

**CENTRE OF ADVANCED FACULTY TRAINING
IN
GENETICS AND PLANT BREEDING**



2011

**Department of Plant Breeding and Genetics
Punjab Agricultural University
Ludhiana-141004**

Progress and Impact during XI Plan

1. **Name of the CAFT/Department/Division:** Centre of Advanced Faculty Training
Department of Plant Breeding & Genetics
Punjab Agricultural University
Ludhiana

2. **Brief Introduction about the department (about 100 words)**

With the understanding of mechanism of inheritance, the varietal development in various crops were initiated in the beginning of twentieth century. Chaudhary Ramdhan Singh was appointed cerealist to concentrate on breeding work of cereals during the year 1925. Later, work on improvement of rice, barley, maize and pulses was also assigned to the cerealist. After that research in rice was started at Kal Shah Kaku (Pakistan). During 1927, Mr. B.S. Sawhney was appointed the Millet Botanist at Lyallpur, where the work on Bajra, gram and tobacco was started. The breeding of cotton was initiated in 1912 at Punjab Agricultural College and Research Institute Lyallpur by Dobbs. The testing of varieties of Sugarcane were started during 1911 at Gurdaspur and later, work on sugarcane was started at Risalewala near Lyallpur (Pakistan) during 1934. At Lyallpur the first research work on brassicas, linseed and sesamum was started with establishment of Oilseeds Section. The groundnut research was started at Ludhiana after opening a sub station during 1933.

With the opening of Punjab Agricultural University during 1962 at Ludhiana, Hisar and Palampur different crop sections were formed in the Department of Plant Breeding. Dr. D.S. Athwal was the first Professor and Head of the Department. Presently, the department of Plant Breeding & Genetics has nine crop based sections.

3. **Objective of CAFT:** To conduct trainings of teachers in the field of Plant Breeding and Genetics and develop facilities for better Research for PG students.

4. **Faculty: Name & Designation (as on 30.9.2011):**

| Sr. No. | Name | Designation | Date of Retirement | Field of Specialization |
|---------|---------------------|----------------------------|--------------------|-------------------------|
| 1 | Dr. S.S. Banga | National Professor ICAR | 31.8.2015 | Oilseed Breeding |
| 2 | Dr. M.S. Gill | Professor Plant Breeding | 28.2.2017 | Cotton Breeding |
| 3 | Dr. S.R. Sharma | Sr. Breeder (Breeder Seed) | 30.4.2012 | Seed Production |
| 4 | Dr. Allah Rang | Professor Plant Breeding | 31.3.2013 | Rice Breeding |
| 5 | Dr. R.K. Bajaj | Sr. Sunflower Breeder | 31.10.2013 | Oilseed Breeding |
| 6 | Dr. Sukhchain Singh | Sr. Maize Breeder | 31.10.2013 | Forage Breeding |
| 7 | Dr. Maninder Singh | Sr. Maize Breeder | 30.4.2015 | Maize Breeding |
| 8 | Dr.(Mrs) S.K. Banga | Senior Breeder | 30.6.2015 | Oilseed Breeding |
| 9 | Dr. S.P.S. Brar | Sr. Maize Breeder | 31.7.2016 | Maize Breeding |
| 10 | Dr. N.S. Bains | Sr. Plant Breeder | 30.11.2021 | Wheat Breeding |

| | | | | |
|----|-------------------------|--------------------------|------------|--------------------|
| 11 | Dr. J.S. Chawla | Sr, Extension Specialist | 31.3.2021 | Extension Edu. |
| 12 | Dr. K.S. Thind | Sr. Sugarcane Breeder | 31.3.2021 | Sugarcane Breeding |
| 13 | Dr. T.S. Bains | Sr. Breeder (Pulses) | 30.6.2022 | Pulses Breeding |
| 14 | Dr. Sarvjeet Singh | Sr. Plant Breeder (P) | 30.6.2022 | Pulses Breeding |
| 15 | Dr.(Mrs) S.K. Dhillon | Plant Breeder | 30.7.2026 | Oilseed Breeding |
| 16 | Dr G.S. Mangat | Sr. Rice Breeder | 30.6.2026 | Rice Breeding |
| 17 | Dr. V.S. Sohu | Sr. Wheat Breeder | 28.2.2027 | Wheat Breeding |
| 18 | Dr. R.S. Sohu | Cotton Breeder | 28.2.2027 | Cotton Breeding |
| 19 | Dr.(Mrs) Gurjit Kaur | Maize Breeder | 30.5.2029 | Maize Breeding |
| 20 | Dr. B.S. Gill | Plant Breeder | 31.3.2029 | Pulses Breeding |
| 21 | Dr. Johar Singh | Wheat Breeder | 31.3.2030 | Wheat Breeding |
| 22 | Dr. R.S. Gill | Plant Breeder | 28.2.2030 | Sugarcane Breeding |
| 23 | Dr.(Mrs) S.K. Sandhu | Sugarcane Breeder | 30.11.2030 | Sugarcane Breeding |
| 24 | Dr. Inderjit Singh | Plant Breeder(P) | 30.6.2030 | Pulses Breeding |
| 25 | Dr. S.S. Kandhola | Plant Breeder | 30.9.2031 | Oilseed Breeding |
| 26 | Dr.(Mrs) R.K. Gill | Asstt. Plant Breeder | 30.9.2031 | Pulses Breeding |
| 27 | Dr. (Mrs.) Chhaya Attri | Asstt. Plant Breeder | 31.7.2031 | Oil Seed Breeding |
| 29 | Dr. B.S. Cheema | Plant Breeder | 31.5.2032 | Barley Breeding |
| 30 | Dr. Dharminder Pathak | Asstt. Plant Breeder | 31.1.2033 | Cotton Breeding |
| 31 | Dr. (Mrs.) Achla | Asstt. Plant Breeder | 31.8.2033 | Wheat Breeding |
| 32 | Dr. G.S. Mavi | Asstt. Plant Breeder | 31.7.2034 | Wheat Breeding |
| 33 | Dr.(Ms) Rupinder Kaur | Asstt. Plant Breeder | 31.10.2035 | Rice Breeding |
| 34 | Dr.(Mrs) Gurpreet Kaur | Asstt. Plant Breeder | 31.5.2036 | Oilseed Breeding |
| 35 | Mrs.Inderpreet Dhaliwal | Asstt. Plant Breeder | 30.4.2034 | Cotton Breeding |
| 36 | Dr. Simarjit Kaur | Asstt. Geneticist | 31.10.2041 | Wheat Breeding |
| 37 | Dr. Navjot Sidhu | Asstt. Geneticist | 31.8.2034 | Rice Breeding |
| 38 | Dr. Ruchika Bhardwaj | Asstt. Geneticist | 31.12.2039 | Forage Breeding |
| 39 | Dr. Renu Khanna | Asstt. Plant Breeder | 31.8.2035 | Rice Breeding |
| 40 | Dr. Harsh | Asstt. Plant Breeder | 31.8.2041 | Oilseed Breeding |

5. Human Resource Development:

Particulars of Short Courses/training program for HRD conducted during XI plant period

| S.No. | Name of the Program | Period | No. of participants | | |
|-------|--|---------|---------------------|----------|-------|
| | | | Internal | External | Total |
| 1. | Use of biotechnological tools in crop improvement held from November 28 to December 18, 2007 | 2008-09 | 3 | 17 | 20 |
| 2. | Recent advances in crop improvement held from February 5-25, 2008 | | 5 | 12 | 17 |
| 3. | Breeding for biotic and abiotic stresses held from October 3- | 2008-09 | 2 | 15 | 17 |

| | | | | | |
|----|---|---------|---|----|----|
| | 23, 2008 | | | | |
| 4. | Breeding for quality – conventional and genomic approaches held from January 7-27, 2009 | | 5 | 16 | 21 |
| 5. | Breeding for designer crop held from March 9-29, 2010 | 2009-10 | 5 | 12 | 17 |
| 6. | Recent advances in plant breeding methodology held from November 9-29, 2010 | 2010-11 | 7 | 9 | 16 |
| 7. | Pre Breeding in Crop Improvement” from 7-27 Sept. 2011 | 2011-12 | 2 | 16 | 18 |

6. Infrastructure development (equipments etc.):

Equipments:

- Phase contrast microscope
- Refrigerated centrifuge
- Ploidy analyzer
- Tissue lyser
- Growth chambers
- Gel documentation system
- Water purification system
- Portable Photosynthesis system
- High volume instrument for cotton fibre quality analysis
- Fluorescence microscope
- HPLC
- Nitrogen analyzer and NIRs
- ALVEO Consistograph to study tenacity, extensibility of wheat dough (for chapatti/bread quality evaluation)
- One stereo microscope with photographic attachment
- PCR machine
- Nitrogen analyzer
- Vertical autoclave
- Nikon trinocular stereo microscope

- High speed centrifuge
- Laminar air flow cabinets
- Microwave oven
- Microcentrifuge
- Autoclave
- UV-VIS spectrometer
- LIR spectrometer
- Hot air oven
- Water bath
- UPLC
- Ice flaking machine
- Biophotonanometer
- Microplate dispenser
- pH meter
- Incubator shaker
- Digital sucromat with abbemat
- Hydraulic press unit
- Fresh evaporator cooling machine
- Bagasse dryer
- Fermenter
- Digital spectrometer
- Kjeldahl apparatus
- Cyclotec machine
- Tractor- trolley
- Intercultural plough
- Electronic moisture meter
- Humidifier
- BOD incubator
- Purification unit
- Mega gel electrophoresis system

- Leaf area meter
- Compound microscope
- Automatic capillary electrophoresis system
- PCR with in situ hybridization programme
- Vertical laminar air flow cabinet
- Water bath-incubator-shaker
- Rice husker
- Rice polisher
- Rotary microtome
- Slide warming table
- Shaking machine (wrist action)
- Microscope attachment cum-camera
- Dual double –wide mini vertical kit for electrophoresis
- Tiller culture chamber
- APS smart UPS RT 600 VA model

7. Renovation of Lecture Room/Laboratories

8. Library upgraded:

| Upgradation | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | Total |
|--------------------|----------------|----------------|----------------|----------------|----------------|--------------|
| Books | 20 | - | 149 | 16 | - | 185 |
| Thesis | 10 | 9 | 6 | 10 | 4 | 39 |

9. Awards/Recognitions:

- Dr. VS Sohu & team (2006) ICAR plaque for development of bread wheat variety PBW 527.
- Dr. G.S Dhindsa was awarded a plaque by the Indian Council of Agricultural Research (ICAR) for development and release of triticale variety TL 2942 for irrigated and rainfed timely sown conditions of the entire Northern Hills Zone of India (NHZ) during the 46th All India Wheat & Barley Research Workers' Meeting, August 24-27, 2007, at MPKV, College of Agriculture, Pune.
- Drs. G.S Dhindsa and Sarvjeet Singh were awarded a plaque by the Indian Council of Agricultural Research (ICAR) for development and release of barley variety PL 751 for irrigated timely sown conditions of the entire Central Zone of India (CZ) during the 46th All India Wheat & Barley Research Workers' Meeting, August 24-27, 2007, at MPKV, College of Agriculture, Pune.
- Certificate of Appreciation Awarded to Dr. U.S. Tiwana, Senior Agronomist in acknowledgement of his contribution to the scientific programme of the National Symposium for participation and presentation of the scientific articles(s) at the National Symposium 'A New Vista to Forage Crop Research' organized by All India Coordinated Research Project on Forage Crops, Directorate of Research, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal.
- Poster by Dr. U.S. Tiwana, K.P.Puri, B.L. Bhardwaj & Pritpal Singh was adjudged second in Scientific Category in Poster Session during the Symposium 'Rangeland and Forage Resource in Changing Socio-economic Scenario' Indian Grassland & Fodder Research Institute, Jhansi (November 15-17, 2007) organized by " Range Management Society of India.
- Dr. Gulshan Mahajan, Agronomist awarded certificate of appreciation for delivering division seminar in CESD Division at IRRI, Manila Philippines February 19, 2008.
- Dr J.S.Sandhu was awarded Best Research Worker Award of the University for the year 2007-08.
- Dr. T.S.Bains and Dr Inderjit Singh were admitted as Fellow of Indian Society of Pulses Research and Development during 2008-09.
- ICAR felicitation to Dr. V.S. Sohu and team members for development of bread wheat variety PBW 550 during 2008-09.
- Best Poster Award by Asmita Sirari in National symposium "Plant Pathology in the changing Global Scenario" held at NBPGR, New Delhi from February 27-28, 2009.

- Dr. T.S. Bharaj, Dr. G.S. Mangat and Dr. H.S. Muker got team award from ICAR for developing variety Basmati 386 by ICAR on February 16, 2009.
- ICAR felicitation to Dr. G.S. Mahal & team members for development of durum wheat variety PDW 291 during 2009.
- Dr. S.S. Banga, awarded National Professor Chair (ICAR) for five years w.e.f 20th Oct. 2009.
- Dr. Dharam Paul, Assistant Biochemist awarded young fellow award by the Society for Scientific Development in Agriculture & Technology on the occasion of National Symposium on Achieving Millennium Development Goals: Problems & Prospectus during 25-26 Oct., 2009 held at Budhelkhand University, Jhansi.
- Dr J.S. Sandhu and Dr Guriqbal Singh were awarded by the Indian Society of Pulses Research and Development (ISPRD) with ISPRD Recognition Award 2009.
- Drs. Ranvir S Gill, Surinder Sandhu, P.S. Sandhu and Chhaya Atri received Australian Endeavour Fellowship Award during the years 2011, 2010, 2009 and 2008 respectively.
- Amandeep Kaur Ph.D. student awarded Monsanto Beachell-Borlaug International Fellowship during 2010.
- Best poster award for paper entitled, “Introgression of alien genes for Botrytis Gray Mould into cultivated chickpea” by Drs. Livinder Kaur, J.S. Sandhu, Inderjit Singh and Asmita Sirari, presented in National Symposium on Emerging Plant Breeding in Northern India – Status and Management Strategies at CCSHAU, Hisar on October 28-29, 2010.
- Poster entitled “Genetic analysis of fibreless trait in *Gossypium arborum* L.” by Dharminder Pathak, Baljinder, M S Gill and Pankaj Rathore was adjudged the second best poster during International Conference on “Preparing Agriculture for Climate Change” organized from February 6-8, 2011 at PAU, Ludhiana.
- Dr Guriqbal Singh and co-workers got first prize in poster presentation in the theme- “Agronomic Mitigations” in the International Conference on Preparing Agriculture for Climate Change held at PAU, Ludhiana on February 6-8, 2011.
- Dharminder Bhatia Ph.D. student got Beachell-Borlaug International Fellowship during 2011.

10. Publications*

- **INTERNATIONAL JOURNAL**

Year 2007:

Bains, T.S., Singh, Sarvjeet, Singh, Inderjit and Gill, R.K. 2007. Breeding for ideal plant type in spring/summer mungbean. *Acta Horticulturae* 752 : 417-422.

Chaudhary, D. P., Boparai, K. Ravneet and Bansal, D. Devi. 2007. Implications of oxidative stress in high sucrose low magnesium diet fed rats. *European Journal of Nutrition* 7:383-90.

Garg, H., Banga, S.K. Bansal, P., Atri C. and Banga, S.S. 2007. Hybridizing *Brassica rapa*, with wild crucifers *Diplotaxis eruroides* and *Brassica maurorum*. *Euphytica* 156: 412-424.

Kooner, B.S., Cheema, H.K. and Taggar, G.K. 2007. Efficacy of different insecticides as foliar sprays against bean thrips, *Megalurothrips distalis* (Karny) in mungbean. *Acta Horticulturae* 752: 531-34.

Li, C.X., Sivasitharnparam, K., Walton, G., Salisbury, P. Burton, W. Banga, S.S., Banga, S. Chatopadhyey, C., Kumar, A., Singh, R., Singh, D. Agnihotri, A., Liu, S.Y., Li, Y.C., Fu, T.D., Yang, Y.F. and Barbetti M.J. (2007) Expression and relationship of resistance to white rust (*Albugo candida*) at cotyledonary, seedling and flowering stages in *Brassica juncea* germplasm from Australia, China and India. *Australian Journal of Agricultural Research* 58: 259-264.

Mahajan, G., Sharda Rakesh, Kumar Ashwani and Singh, K.G. 2007. Effect of plastic mulch on economizing irrigation water and weed control in baby corn sown by different methods. *African Journal of Agricultural Research*, 2: 19-26.

Mahajan, G., Singh, K.G., Rakesh Sharda and Mukesh Siag 2007. Response of red hot pepper (*Capsicum annum* L.) to water and nitrogen under drip and check basin method of irrigation. *Asian Journal of Plant Sciences*, 6: 815-820.

Parkash, V., Siag, R.K and Bains, T.S. 2007. Genetic divergence in indigenous and exotic genotypes of mungbean. *Acta Horticulturae* 752 : 165-168.

Rane J, Pannu R K, Sohu V S, Saini R S, Mishra B, Shoran J, Crossa J, Vargas M and Joshi A K. 2007. Performance of yield and stability of advanced wheat genotypes under heat stress environments of the Indo-Gangetic plains. *Crop Sci.* 47: 1561-73

Sekhon, H.S., Bains, T.S., Kooner, B.S. and Sharma, Pushp. 2007. Grow summer mungbean for improving crop sustainability farm income and malnutrition. *Acta Horticulturae* 752 : 459-464

Sharma, Poonam, Sekhon, H.S., Khanna, Veena and Singh, Guriqbal. 2007. Biological Nitrogen Fixation in mungbean : Facts and Findings. *Acta Horticulturae* 752: 597-601

Singh, Inderjit, Bains, T.S., Singh, Sarvjeet, Sekhon, H.S., Kooner, B.S., Sharma, Poonam and Gill, R.K. 2007. Seed production- An important component for popularization mungbean. *Acta Horticulturae* 752 : 465-468.

Year 2008:

Bansal, U.K., Hayden, M. J., Venkata, B. P., Khanna, R., Saini, R.G. and Bariana, H. S. 2008. Genetic mapping of adult plant leaf rust resistance genes *Lr48* and *Lr49* in common wheat. *Theor.Appl.Genet*, 117: 307-312.

Bansal, U.K., Saini, R.G. and Khanna, R. 2008. Inheritance of leaf rust resistance in Chinese Spring stocks with a *Triticum speltoides* chromosome segment carrying the gene *Lr28*. *Journal Applied Genetics*, 49:141-45.

Cheema, K. K., Grewal, N. K., Vikal, Y., Sharma, R., Lore J. S., Das, A., Bhatia, D., Mahajan, R., Gupta, V., Bharaj, T. S. and Singh, K. 2008. A novel bacterial blight resistance gene from *Oryza nivara* mapped to 38 kb region on chromosomes 4L and transferred to *Oryza sativa* L. *Genet. Res. Camb.* 90: 397-407.

Cheema, Kuljit K., Bains, N S., Mangat, G .S., Das, Aparna., Vikal ,Yogesh., Brar, D.S., Khush, G. S. and Singh, Kuldeep. 2008. Development of high yielding IR64 x *Oryza rufipogon* (Griff.) introgression lines and identification of introgressed alien chromosome segments using SSR markers. *Euphytica*, 160: 401-409.

Chuuneja, P., Kaur, S., Garg, T., Ghai, M., Kaur, S., Prashar, M., Bains, N.S., Goel, R.K., Keller, B., Dhaliwal, H.S. and Singh K. 2008 Mapping of adult plant stripe rust resistance genes in diploid A genome wheat species and their transfer to bread wheat. *Theor Appl Genet*, 116 : 313 -324.

Garg, H., Sivasithamparam, B.K., Banga, S.S. and Barbetti M.J. 2008. Cotyledon assay as a rapid and reliable method of germplasm screening for resistance against *Sclerotinia sclerotiorum* in *Brassica napus* genotypes. *Australasian Plant Pathology*. 37: 106- 111.

Guleria, Shaileja, Sharma, Sucheta, Gill, B.S. and Munshi, S.K. 2008 Distribution and biochemical composition of large and small seeds of soybean (*Glycine max* L.). *Journal of Food Science and Agriculture* 88 : 269-72.

Kaur, S., Bansal, U.K., Khanna, R. and Saini, R.G. 2008. Genetics of leaf and stripe rust resistance in a bread wheat cultivar Tonichi. *Journal of Genetics*, 87: 191-94.

Li, C.X., Wratten, N., Salisbury, P.A., Burton, W. A. Potter, T. D. Walton, G. LiG, H., Sivasithamparam, K., Banga, S.S. Banga, S., . Singh, D., Liu, S.Y., Fu, T.D., Barbetti M.J. (2008) Response of *Brassica napus* and *B. juncea* germplasm from Australia, China and India to Australian populations of *Leptosphaeria maculans*. *Australasian Plant Pathology* 37: 162-170.

Mahajan G. and Bharaj, T.S. 2008. Yield and water productivity of rice cultivars as influenced by transplanting dates and age of nursery in an irrigated semi-arid subtropical

environment. *The Asian and Australasian Journal of Plant Science and Biotechnology*, 2 : 15-19.

Mahajan, G. and Chauhan, B. S. 2008. Performance of penoxsulam for weed control in transplanted rice. *Pest Technology*, 2: 114-116.

Sarna, Simple, Sharma, Poonam and Khurana, A.S. 2008. Combined inoculation of *Azotobacter* and plant growth promoting rhizobacteria on the efficiency of *Rhizobium* in chickpea. *Annals of Plant Soil Research* 10 (1) : 39-43.

Singh, Guriqbal and Jolly, R.S. (2008) Improving emergence of soybean (*Glycine max*) with straw mulch and other practices under normal and crusted soil conditions. *Acta Agronomica Hungarica* 56(3) : 275-283.

Singh, Gurpreet, S.K. Sandhu, Madhu Meeta, Karnail Singh, Raman Gill & S.S. Gosal (2008). In vitro induction and characterization of somaclonal variation for red rot and other agronomic traits in sugarcane. *Euphytica*. 160: 35-47.

Year 2009:

Atwal, A.K., Kumar, M, Chauhan, P., Atri, C., Kular, J.S., Kumar, S. and Banga, S.S. 2009. Myrosinase-Glucosinolate system in crop *brassica* species: variation and association with defensive response to *Pieris brassicae* infestation. *International Journal of Plant Breeding* 3: 121-125.

Bansal,P., Kaur,P., Banga,S.K., Banga,S.S. 2009 Augmenting genetic diversity in *Brassica juncea* through its resynthesis using purposely selected diploid progenitors. *IJPB*. 3: 41-45

Bhardwaj, R., Sandhu, J.S., Kaur, L., Gupta, S.K., Gaur, P.M. and Varshney, R. 2009. Genetics of ascochyta blight resistance in chickpea. *Euphytica* 171: 337-343.

Kapoor, Rahul., Banga, S.S. and Banga, S.K. 2009. A Microsatellite (SSR) based linkage map of *Brassica rapa* *New Biotechnology* 26(5): 239-243.

Kaur, Jagdeep., Bansal U.K., Khanna, R., Saini, R.G. and Bariana, H.S. 2009. Molecular mapping of stem rust resistance in HD2009/WL711 recombination inbred line population. *Int J Plant Breeding*, 3: 29-33.

Mahajan, G., Bharaj, T. S. and Timsina, J. 2009. Yield and water productivity of rice as affected by time of transplanting in Punjab, India. *Agricultural Water Management* , 96: 525-35.

Mahajan, G., Chauhan, B.S., Johnson, DE. 2009. Weed management in aerobic rice in northwestern Indo-Gangetic Plains. *J. Crop Improvement*, 4, 366-82.

Mahajan, G., Sekhon, N.S. 2009. Genotypic variation in nitrogen use efficiency of rice cultivars at various levels of nitrogen under subtropical environment. *Journal of Agricultural Science and Technology*, 3: 1-8.

Mahajan, G., Sharma, N., Bharaj, T. S. 2009. Grain yield, water productivity and quality characteristics of basmati rice in response to cultivars and transplanting dates. *International J. Plant Breeding*, 3: 46-51.

Singh, Guriqbal 2009 Effects of wheat straw and farmyard manure mulches on overcoming crust effect, improving emergence, growth and yield of soybean and reducing dry matter of weeds. *International Journal of Agricultural Research* 4(12) : 418-424.

Year 2010:

Dixit, A., Manes, G.S., Singh, A., Singla, C. and Mahajan, G. 2010. Evaluation of direct-seeded rice drill against Japanese manual transplanter for higher productivity in rice. *Indian Journal of Agricultural Sciences* 80: 884–887.

Garg, H., Atri, C., Sandhu, P. S., Kaur, B., Renton, M., Singh, H., Singh, C., Barbetti, M. J., Banga, S. S. 2010. High level of resistance to *Sclerotinia sclerotiorum* L. in introgression lines derived from hybridization between wild crucifers and the crop *Brassica* species *Brassica napus* and *Brassica juncea*. *Field Crops Research* 117: 51-58.

Gill R.S., Gupta A.K., Taggar G.K. and Sachdeva M. 2010. Role of oxidative enzymes in plant defenses against insect herbivory. *Acta Phytopathologica et Entomologica Hungarica* 45 (2): 277-290

Khosla, Gaurav., Gill, B.S., Singh, T.P. and Kapoor, Rahul. 2010 Biomass, Harvest Index and Yield in Relation to Changes in Photo-thermal Regimes in Soybean (*Glycine max* L. Merrill.) Genotypes. *Int. J. Plant Breed.* 5(1): 25-29.

Mahajan, G., and Sekhon, N.K. 2010. Yield and nitrogen use efficiency of indica rice varieties as influenced by timing of nitrogen fertilization. *Indian J. Agric. Science*, 80P: 327-28.

Mahajan, G., Sekhon, N., Singh, N., Kaur, R., Sidhu, A.S. 2010. Yield and nitrogen use efficiency of aromatic rice cultivars in response to nitrogen fertilizer. *J. New Seeds*, 11: 356-68.

Mahajan, G., Timsina, J. 2010. Effect of nitrogen rates and weed control methods on weeds abundance and yield of direct-seeded rice. *Archives of Agronomy and Soil Science*, 57: 239-50.

Mahajan, G., Gill, M.S., Singh, K. 2010. Optimizing seed rate for weed suppression and higher yield in aerobic direct seeded rice in North Western Indo-Gangetic Plains. *J. New Seeds*, 11: 225-238

Singh, Guriqbal. 2010. Replacing rice with soybean for sustainable agriculture in the Indo-Gangetic Plain of India: Production technology for higher productivity of soybean. *International Journal of Agricultural Research* 5(5) : 259-267.

Singh, K.G., Singh, A. and Mahajan, G. 2010. Response of sweet pepper to irrigation and fertigation grown in naturally ventilated greenhouse. *Indian J. Agric. Sci*, 80: 430-32.

Year 2011:

Berger, J.D., Kumar, S., Nayyar, H., Street, K.A., Sandhu, J.S., Henzell, J.M., Kaur, J. and Clarke, H. C. 2012. Temperature- stratified screening of chickpea (*Cicer arietinum* L.) genetic resource collections reveals very limited reproductive chilling tolerance compared to its annual wild relatives. *Field Crops Research* 126: 119-129.

Bhatia, D., Sharma, R., Vikal, Y., Mangat, G.S., Mahajan, R., Sharma, N., Lore, J.S., Singh, N., Bharaj, T.S., Singh, K. (2011). Marker-assisted development of bacterial blight resistant, dwarf, and high-yielding versions of two traditional basmati rice cultivars. *Crop Sci*. 51: 759 - 770.

Kapoor, Rahul., Kaur, Gurpreet., Banga, Shashi. and Banga, Surindar Singh 2011. Generation of *B. nigra* – *B. rapa* chromosome addition stocks: Cytology and microsatellite markers (SSRs) based characterization. *New Biotechnology* 28(4): 407-417.

Kaur Ramanjit, Mahey, R.K., Mukherjee, J., Mahajan, G. (2011). Weed management in rice-wheat cropping system through remote sensing a review. *Journal of Agricultural Science and Technology*, 5: 366-84.

Kaur, Harminder. and Chhuneja, P.K. 2011. Fecundity of *Varroa destructor* Anderson and Trueman in worker brood of *Apis mellifera* Linnaeus colonies. *Journal of Insect Science* 24: (accepted).

Kaur, L. Singh, V. P. and Gupta, A.K. 2011. Peroxidase: a marker for Ascochyta blight resistance in chickpea. *Archives of Phytopathology and Plant Protection* (Accepted) GAPP ID 439458 (11): 1-5.

Kaur, L., Singh, V.P. and Sandhu, J.S. 2011. Characterization of *Ascochyta rabiei* isolates and evaluation of genotypic stability in chickpea *Archives of Phytopathology and Plant Protection* (Accepted) GAPP 767817 (11): 1-7.

Khosla, Gaurav, Gill, B.S., Singh, T.P. and Kapoor, Rahul. 2011. Biomass, harvest index and yield in relation to photo-thermal regimes in soybean (*Glycine max* L. Merrill.) genotypes. *International Journal of Plant Breeding* 5(1): 25-29.

- Kumar, S. Atri, C., Sangha, M. K. and Banga, S.S. 2011. Screening of wild crucifers for resistance to mustard aphid, *Lipaphis erysimi* (Kaltenbach) and attempt at introgression of resistance gene(s) from *Brassica fruticulosa* to *Brassica juncea*. *Euphytica* 179: 461-470.
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11. Financial Statement

Expenditure under CAFT during XI Plan

| Head | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|----------------------------|----------------|----------------|----------------|----------------|----------------|
| Operating cost of training | 340481 | 351998 | 137132 | 338189 | 98816 |
| Recurring contingency | 199428 | 197959 | 140424 | 195839 | 126331 |
| Non-recurring contingency | - | - | - | - | - |
| T.A. | - | - | - | - | - |
| Library/Books | 49261 | 43228 | - | 29541 | - |
| Total | 589170 | 593185 | 277556 | 563569 | 225147 |
| | | | | | |

