

**A. Personnel Information:****Name: Dr Gulzar S. Sanghera**

Designation: Sugarcane Breeder

D O B: 31-03-1972

Address: PAU, Regional Research Station,  
Post Box 34,

144601 Kapurthala, Punjab

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**B. Academic Education:**

B.Sc. CSK HPKV, Palampur, 1994

M.Sc. CSK HPKV, Palampur, 1996

Ph.D. PAU, Ludhiana, 2009

**C. Research**

- Area of specialization/Research interest:** Worked as Rice Breeder at SKUAST, Kashmir 1998-2013 with major area of research 'Development High yielding, cold tolerant and blast resistant varieties especially suitable for hill ecology of India'. Developed advance generations by exploiting elite material from IRRI and institutions like CSKHPKV, Palampur, The then GBPANT, Ranichauri, GBPUAS&T, Pantnagar, VPKAS, Almora and NEH, Shillong for cold tolerance and high yield including blast resistance. Initiated Hybrid rice programme especially for hill ecologies and developed two CMS lines SKAU 7A and SKAU 11A along with their maintainers and identified restorers for these lines. Developed mapping populations for blast resistant in the background of Jhelum (coarse grained) and Mushkbudgi (aromatic short bold) using MAS DH line procured from CSK HPKV, Palampur. Presently, looking after sugarcane research and development activities both AICRP (S) and state for development of 'High yielding, high sugared and pest and disease resistance varieties of sugarcane specifically for Punjab state and Northern India in general'. Handling hybridization at NHG, SBI, Coimbatore, raising fluff and subsequent clonal stages at RRS, Kapurthala and their multi-location testing at RS, Faridkot and Gurdaspur. Developed advance clones at (C III and multi-location testing level) in both early and mid maturity groups. Developing material for abiotic stresses (water deficit and cold) tolerance and their biochemical and molecular characterization in future in combination with high quality and disease resistance.
- Varieties/Technologies/Recommendations: (In three columns including S. No., Title of recommendation/technology/variety, year):**

S. No	Variety/Technology	Year	Remarks
Rice			

1	Shalimar Rice 1 (SKAU 105)	2005	Suitable for hill ecology at 1560-1800m amsl included in package of practice of SKUAST Kashmir
2	Shalimar Rice 2 (SKAU 341)	2014	Suitable for hill ecology at 1560-1800m amsl included in package of practice of SKUAST Kashmir
3	Shalimar Rice 3 (SKAU 382)	-do-	Suitable for hill ecology at 1560-2000m amsl included in package of practice of SKUAST Kashmir
4	SKAU 7A & B SKAU 11A & B	2009	Suitable for hill ecology upto 1560 for development of hybrid rice in hill zone of India
Sugarcane			
1	CoPb 91	2014	Suitable for Punjab state in mid maturity group included in package of practice of Kharif crops Pau, Ludhiana
2	Co 238	2015	Suitable for Punjab state in mid maturity group included in package of practice of Kharif crops PAU, Ludhiana
3	Co 118	2015	Suitable for Punjab state in early maturity group included in package of practice of Kharif crops PAU, Ludhiana
Oats	OL 10	2014	Suitable for Punjab state included in package of practice of Rabi crops PAU, Ludhiana

3. Major projects handled as PI

- a. **Current Projects:** All India Coordinated Research Project on Sugarcane and Development of high yielding, quality and pest and disease resistance varieties of sugarcane

4. **Awards/Meals/Distinctions in research:**

**Best poster presentation award** for the paper ‘Gamma Rays Induced Useful Variations for Quality and Economic Traits in Sugarcane (*Saccharum* Spp)’ in National Seminar on “Recent Advances and Challenges in Sugarcane Research NSSR-2014” organized by UAS, BC Farm Mandya, Mysore, Jan 23-24, 2014.

Conferred and confirmed in perpetuity with “**Distinction Award**” for contributions towards national and international understanding and goodwill in life science/

biotechnology by “The Society for the Promotion of Plant Science Research” Jaipur National University, Jaipur, Dec. 1-2, 2009.

Qualified National Eligibility Test Conducted by ASRB, Indian Council of agricultural Research, New Delhi, India

#### **D. Publications:**

1. **Gulzar S Sanghera**, Kumar R, Tyagi V, Thind K S and Sharma B (2015) Genetic divergence among elite sugarcane clones (*Saccharum officinarum* ) based on cane yield and quality traits from northern India. *Journal of Experimental Biology and Agricultural Sciences* 3(2): 184-190 [ISSN: 2320-8694].
2. Ratinderbir Kaur, B Kumar, Y Vikal, **Gulzar S. Sanghera** (2014) Genetic diversity among *Colletotrichum falcatum* isolates causing red rot of sugarcane in subtropical region of India *Not Sci Biol*, 6(3):308-315
3. **Gulzar S Sanghera**, Subhash C Kashyap, Vijay Rana and Parray G A (2014) Agromorphological and genetic diversity among elite wheat genotypes grown under Kashmir conditions. *International Journal of Current Research* 6(8): 7735-7740
4. **Gulzar S. Sanghera**, V Tyagi, R Kumar and K S Thind (2014) Genetic variability for cane yield, earliness and quality traits in sugarcane under subtropical region of India. *International Journal of Current Research* 6(8):7763-7765
5. Sajad Hussain Dar, A.G. Rather, **G S Sanghera**, M.A. Ahanger, M.A. Bhat, Noorul - Saleem, M Ahmad, Syeed Talib, S.N. Kurashi and Nazir Ahmad (2014) Identification of effective restorers and maintainers for development of rice hybrids in temperate ecology. *Electronic Journal of Plant Breeding* 5(4): 756-759
6. PK Malhotra, GS Cheema and **GS Sanghera** (2014) Mature Seed based Plant Regeneration system in Wheat (*Triticum aestivum* L). *Research and Reviews in Biotechnology and Biosciences* 11(2): 16-22
7. **G S Sanghera**, V Tyagi, R Kumar, KS Thind and B Sharma (2014) Quality parameters and their association with cane yield in sugarcane under subtropical conditions. In: Proceedings of National Symposium on Crop Improvement for Inclusive Sustainable Development held at Punjab Agricultural University, Ludhiana during November 7-9, 2014. *Crop Improvement* (Sp. Issue) 796-798.
8. R Kumar, **G S Sanghera**, V Tyagi, B Sharma and K S Thind (2014) Correlations among borer complex incidence on cane yield and quality parameters in sugarcane. In: Proceedings of National Symposium on Crop Improvement for Inclusive Sustainable Development held at Punjab Agricultural University, Ludhiana during November 7-9, 2014. *Crop Improvement* (Sp. Issue): 801-803
9. Vijay Raina, **G S Sanghera**, K Raina and D P Pandey (2014) Assessment of genetic diversity in wheat (*Triticum aestivum* L.) over environment. In: Proceedings of National Symposium on Crop Improvement for Inclusive Sustainable Development held at Punjab Agricultural University, Ludhiana during November 7-9, 2014. *Crop Improvement* (Sp. Issue) 494-496.

10. **Gulzar S Sanghera**, V Tyagi, R Kumar, KS Thind and B Sharma (2015) Genetic variability, association and their dissection through path analysis for cane yield and its component traits in early maturing sugarcane clones. *Journal of Science Agriculture* 5 (1): 28-34
11. **Gulzar S. Sanghera**, V Tyagi, R Kumar and K S Thind (2014) Genetic variability for cane yield, earliness and quality traits in sugarcane under subtropical region of India. *International Journal of Current Research* **6(8)**:7763-7765
12. Gazala Hassan Khan, Rakesh Vaishnavi and **Gulzar S. Sanghera** (2014) Genetic divergence studies in bread wheat (*Triticum aestivum* L.) genotypes. *Bioinfolet* **11(2b)**: 481-485
13. D Sharma, **Gulzar S. Sanghera**, P Sahu, Parmeshwar Sahu, M Parikh, B Sharma, S Bhandarkar, P R Chaudhari and B K Jena (2013) Tailoring rice plants for sustainable yield through ideotype breeding and physiological interventions. *African J. Agric. Res.* 8(40): 5004-5019
14. S H wani, S A wani, **Gulzar S Sanghera**, N B singh, Ishfaq abidi, A. Harbushan and Ratan Telem (2013). Novel genome sequencing techniques for accelerating crop improvement. *Journal of Plant Science and Research* **29(2)**: 245-254
15. D Sharma and **Gulzar S. Sanghera** (2013) Breaking yield ceiling in rice through ideotype breeding and physiological interventions. *Journal of Plant Science and Research* **29(2)**: 191-209
16. **Gulzar S. Sanghera**, S C Kashyap and G A Parray (2013) Genetic variation for grain yield and related traits in temperate red rice (*Oryza sativa* L.) ecotypes. *Not Sci Biol* **5(3)**:1-7
17. V K Sharma, **Gulzar S. Sanghera**, P L Kashyap, B B Sharma and C Chandel (2013) RNA interference: A novel tool for plant disease management. *African Journal of Biotechnology* **12(18)**: 2303-2312
18. Z. A. Bhat, M. A Ahangar, **Gulzar S. Sanghera** and T. Mubarak (2013) Effect of cultivar, fungicide spray and nitrogen fertilization on management of rice blast under temperate ecosystem. *International Journal of Science, Environment and Technology* **2(3)**: 410 – 415
19. **Gulzar S Sanghera**, P K Malhotra, G S Sidhu, V K Sharma, B B Sharma and R Karan (2013) Genetic engineering of crop plants for enhanced antioxidants activity. *International Journal of Advancements in Research & Technology* **2(5)**: 428- 458
20. **Gulzar S. Sanghera** and Waseem Hussain (2013) Gene action and combining ability studies using CMS system for developments of hybrid rice under temperate conditions. *American Journal of Agricultural Science and Technology* **1**: 27-44
21. S Latha, D Sharma and **Gulzar S. Sanghera** (2013) Combining ability and heterosis for grain yield and its component traits in rice (*Oryza sativa* L.). *Not Sci Biol* **5(1)**:90-97

22. **Gulzar S. Sanghera** and Waseem Hussain (2012) Manifestation of heterosis for yield and component traits in rice (*Oryza sativa* L.) under temperate environment. *LS – An International Journal of Life Sciences*. **1(2)**: 233-237
23. S H Wani, NB Singh, Jeberson SM, **Gulzar S. Sanghera**, A Haribhushan, BU Chaudhury and MA Bhat (2012) Molecular strategies for identification and deployment of gene(s) for abiotic stress tolerance in crop plants. *LS – An International Journal of Life Sciences*. **1(2)**:128- 142
24. **Gulzar S. Sanghera**, Waseem Hussain, G Singh and G A Parray (2012) Molecular perspective to understand the phenomenon of self-incompatibility and its utilization in crop plants. *INROADS - An International Journal of Jaipur National University*. **1(2)**: 166-177
25. **Gulzar S. Sanghera** and Waseem Hussain (2012) Heterosis in relation to combining ability *per se* performance in temperate rice (*Oryza Sativa* L.). *Pakistan J. Agric. Res.* **25(3)**: 186-195
26. **Gulzar S. Sanghera** and S C Kashyap (2012) Genetic parameters and selection indices in F<sub>3</sub> progenies of hill rice genotypes. *Not Sci Biol* **4(4)**:110-114
27. **Gulzar S. Sanghera** and Waseem Hussain (2012) Study on heterosis in relation to combining ability *per se* performance in temperate rice (*Oryza Sativa* L.). *Elixir Appl. Botany* **49**: 10048-10054
28. **Gulzar S. Sanghera** and Waseem Hussain (2012) Heterosis and combining ability estimates using Line x Tester analysis to develop rice hybrids for temperate conditions. *Not Sci Biol* **4(3)**:131-142
29. **Gulzar S. Sanghera**, M A Ahanger, S C Kashyap, Z A Bhat, A G Rather and G A Parray (2012) False smut of rice (*Ustilaginoidea virens*) under temperate agro-climatic conditions of Kashmir, India. *Elixir Bio Tech.* **49**: 9827-9831
30. S H Wani, **Gulzar S. Sanghera**, H Athokpam, J Nongmaithem, R Nongthongbam, B S Naorem and H S Athokpam (2012) Phytoremediation: Curing soil problems with crops. *African Journal of Agricultural Research* **7(28)**: 3991-4002
31. W Hussain and **Gulzar S. Sanghera** (2012) Exploitation of heterosis in rice (*Oryza sativa* L.) using CMS system under temperate conditions. *Electronic Journal of Plant Breeding* **3(1)**: 695-700
32. **Gulzar S. Sanghera**, M S Gill, G Singh and S S Gosal (2012) *In vitro* plant regeneration through multiple shoot induction in cotton (*Gossypium* spp.). *Elixir Applied Botany* **43**: 6870-6876
33. ZA Bhat, GN Bhat, MA Ahanger, AG Rather, MA Bhat, S Najeeb, FA Sheikh and **Gulzar S. Sanghera** (2012) Bioefficacy of fungitoxicants against blast disease (*Pyricularia grisea*) in rice under temperate conditions of Kashmir, India. *Global Journal of Applied Agricultural Research* **2(1)**: 11-14

34. **Gulzar S. Sanghera**, S H Wani, W Hussain, W Shafi, A. Haribhushan and N B. Singh (2011) The Magic of Heterosis: New Tools and Complexities. *Nature and Science* **9(11)**:42-53
35. **Gulzar S. Sanghera** and V K Sharma (2011) A critical review on morpho-physiological and molecular aspects associated with cold stress in plants. *Elixir Agriculture* **39**: 5065-5075
36. **Gulzar S. Sanghera**, S H Wani, G Singh, P L Kashyap and N. B. Singh (2011) Designing crop plants for biotic stresses using transgenic approach. *Vegetos-An International Journal* **24 (1)**: 1-25
37. **Gulzar S. Sanghera** and V K Sharma (2011) Recent concepts for breeding cold tolerance in crop plants. *The Journal Plant Science Research* **27 (2)**: 123-138
38. **Gulzar S. Sanghera**, M S Gill, S H Wani and S S Gosal (2011) Factors affecting transformation efficiency of shoot apices of *Gossypium arboreum* and *Gossypium hirsutum* cultivars with *Agrobacterium tumefaciens*. *Elixir Bio-Technology* **37**: 3934-3940
39. N Sofi, M A Zargar, AG Rather, B Hassan, FA Sheikh, MA Ahanger, S M Razvi, Z A Dar and **Gulzar S Sanghera** (2011) Hybrid sterility and role of wide compatibility variety in different genetic backgrounds of rice (*Oryza sativa* L.) under temperate conditions of Kashmir. *Applied Biological Research* **13(1)**: 51-53
40. S H Wani, **Gulzar S. Sanghera**, A Haribhushan, N B. Singh and S S Gosal (2011) Bio-physical parameters affecting transient *GUS* expression in *Indica* rice variety PAU 201 via particle bombardment. *Elixir Bio-Technology* **34**: 2496-2501
41. **Gulzar S. Sanghera** and A G Rather (2011) Climate change and importance of maintenance breeding with special reference to rice. In: Rang, A et al. (eds.) Proceeding International Conference on Preparing Agriculture for Climate Change. February 6-8, 2011, Ludhiana, India: *Crop Improvement* **38** (Spl. Issue): pp52
42. P L Kashyap, S Kaur, **Gulzar S. Sanghera**, S S Kang and PPS Pannu (2011) Novel methods for quarantine detection of karnal bunt (*Tilletia indica*) of wheat. *Elixir Agriculture* **31**: 1873-1876.
43. **Gulzar S. Sanghera**, S H Wani, W Hussain and NB Singh (2011) Engineering cold stress tolerance in crop plants. *Current Genomics* **12 (1)**: 30-43.
44. S H Wani, **Gulzar S. Sanghera** and S S Gosal (2011) An efficient and reproducible method for regeneration of whole plants from mature seeds of a high yielding *Indica* rice (*Oryza sativa* L.) Variety PAU 201. *New Biotechnology* **28(4)**: 418-422
45. P Charaya, **Gulzar S Sanghera** and S. S. Gossal (2011) Effect of Genotype and Explants on Direct *In vitro* Plant Regeneration in Brinjal (*Solanum melogena* L.). *The Journal Plant Science and Research* **27 (1)**: 45-51
46. S H Wani, J A. Teixeira da Silva, **Gulzar S. Sanghera**, A. Haribhushan, N. B. Singh, S S Gosal (2011) Regeneration Protocol for Whole Plants from Embryogenic Callus of

Commercial Rice (*Oryza sativa* L.) Variety PR 116. *International Journal of Plant Developmental Biology* **5(1)**:63-66

47. **Gulzar S. Sanghera**, P L Kashyap, G Singh and J A. Teixeira da Silva (2011) Transgenics: Fast Track to Plant Stress Amelioration. *Transgenic Plant Journal* **5 (1)**: 1-26
48. **Gulzar S. Sanghera**, A. M Husaini, Ali Anwer and S C Kashyap (2011) Evaluation of some IRCTN rice genotypes for cold tolerance and leaf blast disease under temperate Kashmir conditions. *Journal of Hill Agriculture* **2(1)**: 28-32
49. P L Kashyap, **Gulzar S. Sanghera**, S H. WANI, W Shafi, S Kumar, A K Srivastva, A Harbushan, D K Arora (2011) Genes of Microorganisms: Paving Way to Tailor Next Generation Fungal Disease Resistant Crop Plants. *Not Sci Biol*, **3(4)**:147-157
50. **Gulzar S. Sanghera** and A M Husaini (2010) Designing maize crop through biotechnological interventions: An overview. *Journal of Research and Development* **10**: 193-214
51. S H Wani, **Gulzar S. Sanghera** and S S Gosal (2010) *In vitro* production of axenic seedlings in rice: Effect of surface sterilants and media on seed germination efficiency. *Journal of Research and Development* **10**: 95-102
52. **Gulzar S. Sanghera**, Husaini AM, Parray GA, Rather AG, Shikari AB, Wani SA (2010) Generation of cold tolerant CMS lines of rice and identification of maintainers/restorers for hybrid rice development in Kashmir. *The Indian Journal of Crop Sciences* **5(1-2)**: 143-146.
53. A M Husaini, M Z Abidin, G A Parray, **Gulzar S. Sanghera**, I Murtaza, T Alam, D K Srivastava, H Farooqi and H N Khan (2010) Vehicles and ways for efficient nuclear transformation in plants. *GM Crops* **1:5**, 1-12.
54. S H Wani, **Gulzar S. Sanghera**, N B Singh (2010) Biotechnology and Plant Disease Control- Role of RNA Interference. *American Journal of Plant Sciences* **1(2)**: 55-68
55. M. Jamal Ahmad and **Gulzar S. Sanghera** (2010) Yield loss assessment of rice cultivars by granivorous birds at pre harvest. *Annals of Plant Protection Sciences* **18(2)**: 521-522
56. **Gulzar S. Sanghera**, AM Husaini, AG Rather, GA Parray and AB Shikari (2010) SKAU 7A and SKAU 11A: New cold tolerant CMS lines from Kashmir, India. *International Rice Research Notes* 35: 1-3
57. S H Wani and **Gulzar S. Sanghera** (2010) Genetic engineering for viral disease management in plants. *Not Sci Biol* **2 (1)**: 20-28
58. **Gulzar S. Sanghera** and GA Parray (2010) Variation for drought tolerance in hill rice genotypes. *Crop Improvement* **37(1)**: 21-24
59. **Gulzar S. Sanghera**, MS Gill and SS Gosal (2010) Optimization of shoot tip-based *in vitro* plant regeneration in cotton (*Gossypium* spp.). *International Journal of Plant Developmental Biology* **4**: 26-30
60. M Mahajan, PK Malhotra, **Gulzar S. Sanghera** and P Mahajan (2010) Response for callus induction and plant regeneration in commercial Potato varieties. *SKUAST J Res* **12**: 42-47
61. **Gulzar S. Sanghera**, MS Gill, JS Sandhu and SS Gosal (2009) Effect of pre-soaking duration, media and sterilization on *in vitro* germination of cotton seeds (*Gossypium* spp.). *SKUAST J Res* **11**: 261-270.

62. **Gulzar S. Sanghera**, M S Gill, J S Sandhu and S S Gosal (2009) Transient expression of  $\beta$ -glucuronidase gene in transformed shoot tips and calli of cotton (*Gossypium spp.*). *Crop Improvement* **24**: 1-5.
63. **Gulzar S. Sanghera**, M S Gill, J S Sandhu and S S Gosal (2009) Effects of genotype, growth regulator and explant on callus induction in cotton (*Gossypium hirsutum* L.). *The Asian and Australian Journal of Plant Science and Biotechnology* **3(1)**: 37-42.
64. AM Husaini, GA Parray AG Rather, and **G S Sanghera** (2009) Performance of elite basmati rice varieties of subtropical India under temperate valley conditions of Kashmir. *IRRN*: 5-8
65. **G S Sanghera** and R K Tyagi (2009) *In vitro* plantlet regeneration from encapsulated shoot buds of ginger (*Zingiber officinale* Rosc.) Cv. Rio de Janeiro. Proceeding National Workshop on "Spices and Aromatic Plants" at Department of Agronomy, PAU, Ludhiana, Feb. 4-5, 2009. pp 42-46.
66. S K Mann, P L Kashyap, **Gulzar S. Sanghera**, Gurpreet Singh and Sondeep Singh (2008) RNA Interference: An eco-friendly tool for plant disease management. *Transgenic Plant Journal* **2(2)**:110-126.
67. **Gulzar S. Sanghera** and S H wani (2008) Innovative approaches to enhance genetic potential of rice for higher productivity under temperate conditions of Kashmir. *The Journal Plant Science and Research* **24**: 99-113.
68. Singh SP, **Sanghera G S**, Parray GA and Bhat GN (2006) Genetic variability and character association studies in rice (*Oryza sativa* L.) *Agric. Sci. Digest*, **26 (3)**: 212- 214.
69. **G S Sanghera** (2005) Path analysis in some rye introgressed wheat derivatives. *Agric. Sci. Digest*, **25(3)**: 178-181.
70. Singh SP, **Sanghera G S**, Parray GA and Bhat GN (2005) Genetic variability and heritability in rice (*Oryza sativa* L.). *Environment and Ecology* **23(3)**: 549-551.
71. **G S Sanghera**, MA Zarger and SP Singh (2004) Heritability and relationships studies for grain yield and some morpho-physiological traits in rice (*Oryza sativa* L.) grown under temperate conditions. *SKUAST J. Res.* **6 (1)**: 134-137.
72. **G S Sanghera** and RK Tyagi (2003) Studies on the effect of Maleic hyderazide on *in vitro* cultures of ginger (*Zingiber officinale* Rosc.) Cv. Rio de Janeiro. *SKUAST J. Res.* **5 (2)**: 202-206.
73. Ali Anwar, N Ahmad, M A Zarger, **G S Sanghera**, M A Rather, GN Bhat, GA Parrey and MY Salroo (2003) Evaluation of elite rice genotypes against blast disease (*Magnaporthe grisea*) under epiphytotic conditions in Kashmir. *Plant Disease Research* **18 (10)**: 77-79.
74. **G S Sanghera**, N Ahmad, M A Zarger and MA Rather (2003) Studies on the performance of some CMS lines under temperate conditions of Kashmir. *SKUAST J. Res.* **5 (1)**: 121-124.
75. **G S Sanghera**, GS Sethi and G A Parrey (2003) Evaluation of some rye introgressed wheat derivatives to leaf rust and powdery mildew diseases. *Ann. Pl. Protec.* **11 (1)**: 90-92.
76. **G S Sanghera** (2003) Genetic variability and association for yield and quality traits in the rye introgressed wheats (*Triticum aestivum* L.). *Applied Biological Research* **5 (1&2)**: 47-49.
77. Ali Anwar, GN Bhat and **G S Sanghera (2003)** Effect of seed treatment through biogents and blitox on the incidence of leaf blast disease (*Magnaporthe grisea*) and seedling growth of rice under temperate conditions. *New Agriculturist* **13 (2)**: 45-47.



78. **G S Sanghera**, N Ahmad, MA Zarger and SP Singh (2003) Variability and association studies for panicle and grain characters in rice (*Oryza sativa* L.) under temperate conditions. *Agric. and Biol. Research* **19** (2): 91-96.
79. Ali Anwar, GN Bhat and **G S Sanghera** (2002) Management of sheath blight and blast in rice through seed treatment. *Ann. Pl. Protec.* **10** (2): 285-287.
80. **G S Sanghera** and GS Sethi (2001) Genetic variability and association studies for drought tolerance in rye introgressed wheat under *in vitro* conditions. *SKUAST J. Res.* **3**: 47-51.
81. **G S Sanghera** and GS Sethi (2001) Relative drought tolerance and association studies in rye introgressed bread wheat under water stress environment. *Applied Biological Research* **3** (1&2): 36-40.
82. **G S Sanghera** and GS Sethi (2000) Comparative assessment of genetic variability among rye introgressed bread wheat under water stress and non-stress environments. *SKUAST J. Res.* **2**: 178-181.

## II) Books (Edited): 3

1. C P Malik, **Gulzar S Sanghera**, S H Wani and P Sharma (2013) *Crop Improvement: Biotechnological, Physiological and Nanotechnological Approaches*. ISBN: 978-81-7910-398-2, Pages: 286, Aavishkar Publishers, Jaipur, India
2. C P Malik, **Gulzar S Sanghera** and P Sharma (2013) *Crop Improvement: An Integrated Approach*. ISBN: 978-81-7533-456-4, Pages: 285, MD Publication Pvt Ltd. New Delhi (www.mdpppl.com)
3. C P Malik, **Gulzar S Sanghera** and S H Wani (2013) *Conventional and Non-conventional Interventions in Crop Improvement*. ISBN: 978-81-7533-457-1, Pages: 279, MD Publication Pvt Ltd. New Delhi (www.mdpppl.com)

## III) Book Chapters: 19

1. Gulzar S. Sanghera, Subhash Chander Kashyap and F.A. Aga (2014) Site Specific Varietal Improvement Strategies for Rice Breeding in Temperate Regions. Precision farming : a new approach (Tulasa Ram et al. eds) Pp 171-191.
2. **Gulzar S Sanghera**, S H Dar, S C Kashyap and G A Parray (2013) Participatory Plant Breeding: Targeting the Needs of Resource-Poor Farmers in Marginal Areas. In: *Crop Improvement-An Integrated Approach* (Malik CP, G S Sanghera et al. eds). Pp 263-284
3. **Gulzar S Sanghera** and SC Kashyap (2013) Mutation breeding in genomic era: New opportunities and challenges. In: *Conventional and Non- Conventional Interventions in Crop Improvement* (Malik CP, G S Sanghera et al. eds) Pp 259-278
4. SC Kashyap and **Gulzar S Sanghera** (2013) Breeding for specific adaptation to increase yield potential of rice for hill regions. In: *Conventional and Non-Conventional Interventions in Crop Improvement* (Malik CP, G S Sanghera et al. eds) Pp 165-184

5. **Gulzar S Sanghera**, W Hussain and SC Kashyap (2013) Progress in hybrid rice research and development under Kashmir condition. In: *University Research in Kashmir Rice- Historical Perspectives* (Shafiq A. Wani et al. eds). Pp 88-102
6. Sajad H Dar, W Hussain and **Gulzar S Sanghera** (2013) Advances in Hybrid Rice Technology through Applications of Novel Technologies. In: *Crop Improvement-An Integrated Approach* (Malik CP, G S Sanghera et al. eds). Pp 61-67
7. W Hussain, **Gulzar S Sanghera**, N S Jamwal and A Badiyal (2013) Crop Improvement in Sustainable way through Genomic Interventions. In: *Crop Improvement-An Integrated Approach* (Malik CP, G S Sanghera et al. eds). Pp 1-13
8. SC Kashyap and **Gulzar S Sanghera** (2013) Rice-wheat rotation in Kashmir: prospects and problems. In: *University Research in Kashmir Rice- Historical Perspectives* (Shafiq A. Wani et al. eds). Pp 170-175
9. S H Dar, **Gulzar S. Sanghera** and A G Rather (2012) Biotechnological Interventions to Improve the Nutritional Quality of Food Crops. In: *Crop Improvement: Biotechnological, Physiological and Nanotechnological Approaches* (Malik CP, G S Sanghera et al. eds). Pp 111-133
10. M A Dar, Gul Zaffar and **Gulzar S. Sanghera** (2012) Genomic Tools in Crop Improvement. In: *Crop Improvement: Biotechnological, Physiological and Nanotechnological Approaches* (Malik CP, G S Sanghera et al. eds). Pp 70-97
11. **Gulzar S. Sanghera**, P L Kashyap and P K Malhotra (2012) Tailoring Crop Plants for Adverse Conditions via Transgenic Approach. In: *Crop Improvement: Biotechnological, Physiological and Nano-technological Approaches* (Malik CP, G S Sanghera et al. eds). Pp 1-69
12. K. Mandal, Prem L. Kashyap, M. S. Gurjar , **Gulzar S. Sanghera**, S. Kumar and S. C. Dubey (2012) Recent Biotechnological Achievements in Plant Disease Management. In: *Current Concepts in Crop Protection* Pp76-129
13. P L Kashyap, S I Kaur, Namita and **Gulzar S. Sanghera** (2011) ABC Transporters: Fascinating Molecules Unraveling Plant Pathogen Interactions. In: *Plant, Environment and Sustainability* (Trivedi P.C. ed) Pp. 209-226
14. P K Malhotra, G Singh, **Gulzar S. Sanghera**, S. K. Sandhu and M. Mahajan (2011) Plastid Transformation and its Applications in Crop Improvement: An Overview. In: *Biotechnology: A New Hope* (Trivedi P.C. ed) Pp. 47-66
15. **Gulzar S. Sanghera**, S H. Wani, M S Gill, P L Kashyap and S S Gosal (2010) RNA Interference: Its Concept and Application in Crop Plants. In: *Biotechnology Cracking New Pastures* (Malik C.P. and Aman Verma eds). Pp. 33-78

16. P L Kashyap, **Gulzar S. Sanghera** and Ashok Kumar (2010) Quorum Quenching: A New Hope for Phytobacterial Disease Management. In: *Biotechnology: Developments and Applications* (Malik C.P. ed) pp 66-86
17. **Gulzar S. Sanghera**, P L Kashyap, S H Wani and G Singh (2010) QTL Herald: A Revival of Biometrical Genetics. In: *Genetic Engineering: A New Hope for Crop Production and Improvement* (Malik C.P. ed) pp 110-138
18. **Gulzar S. Sanghera**, S H wani, M S Gill and S S Gosal (2009) Recent approaches for optimization of transgene expression in plants. In: *Crop Breeding and Biotechnology* (Malik C.P. et al eds) pp 1-32
19. **Gulzar S. Sanghera** and S H wani (2009) Innovative approaches to enhance genetic potential of rice for higher productivity under temperate conditions of Kashmir. In: *Crop Breeding and Biotechnology* (Malik C.P. et al eds) pp 192-208

#### IV) Popular Article: 1

1. **G S Sanghera** (2004) Kashmir Mein Dhan Ki Unnat Kismein. *Unnat Krishi* (ICAR) Nov- Dec. 2004, pp 26-27.

#### V) Other Publications Presented/Documented in Seminars/ Conferences/ Symposia: 40

1. Rajinder Kumar, **Gulzar S Sanghera**, Vikrant Tyagi and Bipen Sharma (2014) Prevalence of insect pests and bioagents in sugarcane agro-ecosystem under Punjab conditions. International conference on **Changing Scenario of Pest Problems in Agri-Horti Ecosystem and their Management** at Department of Entomology, College of Agriculture, Maharana Partap University of Agriculture and Technology Udaipur, Rajasthan during November 27-29, 2014.
2. Rajinder Kumar, **Gulzar S. Sanghera**, K S Thind and Bipan Sharma (2014) Management of borer complex in sugarcane through pheromone. In *National Symposium on Bioenergy for Sustainable Development-The Potential Role of Sugar Corps* organized by Society for Sugarcane Research and Development and Sugarcane Breeding Institute, ICAR, Coimbatore during 23-25 June, 2014 (Accepted).
3. **Gulzar S. Sanghera**, Vikrant Tyagi, Rajinder Kumar and K S Thind (2014) Selection Indices for Earliness, Yield and Quality Traits in Sugarcane for Sub-tropical Region of India. International Conference on "Crop Productivity and Sustainability- Shaping the Future", Baba Farid Group of Institution, Bathinda, March 20-21, 2014. Pp 31-34.
4. K S Thind, Mandeep Kaur, **Gulzar S. Sanghera** and R S Gill (2014) Gamma Rays Induced Useful Variations for Quality and Economic Traits in Sugarcane (*Saccharum* Spp). National seminar on Recent Advances and Challenges in Sugarcane Research UAS, BC Farm, Mandya, Mysore, Jan 23-24, 2014. Pp

5. Rajinder Kumar, **Gulzar S Sanghera** and K S Thind (2014) Evaluation of elite sugarcane genotypes for their reaction against sugarcane borer complex and economic traits under Punjab conditions. In *National Seminar on Recent advances and Challenges in Sugarcane Research* organized by Director of Research Station, V.C. Farm, Mandaya of University of Agricultural Science, GKVK, Bangalore during January 23-24, pp-128.
6. **Gulzar S. Sanghera**, S C. Kashyap, and G A Parray (2012) Recent breakthroughs in hybrid rice research and development in Kashmir, India. 2nd Jammu and Kashmir Agricultural Science congress on "Sustainable hill agriculture for food and livelihood security: technological innovation, opportunities and challenges", SKUAST- Jammu, Chatha, December, 15-17, 2012. pp 287-288
7. G A Parray, S Najeb, S A Wani, M A Bhat, A Ashfaq, **G S Sanghera**, G M Mushki and M Y Ghani (2012) High valued rice landraces of Kashmir-Present status and future prospects. 2<sup>nd</sup> Jammu and Kashmir Agricultural Science congress on "Sustainable hill agriculture for food and livelihood security: technological innovation, opportunities and challenges", SKUAST- Jammu, Chatha, December, 15-17, 2012. pp 77-78
8. S H Dar, AG Rather, **G S Sanghera**, N R Sofi, M A Ahanger, Waseem Hussain and Mushtaq Ahmad (2012) Studies on F1 rice hybrids using CMS lines over environments under temperate conditions. 2<sup>nd</sup> Jammu and Kashmir Agricultural Science congress on "Sustainable hill agriculture for food and livelihood security: technological innovation, opportunities and challenges", SKUAST- Jammu, Chatha, December, 15-17, 2012. pp 365-366
9. **G S Sanghera**, G M Mushki and G A Parray (2012) Evaluation of elite rice lines/ land races for high iron and zinc from Kashmir, India. 2<sup>nd</sup> Jammu and Kashmir Agricultural Science congress on "Sustainable hill agriculture for food and livelihood security: technological innovation, opportunities and challenges", SKUAST- Jammu, Chatha, December, 15-17, 2012. pp 77-78
10. P K Malhotra, G S Sidhu, G Singh, **Gulzar S Sanghera** and S K Sandhu (2012) Marker free Transgenics: Strategies and Drawbacks. National Seminar on Biotechnological Approaches in Pest Management. PAU, Ludhiana, 4-5 May, 2012. Pp 9-10
11. S C. Kashyap, **Gulzar S. Sanghera**, A G Rather, G A Parray, A M Husaini and N R Sofi (2012) Variability and Association Studies for Yield and Component Traits in ZAG land race of rice (*Oryza sativa* L.) National Seminar on Sustainable Agriculture and Food Security: Challenges in Changing Climate. CCS, HAU, Hisar, 27-28 March, 2012.
12. **Gulzar S. Sanghera**, A. G Rather, A M. Husaini, S C Kashyap, Waseem Hussain, Z Dar and N R Sofi (2011) Prospects of three-line hybrid rice (*Oryza sativa* L.) under temperate Kashmir Conditions. 1<sup>st</sup> Jammu and Kashmir Agricultural Science congress on "Mountain Agriculture in Transition: Challenges and way Forward", SKUAST- Kashmir, Srinagar, September, 8-10, 2011. pp 283-284

13. W Hussain, **Gulzar S. Sanghera**, A. G Rather and S C Kashyap (2011) Effects of seed hydo-priming on seed germination and seedling vigour in rice (*Oryza sativa* L.) under temperate conditions. 1<sup>st</sup> Jammu and Kashmir Agricultural Science congress on "Mountain Agriculture in Transition: Challenges and way Forward", SKUAST-Kashmir, Srinagar, September, 8-10, 2011. pp 158
14. S Najeeb, M A Ahangar, A G Rather, M A Zargar, **G S Sanghera**, Z A Bhat, S C Kashyap and Z A Dar (2011) Bakane and foot rot disease: A potent threat to rice production under hill ecology of Kashmir. 1<sup>st</sup> Jammu and Kashmir Agricultural Science congress on "Mountain Agriculture in Transition: Challenges and way Forward", SKUAST- Kashmir, Srinagar, September, 8-10, 2011. pp 231
15. A G rather and **Gulzar S. Sanghera** (2011) Rejuvenation of local aromatic land races of rice (*Oryza sativa* L.). 1<sup>st</sup> Jammu and Kashmir Agricultural Science congress on "Mountain Agriculture in Transition: Challenges and way Forward", SKUAST- Kashmir, Srinagar, September, 8-10, 2011. pp 282-283
16. **Gulzar S Sanghera**, M S Gill and SS Gosal (2010) Optimization of shoot tip based *in vitro* regeneration in cotton (*Gossypium* spp.). Proceedings 97<sup>th</sup> Indian Science Congress, January 3-7, 2010, Thiruvananthapuram. Pp226
17. A M. Husaini, **G. S. Sanghera**, G. A. Parray, S. Kashyap and A. G. Rather (2010) Varietal Improvement through Hybridization between VL Dhan Type Rice Varieties and Valley Temperate Rice Varieties of Kashmir. 6<sup>th</sup> J&K Science congress, University of Kashmir, Srinagar, Dec. 2-4, 2010. Pp 13
18. A M. Husaini, Z. A. Bhat, **G. S. Sanghera**, A. G. Rather, G. N. Bhat and G. A. Parray (2010) Development of Blast Resistant Rice Genotypes for Valley Temperate Conditions through Hybridization -an Initiative. 6<sup>th</sup> J&K Science congress, University of Kashmir, Srinagar, Dec. 2-4, 2010. Pp 13
19. **Gulzar S. Sanghera**, A M. Husaini and A. G Rather (2010) Identification of maintainers and restorers for newly developed CMS lines of rice for temperate Kashmir conditions. 6<sup>th</sup> J&K Science congress, University of Kashmir, Srinagar, Dec. 2-4, 2010. Pp 35
20. S H Wani, **Gulzar S. Sanghera** and S.S. Gosal (2010) Studies on parameters affecting transient GUS expression in rice (*Oryza sativa* L.) calli via particle bombardment. 6<sup>th</sup> J&K Science congress, University of Kashmir, Srinagar, Dec. 2-4, 2010. Pp 228
21. S H. Wani, **Gulzar S. Sanghera** and S.S. Gosal (2010) *In vitro* production of axenic seedlings in rice: Effect of surface sterilant and media on seed germination efficiency. 6<sup>th</sup> J&K Science congress, University of Kashmir, Srinagar, Dec. 2-4, 2010. Pp 31
22. **Gulzar S. Sanghera**, M S Gill, J S Sandhu and S S Gosal (2009) *In vitro* multiple shoot induction and regeneration in cotton (*Gossypium* spp.). 9<sup>th</sup> Agricultural Science congress on "Technological and Institutional Innovations for Enhancing Agricultural Income" at SKUAST- Kashmir, Srinagar, June 22-24, 2009. pp338.

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24. **Gulzar S. Sanghera**, M S Gill, J S Sandhu and S S Gosal (2009) Factors affecting production of axenic seedlings *in vitro* for genetic transformation in cotton. In: 12<sup>th</sup> Punjab Science Congress, Feb., 7-9, 2009 abstract no.Ap154 pp.109.
25. **Gulzar S. Sanghera**, M S Gill, J S Sandhu and S S Gosal (2008) Influence of hormonal regime and explant types on callus induction and proliferation in elite cotton (*Gossypium hirsutum* L.) cultivars. National Symposium on “New Biology in Agriculture” Punjab University, Chandigarh, Nov., 7-8, 2008 pp.38.
26. Singh SP, **Sanghera G S**, Parray GA and Bhat GN (2005) Performance of some aromatic short grained basmati rices in Kashmir. National symposium on “Basmati Rice Research: Current Trends& Future Prospects” at S.V.B.P.U.A. &T, Meerut, 6-7 Sept. 2005. pp 159.
27. **G S Sanghera**, SP Singh, Shafiq A Wani, GA Parrey and GN Bhat (2005) Problems and prospects for basmati rice cultivation in Kashmir to harness commercial benefits to farmers- An Overview. National symposium on “Basmati Rice Research: Current Trends& Future Prospects” at S.V.B.P.U.A. &T, Meerut, 6-7 Sept. 2005.pp 125-126.
28. Singh SP, **Sanghera G S**, Parray GA and Bhat GN (2005) Performance of some rice genotypes in variable environments. In: 7th Indian Agricultural Scientists and Farmers Congress organized by Bioved Research and Communication centre, Allahabad and S.V.B.P.U.A. &T, Meerut. 19-20 Feb., 2005, abstract no. 31 pp 14
29. Singh SP, **Sanghera G S**, Parray GA and Bhat GN (2005) Estimation of genetic variability and heritability in rice (*Oryza sativa* L.). In: 1st J& K Science Congress held at University of Jammu during 7-9 Feb., 2005, Abstract no. 337, pp : 235-236.
30. **G S Sanghera**, SP Singh, GN Bhat and GA Parrey (2004) Impact of water stress on grain yield and its component traits in rice. International symposium on “Rainfed Rice Ecosystems: Perspectives and Potentials” at IGAU, Raipur, Chhattisgarh, 11-13 Oct., 2004. pp 35-36.
31. SP Singh, **G S Sanghera**, GA Parrey and GN Bhat (2004) Characterization of traditional rice cultivars of Kashmir. Presented in “6th Indian Agricultural Scientists and Farmer Congress” 21-2Feb.2004. pp39.
32. SP Singh, **G S Sanghera**, GA Parrey and GN Bhat (2003) Variability and character association in rice (*Oryza sativa* L.). National seminar on “Advances in Genetics and plant Breeding- Impact of DNA Revolution” at UAS, Dharwad, Oct., 30-31, 003. pp 103-104.

33. SP Singh, **G S Sanghera**, MA Rather and MA Zarger (2002) Studies on performance of some exotic fine grained aromatic rice (*Oryza sativa* L.) strains under temperate conditions of Kashmir. National symposium on "Agriculture in Changing Global Scenario" at IARI, New Delhi, 221-223 Feb. 2002. pp 70-71.
34. **G S Sanghera**, G A Parrey, S P Singh, Md Jamal Ahmad and A H Bandey 2002) Studies on comparative performance of some rice varieties/ elite lines under normal and water stress conditions. National symposium on "Upland Rice Production Systems" at CRURRS, Hazaribagh, Jharkhand, 26-28 sept. 2002, pp 157.
35. **G S Sanghera** and R K Tyagi (2001) Studies on the effect of Maleic hyderazide on *in vitro* cultures of ginger ( *Zingiber officinale* Rosc.) Cv. Rio de Janeiro. National Seminar on "Agriculture and Environment" at SKUAST, Shalimar, March 28-29, 2001. pp38.
36. **G S Sanghera**, N Ahmad, M A Zarger and M A Rather (2001) Studies on the performance of some CMS lines under temperate conditions of Kashmir. National Seminar on "Agriculture and Environment" at SKUAST, Shalimar, March 28-29, 2001. pp54.
37. G N Bhat, Ali Anwar, **G S Sanghera** and M A Rather (2001) Occurrence of fungal diseases and their severity on rice under Kashmir conditions. National Seminar on "Agriculture and Environment" at SKUAST, Shalimar, March 28-29, 2001. pp57.
38. **G S Sanghera**, Ali Anwar, S P Singh, M A Zarger and GN Bhat (2001) Reaction of some rice genotypes to blast disease ( *Magnaporthe grisea*) under Kashmir conditions. National Symposium on "Plant Protection Strategies for Sustainable Agri- Horticulture" SKUAST (J), R.S.Pora, Jammu, 12-13 October, 2001. pp125.
39. **G S Sanghera**, M A Zarger, Ali Anwar, S P Singh, G N Bhat and M A Rather (2001) Studies on spikelet fertility and incidence of leaf blast on certain IRCTN rice genotypes under temperate conditions. National Symposium on "Plant Protection Strategies for Sustainable Agri- Horticulture" at SKUAST (J), R.S.Pora, Jammu, 12-13 October, 2001. pp 125-126.
40. **G S Sanghera** and G S Sethi (2001) Genetic variability studies on seed germination and seedling traits of rye introgressed wheats under different external conditions *in vitro*. National seminar on " Role of Plant Physiology for Sustaining Quality and Quantity of Food production in relation to environment" at UAS, Dharwad, 5-7,Dec., 2001. pp94.

## VI) Article Presented in Refresher course/winter/ summer schools: 8

1. **Gulzar S. Sanghera** (2012) Action plan for participatory plant breeding at community level. Lecture delivered in training programme on "Participatory Plant Breeding and Local Seed System" held at Directorate of Research, SKUAST-Kashmir, Shalimar Srinagar (Sept. 17, 2012).

2. **Gulzar S. Sanghera** and Amjad M. Hussaini (2010) Biotechnological interventions in maize crop. Lecture delivered in training programme on “ISOPOM Training on Maize” held at K D Research Station, Old Airport Srinagar (Feb. 9, 2010).
3. **Gulzar S. Sanghera** (2007) Advances in transgenic development and optimization of transgene expression. Lecture delivered at training programme on “Use of Biotechnological Tools in Crop Improvement”. Sponsored by ICAR (28-11- 2007 to 18- 12-2007) at Centre of Advance Studies, Department of Plant Breeding, Genetics and Biotechnology, PAU, Ludhiana.pp 43-61.
4. **Gulzar S. Sanghera** and M A Zarger (2005) Strategies to enhance stability in rice genotypes for yield and grain characteristics. Presented in a model training course on “Temperate Rice Production Technology” sponsored by Ministry of Agriculture and Cooperation (Nov.7-14, 2005) at Directorate of Extension Education, SKUAST, Shalimar
5. **G S Sanghera**, S P Singh, N Ahmad and Raj Narayan (2004). Use of gametocides in hybrid seed production of vegetables. Presented in summer school on “Recent Advance in Hybrid Seed Production of Important Vegetables” held on 03-23 August, 2004 at Division of Olericulture, SKUAST (K) Shalimar. Pp, 93-98.
6. Singh S P, **Sanghera, G S**, Ahmed N and Raj Narayan (2004) Production and development of vegetable hybrids under protected conditions/ structures. Lecture delivered at Summer/ Winter School on “Recent Advances in Hybrid Seed Production of Important Vegetables”. Sponsored by ICAR (03-23 August, 2004), Division of Olericulture, SKUAST (K) Shalimar. Pp, 54-56
7. A H Bandey and **G S Sanghera** (2002) Seed quality assurance during production, processing and storage. Presented in a short course on “Recent Advances in Rice Production Technology in the Hills” held on 1-10 August, 2002, at Division of Plant Breeding and Genetics, SKUAST (K)- Shalimar. Pp 32-41.
8. N Ahmad, **G S Sanghera**, M A Zarger and M A Rather (1999) Status of rice production in world, India and Jammu and Kashmir. Presented in a training programme on “Rice Production Technology” held on 25-29, 1999 at Directorate of Extension Education, SKUAST, Shalimar. Pp1-15.

### **Participation in Refresher course/Summer school: 10**

S. No.	Title of Course	Duration	Organizing Institute
1	Attended training on “Novel Genomic Tools and Breeding Approaches for Sugar Crops Improvement”	21 days (September 09-29, 2014)	ICAR-Indian Institute of Sugarcane Research, RaeBareli Road, Lucknow - 226002 (U.P.)
2	International training on “Application of Geo-Informatics and remote sensing in Agriculture land use management”	14 days (Dec. 27, 2012 to Jan. 9, 2013)	CGIRT, CSKHPAU, Palampur



3	International training course on “Advanced Approaches in Participatory plant Breeding for food security and sustainable agriculture”	5 days (July 23 -27, 2012)	SKUAST-Kashmir, CARIAD, Bangor university, UK and Biodiversity international, New Delhi
4	Breeding Designer Crops	21 days (March 9-30, 2010)	Centre for advance faculty training, Deptt. Plant breeding and Genetics, PAU, Ludhiana
5	Recent Advances in Chromosome Manipulation for Increasing Production and Transfer of In Built Resistance to Biotic and Abiotic Stresses	21 Days (Nov. 8-28, 2005)	Department of Botany, MPKV, Rahuri, Ahmednagar, Maharashtra
6	Alien Introgression and Wide Hybridization in Crop plants	21 days (Feb. 2-22, 2005)	Centre of advance studies, Deptt. Plant breeding, Genetics and Biotechnology, PAU, Ludhiana
7	Advances in Rapeseed Mustard Research Technology for Sustainable Production of Oilseeds	21 days (15Dec. 2004 - 4 Jan. 2005)	NRCR&M (ICAR), Bharatpur, Rajasthan
8	Wild Relatives of Crop plants and post collection Handling of germplasm	5 days (27-30 Aug. 2004)	NBPGR, Regional Station, Phagli, Shimla at CSKHPKV, Palampur
9	Advances in Hybrid Rice Technology	21 days (10-30 Sept., 2003)	Directorate of Rice Research (ICAR), Rajanderanagar, Hyderabad
10	<p>HRD in PGR Conservation and Management under ToE mode of NATP</p> <p><b>i) Course Offered :</b> <i>Ex situ</i> Conservation of PGR</p> <p><b>ii) Project Undertaken:</b> <i>In vitro</i> conservation and Cry preservation of ginger (<i>Zingiber officinale</i> Rosc.) Cv. Rio de Janeiro.</p> <p><b>iii) Objectives :</b> a) <i>In Vitro</i> multiplication of ginger</p> <p>b) Studies on effect of growth retardants on <i>in vitro</i> cultures of ginger</p> <p>c) Cryo preservation of shoot buds of ginger</p>	6 Months (4-1-2000 to 30-6-2000)	NBPGR, New Delhi

