1986-87	I Trim	Hort 201	Fruit Growing	3+1
	II Trim	Hort 201	Fruit Growing	3+1
		PFT	Practical Field Training	0+2
	III Trim	Hort 423	Commercial Fruits of Punjab	4+1
1987-88	I Trim	Hort 303	Home Gardening	2+1
	III Trim	Hort 201	Fruit Growing	3+1
1988-89	I Trim	Hort 423	Commercial Fruits of Punjab	4+1
		Hort 303	Home Gardening	2+1
	II Trim	Hort 421	Propagation and Nursery Management	3+1
		Hort 201	Fruit Growing	3+1
	III Trim	Hort 422	Fundamentals of Fruit Production	3+1
		PFT	Practical Field Training	0+2
1989-90	I Trim	Hort 201	Fruit Growing	3+1
	I Sem.	Hort 421	Fundamentals of Fruit Production	2+1
1990-91	II Trim	Hort 201	Fruit Growing	3+1
	III Trim	Hort 201	Fruit Growing	3+1
		Edu. Tour-IV	Educational Tour (Elective)	0+2
1991-92	I Sem	Hort 201	Fruit Growing	3+1
	II Trim	Hort 421	Propagation and Nursery Management	3+1
	III Trim	Hort 422	Fundamentals of Fruit Production	3+1
		PFT	Practical Field Training	0+2
1992-93	I Sem.	Hort 422	Propagation and Nursery Management	2+1
		Hort 425	Practical Training in Horticulture-II	0+1
	II Sem	Hort 201	Fruit Growing	3+1
		Hort 424	Practical Training in Horticulture-I	0+1
		NSS	National Service Scheme	0+1
	III Trim	Hort 421	Propagation and Nursery Management	3+1
1993-94	I Sem.	Hort 202	Home Gardening	1+1
		Hort 422	Propagation and Nursery Management	2+1
		NSS	National Service Scheme	0+1
	I Trim	Hort 422	Propagation and Nursery Management	3+1
	II Sem.	Hort 201	Fruit Growing	3+1
		Hort 422	Propagation and Nursery Management	2+1
		Hort 424	Practical Training in Horticulture-I	0+1
		Adv. Group	Advisory Group	0+1
		NSS	National Service Scheme	0+1
1994-95	I Sem.	Hort 422	Propagation and Nursery Management	2+1
		Hort 425	Practical Training in Horticulture-II	0+1
		Adv. Group	Advisory Group	0+1
		NSS	National Service Scheme	0+1

		Edu. Tour-II	Educational Tour-II	NC
	II Sem.	Hort 202	Home Gardening	1+1
		Hort 421	Fundamentals of Fruit Production	2+1
		Hort 423	Commercial Fruits of Punjab	2+1
		Adv. Group	Advisory Group	0+1
		NSS	National Service Scheme	0+1
1995-96	I Sem.	Adv. Group	Advisory Group	0+1
		NSS	National Service Scheme	0+1
	II sem	Hort 201	Fruit Growing	3+1
		Hort 423	Commercial Fruits of Punjab	2+1
		Adv. Group	Advisory Group	0+1
		NSS	National Service Scheme	0+1
1996-97	I Sem	Hort 424	Practical Training in Horticulture-I	0+1
		Adv. Group	Advisory Group	0+1
	II Sem.	Hort 201	Fruit Growing	3+1
		Hort 425	Practical Training in Horticulture-II	0+1
		Adv. Group	Advisory Group	0+1
1997-98	I Sem	Hort 424	Practical Training in Horticulture-I	0+1
		Adv. Group	Advisory Group	0+1
	II Sem	Hort 201	Fruit Growing	3+1
		Hort 425	Practical Training in Horticulture-II	0+1
		Adv. Group	Advisory Group	0+1
		Edu. Tour IV	Educational Tour (Elective)	0+2
1998-99	I Sem	Adv. Group	Advisory Group	0+1
	II Sem	Hort 201	Fruit Production	3+1
		Hort 422	Propagation and Nursery Management	2+1
		Hort 425	Practical Training in Horticulture-II	0+1
		Adv. Group	Advisory Group	0+1
1999-2000	ISem	Hort 424	Practical Training in Horticulture-I	0+1
		Adv. Group	Advisory Group	0+1
	II Sem	Hort 422	Propagation and Nursery Management	2+1
		Hort 423	Commercial Fruits of Punjab	2+1
		Hort 425	Practical Training in Horticulture-II	0+1
		Adv. Group	Advisory Group	0+1
2000-01	I Sem	Hort 201	Fruit Production	3+1
		Hort 423	Commercial Fruits of Punjab	2+1
		Hort 424	Practical Training in Horticulture-I	0+1
		Adv. Group	Advisory Group	0+1
	II Sem	Hort 422	Propagation and Nursery Management	2+1
		Hort 423	Commercial Fruits of Punjab	2+1
		Adv. Group	Advisory Group	0+1
2001-02	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
	II Sem	Hort 201	Fruit Production	3+1
2002-03	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
	II Sem	Hort 423	Commercial Fruits of Punjab	2+1
2003-04	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
	II Sem	Hort 423	Commercial Fruits of Punjab	2+1
2004-05	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
		Edu. Tour-IV	Educational Tour (Elective)	0+2

	II Sem	Hort 423	Commercial Fruits of Punjab	2+1
2005-06	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
		Adv. Group	Advisory Group	0+1
	II Sem	Adv. Group	Advisory Group	0+1
2006-07	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
		Adv. Group	Advisory Group	0+1
	II Sem	Adv. Group	Advisory Group	0+1
2007-08	I Sem	Hort 421	Fundamentals of Fruit Production	2+1
		Adv. Group	Advisory Group	0+1
	II Sem	Adv. Group	Advisory Group	0+1
2008-09	I Sem	Adv. Group	Advisory Group	0+1
	II Sem	Adv. Group	Advisory Group	0+1
2011-12	II Sem	BTY 121 T	Fundamentals of Horticulture	9+0 (3 Groups)
		BTY 121 P	Fundamentals of Horticulture	0+3(3 Groups)
2012-13	I Sem	Agr 100	Crop and Seed Identification Lab	0+5(5 Groups)

B. Post-graduate Courses Taught : 182 Credit hours

<i>Year</i>	<i>Trim/Sem.</i>	<i>Course No.</i>	<i>Title of the Course</i>	<i>Credit hours</i>
1980-81	I Trim	Hort 507	Temperate Fruit	2+1
	II Trim	Hort 506	Sub-Tropical Fruits	3+1
	III Trim	Hort 502	Orchard Soil Management	2+1
1981-82	I Trim	Hort 507	Temperate Fruits	2+1
	II Trim	Hort 506	Sub-Tropical Fruits	3+1
	III Trim	Hort 502	Orchard Soil Management	2+1
1982-83	II Trim	Hort 505	Citriculture	2+1
		Hort 508	Tropical Fruits	2+1
	III Trim	Hort 503	Orchard Soil Management	2+1
		Hort 509	Temperate Fruits	2+1
1983-84	I Trim	Hort 507	Temperate Fruits	2+1
	II Trim	Hort 505	Citriculture	2+1
1990-91	I Sem.	Hort 526	Tropical and Sub-Tropical Fruits	3+1
1991-92	I Sem.	Hort 526	Tropical and Sub-Tropical Fruits	3+1
	II Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
1992-93	I Sem.	Hort 591	Seminar	0+1
	II Sem	Hort 591	Seminar	0+1
1993-94	II Sem.	Hort 591	Seminar	0+1
1994-95	I Sem.	Hort 591	Seminar	0+1
	II Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
1995-96	I Sem.	Hort 526	Tropical and Sub-Tropical Fruits	3+1
1996-97	I Sem.	Hort 591	Seminar	0+1
	II Sem.	Hort 591	Seminar	0+1
1997-98	I Sem.	Hort 526	Tropical and Sub-Tropical Fruits	3+1
	II Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
1998-99	I Sem.	Hort 526	Tropical and Sub-Tropical Fruits	3+1
	II Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
1999-2K	I Sem.	Hort 529	Post-harvest Physiology of Fruits	2+1
	II Sem.	Hort 529	Post-harvest Physiology of Fruits	2+1
2000-01	I Sem.	Hort 523	Soil & Water Management for Orchards	2+1

	II Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
2001-02	I Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
	II Sem.	Hort 529	Post-harvest Physiology of Fruits	2+1
2002-03	I Sem.	Hort 530	Plant Regulators in Fruit Crops	2+1
	II Sem.	Hort 529	Post-harvest Physiology of Fruits	2+1
2003-04	II Sem.	Hort 529	Post-harvest Physiology of Fruits	2+1
2004-05	I Sem.	Hort 523	Tropical and Sub-Tropical Fruits	3+1
	II Sem.	Hort 591	Seminar	0+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2005-06	I Sem.	Hort 604	Ecology of Fruit Plants	2+0
	II Sem.	Hort 524	Temperate Fruits	2+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2006-07	I Sem.	Hort 591	Seminar	0+1
	II Sem.	Hort 524	Temperate Fruits	2+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2007-08	I Sem.	Hort 591	Seminar	0+1
		Hort 604	Ecology of Fruit Plants	2+0
	II Sem.	Hort 524	Temperate Fruits	2+1
		Hort 591	Seminar	0+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2008-09	I Sem	Hort. 523	Tropical and Sub-Tropical Fruits	3+1
		Hort 591	Seminar	0+1
	II Sem.	Hort 524	Temperate Fruits	2+1
		Hort 591	Seminar	0+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2009-10	I Sem	Hort 523	Tropical and Sub-Tropical Fruits	3+1
		Hort 591	Seminar	0+1
	II Sem.	Hort 524	Temperate Fruits	2+1
		Hort 591	Seminar	0+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2010-11	Ist Sem	Hort 501	Tropical and Dry Land Fruit Production	2+1
		Hort 523	Tropical and Sub-Tropical Fruits	3+1
		Hort 529	Plant Regulators in Fruit Crops	2+1
		Hort 591	Seminar	0+1
	II Sem	Hort 502	Sub-Tropical and Temperate Fruit Production	2+1
		Hort 524	Temperate Fruits	2+1
		Hort 591	Seminar	0+1
		Hort 602	Advances in Fruit Plant Propagation	2+0
2011-12	I Sem	Hort 501	Tropical & Dry Land Fruit Production	2+1
		Hort 591	Seminar	0+1
2012-13	I Sem	Agr 426	Propagation and Nursery Management of Horticultural Crops	2+0
		Agr 427	Commercial Fruit Production	2+0
		Agr 428		0+1
2020-21	I Sem	MAF 101	Tropical and Dry Land Fruit Production	2+1
		MAF 103	Systematic Pomology	2+0
	II Sem	MAF 202	Breeding of Fruit Crops	2+1
			Master Seminar	0+1

2021-22	I Sem	MAF 302	Growth and Development of Horticultural Crops	2+1
		Hort 601	Advances in Fruit Science	4+0
		Hort 602	Seminar	0+2
	II Sem	Hort 505	Breeding of Fruit Crops	2+1

Plant Regulators in Fruit Crops : Taught 24 credit hours in 8 years

- ii) Text Books Written : 11**
- **Plant Growth Regulators in Fruit Science : 2020 : J. S. Bal**
 - Fruit Science Culture & Technology : 2018 : J. S. Bal
(Vol.1 Basic Aspects & Practices)
 - Fruit Science Culture & Technology : 2018 : J. S. Bal
(Vol.2 Tropical Fruits)
 - Fruit Science Culture & Technology : 2018 : J. S. Bal
(Vol.3 Sub-Tropical Fruits)
 - Fruit Science Culture & Technology : 2018 : J. S. Bal
(Vol.4 Temperate Fruits)
 - Raising Fruit Nursery(New version) : 2016 : J. S. Bal, S.S. Gill, A.S. Sandhu
 - Mulching in Ber Orchards : 2012 : J.S. Bal, Surjit Singh
 - Postharvest Handling of Fruits & Vegetables : 2002 : A.S. Sandhu, J.S. Bal
 - Fruit Growing : 2014 : J.S Bal (3rd Edition)
: 2006 : J.S Bal (2nd Edition)
: 1997 : J.S Bal (1st Edition)
 - Ber Varieties : 1992 : J.S. Bal, D.K. Uppal
 - Raising Fruit Nursery : 1985 : S.S. Gill, J.S. Bal, A.S. Sandhu
- iii) Teaching Manuals Written : 7**
- Laboratory Manual on Practices of Horticulture Techniques lab : 2012 : J.S. Bal
 - Practical Manual of Tropical and Sub-Tropical Fruits : 2009 : J.S. Bal, H.S. Dhaliwal, N.K. Arora
 - Practical Manual of Work Experience Specialized Skills in Horticulture : 2008 : J.S. Bal, H.S. Rattanpal. N.K. Arora, J. Singh
 - Practical Manual of Temperate Fruits : 2006 : J.S. Bal, Harminder Singh
 - Practical Manual of Propagation and Nursery Management : 2004 : J.S. Kanwar, J.S. Bal
 - Laboratory Manual of Fruit Production : 1998 : A.S. Sandhu, G.S. Dhaliwal, J.S. Bal
 - Citriculture Manual : 1984 : G.S. Bajwa, J.S. Bal
- iii) Book Chapters : 24**
- History and nomenclature of PGR : 2020 : J.S. Bal, N. Kaur
 - Preparation of PGR soln.& methods of appl. : 2020 : J.S. Bal, N. Chawla
 - PGR in propagation of fruit plants : 2020 : T.S. Chahal, J S. Bal
 - PGR in flowering of fruit crops : 2020 : J.S. Bal, R. S. Boora, D. Singh
 - PGR in flower and fruit thinning : 2020 : J.S. Bal, J.S. Dhaliwal, A. Mirza,
 - PGR in fruit drop and induced fruit abscission : 2020 : N. Kaur, J.S. Bal, R. Kaur
 - PGR in post-harvest life of fruits : 2020 : V.Y.Tokala, B.V.C.Mahajan, J.S.Bal
 - Fruit area & production status-in Fruit Science : 2018 : J.S. Bal
 - Physiology of fruit plants-in Fruit Science : 2018 : J.S. Bal, K.S. Gill
 - Propagation media, mixtures and containers. : 2018 : S.S. Gill, J.S. Bal

- Care of propagated plants-in Fruit Science : 2018 : J.S. Bal
- Fruit grading and packaging-in Fruit Science : 2018 : B.V.C. Mahajan, J.S. Bal
- Guava-in Fruit Science : 2018 : J.S. Bal
- Ber-in Fruit Science : 2018 : J.S. Bal
- Aonla-in Fruit Science : 2018 : Devi Singh, J.S. Bal
- Loquat-in Fruit Science : 2018 : H.K. Bons, J.S. Bal
- Date Palm –in Fruit Science : 2018 : A. Kumar, N. Kaur, J.S. Bal
- Plum-in Fruit Science : 2018 : J.S. Bal
- Rootstock –Scion interaction in fruit trees. : 2016 : J.S. Bal
- Ber - 40 Years of Research on Fruit Crops. : 2005 : J.S. Bal
- Guava – 40 Years of Research on Fruit Crops : 2005 : B.S. Chahal, J.S. Bal
- Maturity indices and harvesting of fruit crops : 2002 : W.S. Dhillon, J.S. Kamboj, J.S. Bal
- Grading and sorting of horticultural produce : 2002 : J.S. Randhawa, J.S. Bal, J.S. Kamboj
- Training and pruning in grapes : 1992 : K.L. Chadha, A.S. Bindra, J.S. Bal

v) Under-Graduate Advisement : 5 Groups

- Advisor of 4 UG students from August 1980 to June 1981.
- Advisor of 8 UG students from August 1981 to July 1986.
- Advisor of 8 UG students from April 1994 to July 1997.
- Advisor of 6 UG students from September 1997 to July 2001.
- Advisor of 9 UG students from July, 2005 to June 2009.
- Sub-Coordinator, Class In-charge Level, COA from Aug. 1986 to Dec. 1989
- Coordinator, Horticultural Advisory Groups from 1998 to 2001.

vi) Post-Graduate Advisement: 108

- **M.Sc/Ph.D Students Guided : 98**
Major Advisor : M.Sc : 16 Ph.D : 3
Co-Advisor : M.Sc : 65 Ph.D : 14
- **M.Sc Students Presently Guiding**
Major Advisor : M.Sc : 7 Ph.D : 3

vii) Course CD: 2

- Prepared CD of 2 UG Elective Courses
-Hort. 421 (Propagation and Nursery Management)
-Hort. 423 (Commercial Fruits of Punjab)

viii) Video Films: 2

- Developed Video Films on **Ber** and **Guava** cultivation for UG/PG students & fruit growers.

ix) PAU- Abstracts of Thesis

- Compiled “Research in PAU-Abstracts of Theses” (1970 – 1999).

x) Course Curriculum Developed

- Developed curriculum of Horticultural Trade at Plus 2 level invited by Punjab State University Text Book Board, Chandigarh, August 30-31, 1989
- Attended Agri. Project Meeting of Punjab School Education Board, Mohali, Oct. 11, 2005
- Modified PG Courses of Deptt. of Horticulture, PAU during 2004 and 2010.
- Developed course curriculum of B.Sc Agri.(Hort Elective) and M.Sc Hort. of LPU viz. Agr 101, Agr 121 Agr 122, Agr 426, Agr 427, Agr 428, Agr 429, Agr 521, Agr 523.
- Developed course curriculum of M.Sc. Agri. 6 subjects(Agronomy, Plant Breeding, Fruit Science, Vegetable Science, Entomology and Plant Pathology), 2 year diploma in Agriculture and one year certificate course in Horticulture at Sri Guru Granth Sahib World University at Fatehgarh Sahib in February 2021.

- Developed course curriculum of Ph.D. Agri. 3 subjects (Agronomy Fruit Science and Vegetable Science)at Sri Guru Granth Sahib World University at Fatehgarh Sahib in October 2021.

xi) UGC Project

- University Grant Commission (UGC) approved my project for Writing University Level Text Book “Fruit Growing” during August 1993. Book published in 1997 and recommended for UG/PG students in horticulture in State Agricultural Universities.

xii) Dean PG’s Nominee

- Remained Dean Post-graduate’s Nominee in Deptt. of Horticulture, PAU from August 1999 to July 2004, 2006-07 and 2007-08 to 2010-11.

xiii) Plant Health Clinic

- In-charge Plant Clinic, Deptt. of Horticulture from 2002-03 to January 2009. Installed 69 Blow Ups, 38 Wall Charts, 56 Coloured Transparencies, 25 Wooden Mounted Laminations, 20 Jar Specimens, 1 Horticultural Tool Box and 1 Exhibit Panel.
- Principal Investigator Plant Health Clinic “Adhoc Project from NHM” from August 2009 to October 2011. Purchased pH Meter, Conductivity Bridge, Seed Tester, BOD Incubator, Shaker, Centrifuge, Elisa Kits (200), Microscope Trinocular, Distillation Unit, Glasswares, Glass Jars, Computer, Printer, UPS, Officer furniture, Display Boards (12), Iron Racks (12), Godrej Almirah, Laminated Wooden Blow Ups (50) and Wall Charts (50).

xiv) UG/PG Laboratory

- In-charge UG Teaching Laboratory, from April 2002 to January 2009
- In-charge PG Laboratory from June 2004 to January 2009.

xv) Library-cum-Museum Committee

- Chairman, Library-cum-Museum Committee in Deptt. of Horticulture during 2007-08 to 2010-11.
- In-charge Department Library from April 1999 to January 2009.

xvi) Book Bank

- Member Book Bank Committee, COA, PAU during 2002.
- Chairman, Book Bank Committee, COA, 2005-06, 2006-07 and 2007-08.

xvii) Educational Tour: 13

- Conducted 8 Under-graduate and 5 Post-graduate educational tours for students.

xviii) Academic Affairs Committee (Teaching)

- Chairman Academic Affairs Committee (Teaching) in Deptt. from 7 June 2004 to 8 January 2009.
- Member of Academic Affairs Committee (Teaching) in Deptt. from 1985 to 2004.
- Convener, Academic Affairs Committee (Teaching) in Deptt. from 19 Feb 2001 to 30 July 2003.

xix) Administrative -cum-Budget Committee

- Chairman, Administrative-cum-Budget Committee, Department of Horticulture, PAU Ludhiana from 8 January to 27 July 2009.
- Member, Administrative-cum-Budget Committee, Department of Horticulture, PAU from January 2007 to January 2009.

xx) Board of Studies and Academic Council

- Member Board of Studies, College of Agriculture, PAU (1992-93).
- Member Board of Studies of Agricultural Science, Chandigarh University (2014-15 to 2015-16).
- Member Academic Council of Khalsa College, Amritsar (July 2015 to July 2017).
- Member Board of Studies, School of Agricultural Sciences & Technology, RIMT University Mandi Gobindgarh w.e.f. February 2021.
- Chairman, Board of Studies, Faculty of Agriculture, Sri Guru Granth Sahib World University, Fatehgarh Sahib w.e.f November 2020.

- Member Academic Council of Sri Guru Granth Sahib World University, Fatehgarh Sahib w.e.f November 2020.

xxi) Examinership

- Acted as theory and practical examiner of B.Sc./M.Sc. (Hort.) students and Thesis Examiner of M.Sc./Ph.D. (Hort.) students at GNDU Amritsar, Punjabi University Patiala, CCS HAU Hisar, UHF Solan, SKAUST Jammu, SKUAST Srinagar, OUAT Bhubeneshwar, CCSU Meerut, RAU Bikaner, CSKHPKU Palampur, VBS Purvanchal University Jaunpur, Sri Guru Granth Sahib World University Fatehgarh Sahib and RIMT University Mandi Gobindgarh.
- Evaluated and conducted viva-voce of 32M.Sc and 26Ph.D students of different Universities as External Expert.

xxii) Career Advancement Scheme

- Assessed Assoc. Prof. for Professor and Asstt. Prof. for Assoc. Prof. level in Horticulture under CAS at CCS HAU, Hisar during 2002, 2005, 2006, 2007, 2008 and 2009.
- Assessed bio-data of Assoc. Prof. for Professor level in Horticulture under CAS of UHF, Solan during 2007 and 2008.

xxiii) Expert Selection Committee of Teachers

- Acted as Expert member in selection committee for the post of Asstt. Prof. of Horticulture & equivalent at UHF Solan in August 2009.
- Acted as Expert in Himachal Pradesh Public Service Commission, Shimla for the selection of Horticulture Development Officers from 18-21 August 2009.
- Acted as Expert members in the selection committee for the post of Asstt. Prof. of Horticulture & equivalent at CCS HAU Hisar in August 2010.
- Acted as Expert to select scientists in DRDO, RAC Delhi on 18 May and 31 May 2013.
- Acted as expert in selection of two Asstt. Prof. in Horticulture and Agriculture at Sri Guru Granth Sahib World University, Fatehgarh Sahib on 16 September 2018.
- Acted as expert in selection of 5 Asstt. Prof. in Agriculture at RIMT University, Mandi Gobindgarh on 14 October 2020.
- Acted as expert in selection of 4 Asstt. Prof. in Agriculture at RIMT University, Mandi Gobindgarh on 11 August 2021.
- Selected 21Asstt. Prof., 9 Assoc. Prof., 24 Professors in various Universities and 25 Horticulture Development Officers in other States as an expert member.

xxiv) Conduct of BOS and RDC meeting

- Chaired, Board of Studies Meeting of Faculty of Agriculture at SGGS World University on 15th June 2021 and passed M.Sc. Agri. 6 subjects, 2 year Diploma in Agriculture and one year Certificate Course in Horticulture.
- Chaired, Board of Studies Meeting of Faculty of Agriculture at SGGS World University on 16th September 2021 and passed B.Sc. Agri. courses as per 5th Dean's Committee of ICAR recommendations.
- Chaired, Research Degree Committee Meeting of Faculty of Agriculture at SGGS World University on 25th October 2021 and passed Ph.D. Agri. 3 subjects.
- Chaired, Faculty Improvement Committee Meeting of Faculty of Agriculture at SGGS World University on 26th November 2021 and discussed various teaching facilities needed in the Faculty of Agriculture.

xxv) Book Release Ceremony

- My edited book "Plant Growth Regulators in Fruit Science" was released by Dr. S.S. Johl Chancellor Central University, Punjab at Sri Guru Gobind Singh Study Circle, Model Town Ludhiana on 10th October 2020

- My edited book” Plant Growth Regulators in Fruit Science” was released by Dr. Prit Pal Singh Vice-Chancellor Sri Guru Granth Sahib World University, Fatehgarh Sahib in Senate Hall of the University on 21st December 2020.

14. Extension Contributions

i) Publications	:	145
Technical Articles	:	132
Bulletins/Newsletter	:	13
ii) TV/Radio Talks	:	18 (TV: 16, Radio: 2)

iii) Fruit Growers Quarries

- Answered 1025 letters of fruit growers on various horticultural aspects on behalf of Department of Horticulture, Punjab Agricultural University, Ludhiana.
- Attended 1670 phone quarries of growers/farmers on fruit growing and related problems during service and after that till to date.

iv) Lecture Delivered in Refresher Training Courses : 94
to HDO,S , IAS, MBBS Students and Farmers

v) Field Outreach Activities	:	71
vi) Exhibition of Horticultural Activities	:	88

vii) Editing

- Edited The Horticultural Bulletin monthly in English and Punjabi from September 1980 to May 1986 published by the FRUITFED, Chandigarh.
- Edited Horticulture Newsletter PAU, Ludhiana from January 2008 to October 2011.

viii) Horticultural Operations

- Compiled horticultural operations for *Progressive Farming* and *Changi Kheti* for several years.

ix) Advisory Agriculture

- Contributing monthly agricultural operations for appearing in *Facebook* page of SGGS World University and in Sade Pind Sade Khet column of *Ajit* newspaper for farmers from May 2021,

x) Additional Charge of Asstt. Prof. Hort. (Extension)

- Held additional charge of Asstt. Prof. Hort. (Extn.) as In-charge Garden Training Class from 21 May 1980 to 31 May 1981.

xi) Additional Charge of Assoc. Prof. Hort. (Extn.)

- Held additional charge of Assoc. Prof. Hort. (Extn.) from 17 August 1998 to 26 May 2000.

xii) State Level Collaborative Training Course

- Assisted in organizing state level collaborative training course on “Post-harvest Handling of Fruits and Vegetables” at PAU for HDO’s from 17-21 January 2000.

xiii) Academic Affairs Committee (Extension)

- Member, Academic Affairs Committee (Extn.) in the Department of Horticulture during 1987-89 and 1995-96.

xiv) Social Work in Horticulture - Revival of Historic Trees

i) Revival of Historic Ber Trees at Golden Temple Amritsar

- Instrumental in reviving 450 years old historic ber trees “Ber Baba Budha Sahib’ and ‘Dukh Bhanjani Beri” at Golden Temple Amritsar with 20 years of consistent care from 1993 to 2014.
- The historic ber trees had started drying up from the tip during 1990 and many branches were dried and heavily infested by lac insect. The devotee used to touch the main stem with their greasy hands

after partaking of the Parshad. This results into clogging the passage of sap of the trees and they started drying up and further attacked by lac insect. The SGPC requested PAU for suitable treatment of historic ber trees.

- A team of scientists lead by me looked after the old ber trees from time to time during the last two decades. The ber trees started showing sign of improvement year after year and now health of the trees is improved drastically. The ber trees have returned to life and starts bearing fruits. Useful precautions need to be adopted so that life of ber trees can be further prolonged.
- The historic ber trees at Golden Temple Amritsar were revived with 20 years of consistent care from 1993 to 2014. Now about one lakh people visit Golden Temple daily to pay obeisance and all pay respect to oldest ber tree (Ber Baba Budha Sahib) and seek blessings of Guru while standing under the canopy of the ber tree.

ii) Revival of Historic Ber Trees at Achal Sahib Batala

- More than 500 years old historic ber tree at Achal Sahib Batala is associated Sikh Guru Shri Guru Nanak Dev Ji. The tree was pruned heavily and lac infested branches were completely removed. Remaining portion was treated against insect-pests and diseases

iii) Revival of Historic Ber Trees at Gurdwara Ber Sahib Sultanpur Lodhi

- The old historic ber tree is more than 500 years of age. It is a sign of our rich heritage as it is associated with Guru Nanak Dev Ji. The ber tree was revived with pruning technique and insect and disease control treatments.

iv) Historic Ber, Neem and Banyan Trees at Takhat Sri Keshgarh Sahib Anandpur Sahib

- Treated three Historic ber trees, two neem trees and one banyan tree against insects and diseases at Gurdwara Takht Sri Keshgarh Sahib and Gurdwara Baba Gurdita Ji at Anandpur Sahib on 13 October 2018.

v) Treatment of Historic Ber Trees at Naded Sahib Maharashtra

- Rejuvenated 500 years old ber tree at Gurdwara Nanak Pura, Naded Sahib, Maharashtra The process rejuvenation was followed by doing heavy pruning including removal of dead, dried and lac infested branches and spaying of need based insecticide and fungicide on 12-13 May 2018.

International Presentations

- Deliver presentation on “Revival of Historic Ber Trees in Golden Temple” at Sikh Temple Elsbrante San Fransisco, USA on 30 May 2010.
- Deliver presentation on “Revival of Historic Ber Trees in Golden Temple” at Sikh Temple Brookfield, Milwaukee (Wisconsin), USA on 6 March 2016.

xv) Lecture Organized:

- Organized special lecture on Environment dedicated to Shri Guru Har Rai Sahib Ji collectively by Faculty of Religeous Studies and Faculty of Agriculture, Sri Guru Granth Sahib World University, Fatehgarh Sahib on 14 March 2022 and invited Dr H.S. Dhillon Landscape Expert from Chandigarh.

15. Total Publications	: 397
• Books	: 11
• Book Chapters	: 24
• Research Papers	: 163
• Paper Presented in Seminars/Conferences	: 42
• Research Proceedings/Reports	: 5
• Bulletins/Newsletters	: 13
• Teaching Manuals	: 7
• Technical Articles	: 132

16. Awards/Fellowship/Distinction

- Awarded **Fellowship** in Fruit Science by The Horticultural Society of India, New Delhi in 2018.
- Awarded **Appreciation Letter** by the Pro-Chancellor, LPU for book writing on 25 June 2012.
- Awarded **Best Poster Paper Award** in National Seminar “Impact of Climate Change on Fruit Crops” held at PAU on 8 October 2010.
- Awarded **Best Poster Paper Award** in Punjab Science Congress by Punjab Academy of Sciences held on 9 February 2007.
- Awarded **The Best Citizens of India Award** by I. P.H., New Delhi in 2006.
- Awarded **Shri G. L. Chadha Memorial Gold Medal 2004** by The Horticultural Society of India.
- Awarded **Distinguished Alumni Award** by Khalsa College, Amritsar at convocation held on 24 March 2002.
- Presented ‘**Sanman Pattar**’ by Punjab Govt. Minister in the function organized by Ravi Sports & Sabyacharak Club, Ajnala on 8 September 2002.
- Awarded **Shri Hans Raj Pahwa Award 1998** by PAU at convocation held on 20 March 2001.
- University Grant Commission awarded **University level book writing project** for book **Fruit Growing**. Book published in 1997 and recommended for UG/PG students in horticulture in State Agricultural Universities.
- Awarded ‘**Senior Fellowship**’ by ICAR under Improvement of Teaching Competence Scheme for leading Ph.D. degree during 1987.

17. Membership of Scientific Societies

- Life member, The Horticultural Society of India.
- Life member, Punjab Academy of Sciences.
- Life member, The Punjab State Co-operative Fruit Development Federation Ltd., Chandigarh.
- Life member, The Horticultural Society of Haryana.
- Life member, Bahumantavi Kheti.
- Member, The International Society for Horticultural Science, Belgium.

18. Offices held in Professional Societies

- Member, Scientific Committee, 5th International Jujube Symposium, Baoding, China, September 6-7, 2021.
- Member, Scientific Committee, XXX. International Horticultural Congress. (4th International Jujube Symposium) Istanbul-Turkey, August 12-16, 2018.
- Member, International Scientific Committee, Jujube 2016 Workshop, Bucharest, Romania, October 9-12, 2016.
- Member Editorial Board *Acta Horticulturae* No.1116. Proc.III International Jujube Symposium (23rd International Horticultural Congress on Horticulture) published by ISHS in April 2016.
- Member, Academic Council Khalsa College, Amritsar for 2 years from July 2015 to July 2017.
- Member, Scientific Committee and Editorial Board in 3rd International Jujube Symposium Brisbane Australia, August 17-22, 2014.
- Member Editorial Board *Acta Horticulturae* No.993 special volume on jujube published by “Work Group Jujube” in 2013.
- Member, Scientific Committee and Editorial Board in 2nd International Jujube Symposium, Xinzhen, China, September 3-7, 2011.
- Member, Guru Nanak National Colleges, Nakodar (Jalandhar) as Eminent Educationist from September 2009 to March 2010.
- Member, Agri. Business: Agri Advisory Panels, SBI, Chandigarh in 2009-10.
- Editor, *Horticulture Newsletter*, PAU from 2008 to 2011.

- Editorial Board, “*Agrovet Buzz*” Chandigarh from 2007-08 to 2008-09.
- Member, Advisory Board, *The Asian Journal of Horticulture* from 2006-07 to 2009-10.
- Member Editorial Board, *Intern. J. Agric. and Statistical Sciences* from 2006-07 to 2009-10.
- Member, Executive Council, The Horticultural Society of Haryana (Jan. 2006 to Dec. 2007).
- Member, Editorial Board, *International J. Agri. Sciences* Muzaffarnagar from 2005 to 2010.
- Vice President, Horticultural Science Society, PAU, Ludhiana from 2004-05 to 2006-07.
- Editor *The Horticulture Bulletin* from Sept. 1980 to May 1986 published by the FRUITFED, Chandigarh.

19. Conferences/Seminars/Workshops/Symposia Attended : 34

- Participated in “3rd National Research Scholar Meet-2022” on “Innovation Challenges in Interdisciplinary Research and Practices organized by SGGGS World University, Fatehgarh Sahib in association with Indian Science Congress association Patiala Chapter on 25th March 2022 and acted as Expert in Oral Session for Evaluation of Research Papers.
- Attended National Seminar on “*Fruit Production in Eastern Tropical Region of India Challenges and Opportunities*” organized by Horticultural Experiment Station (ICAR-IIHR), Bhubaneswar, March 24-26 online and presented Invited Talk on “Approaches for enhancing ber cultivation in tropical region of India Challenges and Opportunities” on 25th March.
- Attended “5th International Jujube Symposium” Baoding, China, September 6-7, 2021 online and presented keynote lecture on “Manipulation in Jujube Crop Culture using Plant Growth Regulators for Better Sustainability” on 6th September and “Strategies for Picking, Post-harvest Fruit Disposal and Comparative Economics of Jujube Fruit Crop in India” on 7th September. My message of best wishes for symposium was shown on the screen during inaugural session on 6th September.
- Presented talk as a invited speaker on “Planting of new orchard during rainy season” in *Special Webinar* organized by Dr Inderjit Singh Agricultural and Rural Development Centre, Guru Gobind Singh Study Circle, Ludhiana on 6 August 2020.
- Participated in “*International Symposium on “Innovations in Horticulture for Nutritional Security, Conserving Biodiversity and Poverty Alleviation*” held at BBAU Lucknow on 16-18 October 2014. Presented Invited lecture, one Research paper and chaired two oral sessions. My book “Fruit Growing 3rd Revised edition” was released on 16 October in inaugural session of the symposium” by Padam Shri Dr. Brama Singh.
- Invited to participate in “3rd International Jujube Symposium” held at Brisbane Australia, August 17-22, 2014 and presented keynote report on “Development and Production of Indian Jujube (ber) in India” in inaugural session and chaired session on “Genetics, breeding, disease and cultivation.” Presented 3 Research papers. My book Fruit Growing 3rd edition released in keynote address session by President of World Jujube Group.
- Attended 5th Indian Horticulture Congress held at PAU, Ludhiana on November 6, 2012.
- Attended “*Bhartiya Vigyan Sammalen and Expo*” at LPU from October 11-14, 2012 and presented 2 Research papers. Chaired one session “Bio Sciences” conducted on 12 October 2012. Deliver keynote lecture on “Sustainable Agriculture-Role of Horticulture” in inaugural session.
- Attended training on “Best Teaching Practices for Improved Learning” on 20 July 2012 at LPU by the teachers from USA.
- Invited to attend “2nd International Jujube Symposium” at Zhengzhou Xinzheng (China), September 3-7, 2011 and presented keynote report on “Use of rootstocks in Indian Jujube” in inaugural session and chaired session on “Post-harvest physiology, nutrition and processing”. Presented 6 Research papers in the symposium.
- Attended National Seminar on “*Prospects and Challenges of Sustainable Agriculture and Organic Farming in India*” held at NITTTR Chandigarh on 24-25 March 2011 and presented Lead paper on “Bio-diversity in ber varieties”.
- Attended National Seminar on “*Impact of Climate Change on Fruit Crops Papers*” held at PAU Ludhiana, Oct. 6-8, 2010 and presented 7 Research. Acted as Rapporteur in one session.

- Attended Seminar on “*Advances in Cultivation of Temperate Fruits in Sub-tropics*” at PAU Ludhiana on February 4, 2010 and presented vote of thanks in Inaugural Session.
- Attended seminar on “*Sustainable Agriculture: Emerging Trends*” at Khalsa College, Amritsar on 19 November 2009 and presented one Lead paper on “Recent development in horticulture” and chaired valedictory session.
- Preside over as Chief Guest in seminar “Pruning in ber and crop regulation in guava” organized by *Farmer Organization of Agricultural Development (Regd.) Fazilka* on 8 May 2009. Delivered lecture on training and pruning of ber and crop regulation in guava and addressed the fruit grower problems on different fruit crops of the region.
- Organized one day seminar on “*Insect-pest and Disease Problems in Fruit Crops and their Management*” at PAU Ludhiana on 24 April 2009 funded by NHM and delivered lecture on “Scenario of Horticulture in Punjab”.
- Attended workshop on “*Building Capacity for Student Centered Learning*” by experts of Ohio State University at PAU Ludhiana on August 11, 2008.
- Attended and organized Seminar on “*Prospects and Problems of Citrus in Punjab*” at PAU Ludhiana on April 28, 2008.
- Attended “*National Seminar on Opportunities and Challenges of Arid Horticulture for Nutrition and Livelihood*” held at CIAH Bikaner, March 8-9, 2008 and presented 2 Research Papers. Appointed Evaluator in Poster session on “Plant Genetic Resource Management”.
- Attended “*11th Punjab Science Congress*” held at Thapar University Patiala, February 7-9, 2008 and presented 3 Research Papers.
- Presented one research paper on ber in “*First International Conference on Agrochemicals Protecting Crop, Health and Natural Environment*” held at IARI, New Delhi on 8-11 Jan. 2008.
- Attended “*10th Punjab Science Congress*” held at DAVIET Jalandhar February 7-9, 2007 and
- Attended “*National Seminar on Viticulture in Non-traditional, Marginal and Degraded Soils*” held at PAU, Ludhiana, May 25-26, 2005. Acted as Rapporteur in one session.
- Attended “*National Biennial Conference, Indian Society of Weed Sciences*” held at PAU Ludhiana, April 6-9, 2005 and presented 1 Paper. Acted as Rapporteur in one session and Chairman of Editing Committee.
- Attended “*7th Punjab Science Congress*” held at GNDU Amritsar, February 7 – 9, 2004 and presented 2 Research Papers.
- Attended “*91st Indian Science Congress*” held at Punjab University Chandigarh, January 3 – 7, 2004 and presented 2 Research Papers.
- Attended “*National Workshop on Post-harvest Management of Horticultural Produce*” organized by NPC Chandigarh, February 7-8, 2002 and presented 3 Research Papers.
- Attended “*National Seminar on Production and Post-Harvest Technology of Guava*” held at CSAUAT Kanpur, January 9-10, 2002 and presented 3 Research Papers.
- Attended “*Symposium Plant Genetic Resources Management: Advances and Challenges*” held at NBPGR New Delhi, August 1-4, 2001 and presented 1 Research Paper.
- Attended symposium on “*Tropical Crop Research and Development India-International*” held at Trichur, Kerala on 9-12 September 1997. Presented 3 oral and 1 poster Research papers on ber. My book “Fruit Growing” 1st edition released in the inaugural session on 9 September 1997.
- Attended “*National Seminar on Orchard Management for Sustainable Production of Tropical Fruits*” held at RAU Patna, March 10-11, 1997 and presented 4 Research Papers.
- Attended “*Silver Jubilee National Symposium on Arid Horticulture*” held at HAU Hisar, December 5-6, 1996 and presented 2 Research Papers.
- Attended Golden Jubilee Symposium “*Horticultural Research - Changing Scenario*” held at Bangalore, May 24-28, 1993 and presented 4 Research Papers.

- Attended "*National Seminar on Dryland Horticulture*" held at Hyderabad, July 20-22, 1988 and presented 4 Research Papers.

20. Extra Curricular Activities

- President, Fine Arts and Literary Events Committee, COA, PAU from 2009-10 to 2010-11.
- President, Basket Ball (M & W), PAU from 2008-09 to 2009-10.
- President, Kabaddi (M), PAU from 2006-07 and 2007-08.
- Chairman, NSS Committee, COA from 2006-07 and 2007-08.
- Member, Dance, Drama and Music Club, COA in 2005-06.
- Member, University Basket Ball (M & W) Committee, 2004-05 to 2007-08 & 2010 to 2011.
- President, Kabaddi, COA, PAU from 2003-04 to 2007-08.
- Member, Kabaddi (M) Committee PAU from 2003-04 to 2005-06.
- President, Basket Ball, COA, PAU from June 2003 to October 2011
- Member, PAU Sports and Cultural Committee in 2002-03.
- Member, Young Writers Association (M & W) PAU from 2001 to 2005.
- Member, NSS Advisory Committee, COA, PAU in 2001-02.
- Member, Fine Arts and Literary Events Committee, COA from 1999 to 2007-08.
- Convener, Poetic Symposium in Alumni Meet, COA, PAU during 1998, 2002, 2003, 2004, 2007 and Co-Convener during 2008.
- President, Art and Literature / Young Writers Assoc. COA, PAU from July 1997 to July 2004.
- Member, Fine Arts & Photography Club (M & W) PAU from 1997 to 2004.
- Member, College Sports and Youth Activities Committee, COA, PAU from 1993- 1996.
- Organized 10 days 3 special NSS camps from 1993 to 1995 (2 Ballawal Saunkhari, 1 Khaira Bet).

21. Miscellaneous Activities

Training in Indian Parliament

- Attended appreciation course in Parliamentary Processes and Procedures at Lok Sabha Secretariat, New Delhi, July 19-23, 1993.

Lok Sabha Election

- Appointed Alternative Presiding Officer in 9 Lok Sabha election at Ludhiana on 26 Nov.1989.
- Appointed Counting Supervisor in 9 Lok Sabha election at Ludhiana on 27 November 1989.

Training in National Service Scheme (NSS)

- Attended NSS training and orientation course organized by the Training and Orientation Centre, Punjabi University at PAU, October 2-14, 1993.
- Attended training programme on Aids Education organized by the Training and Orientation Centre, Punjabi University at PAU, August 25-28, 1995.

22. Total Service : 36 Years

23. Wikipedia Citation

- 'Fruit Growing' book authored by me is cited as a reference in Amrapali (mango) in Wikipedia.

24. Google Scholar Citation : As on 30- 03-2022

Citation Indices	:	All
Citations	:	1169
h-index	:	18
i10-index	:	41

Dated: 30-03-2022

(Dr. J. S. Bal)

LIST OF PUBLICATIONS OF DR J. S. BAL

(i) RESEARCH PAPERS

1. Bal, J.S. and P. Singh, 1978. Developmental physiology of ber (*Zizyphus mauritiana* Lam.) var. Umran. Part I. Physical changes. *Indian Food Packer*, **32**(3) : 59-61.
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