

## Profile

### Dr. Sohail Hameed, PS

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### Academic Qualifications:

Ph.D	2004	Quaid-i-Azam University, Islamabad, <b>Pakistan</b>
M.S. (Biol.)	1986	Memorial Univ. of NFLD, Newfoundland, <b>Canada</b>
M.Sc.(Biol.)	1982	Quaid-i-Azam University, Islamabad, <b>Pakistan</b>
B.Sc.	1979	Govt. Degree College, Rawalpindi, (Punjab University, Lahore) <b>Pakistan</b>
F.Sc.	1975	C.B. College for Boys, Wah Cantt, <b>Pakistan</b>
S.S.C.	1973	Sir Syed High School, Wah Cantt, <b>Pakistan</b>

### Specializations:

#### *Agriculture Biotechnology*

Applied Microbiology, Molecular Ecology & Transmission Electron Microscopy

### Current Responsibilities:

- \* Head, Plant Microbiology Division
- \* Microbial Interaction in Leguminous and Non-leguminous Crops
- \* Group Leader: Microbial Physiology Group
- \* Incharge: Transmission Electron Microscope Facilities
- \* Higher Education Commission approved Ph D supervisor
- \* Faculty member M Phil / Ph D School of Biotechnology, NIBGE/ Quaid-i-Azam University, Pakistan Institute of Engineering and Applied Sciences (PIEAS)

### Scientific Achievements:

- \* Development of Bio-inoculants for legumes (fodder & grain), cereals (rice & wheat) and others (cotton, maize and onion).
- \* Development of commercial scale production facilities for Bio-inoculants.
- \* Introduction, distribution and marketing of Bio-inoculants in Pakistan.
- \* Established Transmission Electron Microscopy (TEM) & related facilities at NIBGE.
- \* Established Immunogold Labeling technique for TEM at NIBGE.

### Commercial Product:

- \* Development of commercial Bio-inoculants (**BioPower**)

### Scientific Work In Progress:

- \* 16S rRNA Sequencing of (*Brady*)*rhizobium* strains for identification and characterization
- \* Immunogold labelling of (*Brady*)*rhizobium*, Plant Growth Promoting Rhizobacteria and Fungi for ultrastructure identification and their localization with plant tissue
- \* Effect of pesticides on seed/seedling application of Bio-inoculants
- \* Field evaluation of Bio-inoculants, developed for various crops

- \* Mobilization of macronutrients (phosphates) & micronutrients (zinc) by rhizobacteria
- \* Interaction of mycorrhizae with rhizobacteria and its association with plant roots

### Research/ Job Experience:

Research experience of over 22 years in the field of Biological Nitrogen Fixation & Transmission Electron Microscopy

- Principal Scientist:** National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad, Dec. 2000 - to-date
- Senior Scientific Officer:** National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad, Dec. 1992 - Nov. 2000
- Scientific Officer:** Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Apr. 1989 - Nov. 1992
- Teaching Research Associate:** Quaid-i-Azam University, Islamabad, Apr. 1988 - Dec. 1988
- Research Fellow:** Memorial Univ. of NFLD, Canada, Jan. 1984 - Sep. 1986

### Trainings:

- \* **HEC Post – Doctoral Fellowship:** Scottish Crop Research Institute (SCRI), Dundee, Scotland, **UK.** December 16, 2006 – December 16, **2007.**
- \* **First PAEC Advanced Management Course:** Pakistan Institute of Engineering and Applied Sciences (PIEAS), Nilore, Islamabad, **Pakistan.** January 23 – February 03, **2006.**
- \* **ISO 1725 Lab. certification:** NIBGE, Faisalabad / Directorate of Quality Assurance PAEC - **Pakistan,** September 22, **2005.**
- \* **Digital Library Training Workshop scheduled Biological Sciences Resources Online:** Higher Education Commission/ University of Punjab, Lahore-**Pakistan.** June 02, **2005.**
- \* **Understanding ISO 9001:2000:** Qualitas Training Division, Qualitas Systems, Registered Consultants with Ministry of Science & Technology, Govt. of Pakistan/ National Institute for Biotechnology and Genetic Engineering, Faisalabad, **Pakistan.** October 03, **2003.**
- \* **Techniques in Transmission Electron Microscopy. Three months IAEA fellowship:** Scottish Crop Research Institute, Invergowrie, Dundee, DD2 5DA, Scotland, **U.K.** June 11, 2001 - Sept. 10, **2001.**
- \* **The Application of Immuno Gold Labeling Technique for the Detection of Viruses and Bacteria in Thin Sections under Transmission Electron Microscope:** IAEA/National Institute for Biotechnology and Genetic Engineering, Faisalabad, **Pakistan.** Sept. 4 - 15, **2000.**
- \* **Advance Technical Training Course in Transmission Electron Microscopy:** JEOL Ltd, Tokyo, **Japan.** May 10 - 16, **1999.**
- \* **Technical Training in Transmission Electron Microscopy:** IAEA/National Institute for Biotechnology and Genetic Engineering, Faisalabad, **Pakistan.** Dec. 5 - 12, **1998.**
- \* **Advance Courses in Biotechnology:** National Institute for Biotechnology and Genetic Engineering, Faisalabad, **Pakistan.** Sept. 1995 - Jan. **1996.**
- \* **Molecular Ecology of *Frankia* by 16S rRNA Sequence Analysis:** Wageningen Agricultural University, Wageningen, **The Netherlands.** Jan. 1993 - Jun. **1993.**
- \* **Nuclear Orientation Course for Scientists/Engineers:** Centre for Nuclear Studies, Nilore, Islamabad, **Pakistan.** Jul. 1990 - Oct. **1990.**
- \* **Nuclear Orientation Course for Scientists:** Nuclear Institute for Agriculture and Biology, Faisalabad, **Pakistan.** Jan. 1989 - Mar. **1989.**
- \* **Radiation Safety program:** Memorial Univ. of Newfoundland, NFLD, **Canada.** Jan. **1985.**

### Supervising (M. Phil / Ph. D):

- \* Tahira Yasmeen, **Ph. D.** - HEC program (2005). Legume root associated mycorrhizae and (*Bradyrhizobium*) for improving crop productivity. NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Mohsin Tariq, Research Fellow/ **Ph. D.** – ALP project (2006). Role of legume root exudates and rhizobial quorum sensing for colonization. NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Amanat Ali, **Ph. D.** - HEC program (2006). Involvement of catalytic enzyme activity in nitrogen fixing symbiosis. NIBGE/Quaid-i-Azam Univ., Islamabad.

- \* Mudasir Ahmed, **M.Phil** (2006). Molecular aspects of zinc mobilization in rice. NIBGE/ Quaid-i-Azam Univ., Islamabad.

#### **Co-Supervised (M. Phil / Ph. D):**

- \* Research projects of Research fellows, M. Phil and Ph. D students registered at University of Agriculture, Faisalabad, Quaid-i-Azam University, Islamabad and others.
- \* Rozina Sardar, **M.Phil** (2000). Growth Hormone Production by *Rhizobium* Species and Their Effect on Plant Growth and Nitrogen Fixation. Univ. of Agri. Faisalabad.
- \* Naeem Iqbal, **M.Phil** (2001). Ultrastructural localization of Cotton Leaf Curl Virus. Univ. of Agri. Faisalabad.
- \* Farrukh Naeem, **M.Phil** (2001). The Ultrastructural Studies of Legume Root Nodules Under Salt and Temperature Stress. NIBGE/ Quaid-i-Azam Univ., Islamabad.
- \* Syed Hammad Raza, **M.Phil** (2001). Effect of Growth Hormone Production by *Rhizobium* on Cereals. Univ. of Agri., Faisalabad.
- \* Nosheen Mushtaq, **M.Phil.** (2003). Genetic Diversity Among Cotton Associated PGPR Strains and Ultrastructural Colonization with Cotton. NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Zakira Naureen Ashraf, **M.Phil.** (2003). Genetic Diversity Among Maize Associated PGPR Strains and Ultrastructural Colonization with Maize. NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Maryam Juma Abdulla, **M. Phil.** (2004). Identification and Characterization of Effective Indigenous Rhizobial Strains from Different Soils of Zanzibar. NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Mohammad Tariq, **M. Phil.** (2005). Mobilization of Zinc by Plant Growth Promoting Rhizobacteria in Rice (*Oryza sativa* L.). NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Naila Arif, **M. Phil.** (2005). Effect of Dual Inoculation of Plant Growth Promoting Rhizobacteria and AM Fungi on Wheat. NIBGE/Quaid-i-Azam Univ., Islamabad.
- \* Zafar Iqbal, **Ph. D.** (2003-2005). Fungal Malformation in Mango. Botany Dept., Bahudin Zakria Univ., Multan/NIBGE, Faisalabad.
- \* Fathia Mubeen, **Ph. D.** (2006). Effect of fungicides on plant growth promoting rhizobacterial interaction with wheat roots. NIBGE/Univ. of Agriculture, Faisalabad

#### **Co-Supervised Trainings of IAEA fellow scientists:**

- \* Indonesia, Two, for 3 months each (Dec.1999 - Mar.2000)
- \* Indonesia, Two, for 3 months each (Feb. 2001 - April. 2001)
- \* Mongolia, Two, for 3 months each (Jan. 2001 - Mar. 2001)
- \* China, One, for 6 months (May - Oct, 2001)
- \* Tanzania, One, for 8 months (May- September, 2002)
- \* Tanzania, for one year (September, 2003-Aug 2004)

#### **International and National Projects /Training Courses and Workshops:**

##### **Projects:**

- \* Assisted in IAEA Technical Cooperation Project on Biofertilizers.
- \* Assisted in Islamic Development Project “BIRCEN” on Biofertilizers.
- \* Assisting in on-going commercial project on *BioPower* production and promotion for cereals, legumes and non-legume crops
- \* Assisted in IAEA project on Fast Growing Trees.
- \* Assisted in PSF project on Chickpea Biofertilizers.

##### **PROJECTS SUBMITTED/ ACCEPTED/ INPROGRESS:**

- \* Principal Investigator ALP Project on the “Biochemical and molecular approaches to study the effect of pesticide on nitrogen fixing bacteria in legumes”. (In progress July, 2005 - June, 2008).
- \* Principal Investigator PSF Project on the “Use of mycorrhizae and rhizobacteria for improving crop productivity on low fertility marginal soils” (Accepted Dec., 2004).

##### **WORKSHOPS:**

- \* Assisted in organizing one week workshop on “Biofertilizer Technology” 12-16 March, 1995.
- \* Assisted in organizing two-weeks training course on “Biological Nitrogen Fixation” for scientists of Punjab Agriculture Department, July 21-August 4, 1997.

- \* Assisted in organizing two one-day-workshops on the “Use of *BioPower*” for MCOs of Agriculture Development Bank of Pakistan, April 30, 1997 and Sept. 29, 1997.
- \* Assisted in organizing three day workshop on “Sustainable Agriculture for Oxfam NGO Farmers” 23-25 February, 1999.
- \* Organized following one day workshops on the “Use of Biofertilizer: *BioPower* for Farmers, NGOs and Extension Staff (Sponsors, IDB, IAEA, PIBS & PAEC):
  - 1) 16<sup>th</sup> May, 2002 at NIBGE, Faialabad.
  - 2) 13<sup>th</sup> July, 2002 at (Swat) NWFP.
  - 3) 18<sup>th</sup> July, 2002 at NIA Tandojam, Sind.
  - 4) 31<sup>st</sup> July, 2002 at Deska, Sialkot, Punjab.
  - 5) 09<sup>th</sup> July, 2003 at Badin, Sind.
  - 6) 07<sup>th</sup> October, 2003 at NIBGE, Faisalabad.
- \* Assisted in organizing the preparation of training material (manuals, leaflets, brochures and audio-visuals) for the training courses and workshops held from time to time.

#### **Training Courses Conducted:**

- \* Two-weeks training course on “Biological Nitrogen Fixation” for scientists of Punjab Agriculture Department, July 21-August 4, 1997.
- \* National Training Course on Modern Techniques in Biotechnology from 2003 - 2006 (annually) at NIBGE, Faisalabad, sponsored by COMSTECH, NCB, PAEC & PSF.
- \* International Workshop on Advanced Techniques in Biotechnology, January 5-17, 2004, NIBGE, Faisalabad, Pakistan.
- \* Resource person on “Electron Microscopy”, in “Research Orientation Program (3<sup>rd</sup> course)”, August 8-20, 2005, Univ. of Agriculture-Faisalabad.
- \* Training course/ awareness seminars on “Cotton and rice *BioPower*, for Zonal Marketing Managers of Ali Akbar Enterprises-Lahore”, at Lahore, Multan and Bahawalpur, 2005.
- \* Resource person on “Transmission Electron Microscopy and Immuno Gold Labeling”, in International Symposium on Applications of Plant Sciences in Emerging Scenario, March 20 – 22, 2006, GC University-Faisalabad.

#### **Training Course Attended:**

- \* In-house course on “Understanding ISO 9001:2000” held at NIBGE on 3<sup>rd</sup> October, 2003 organized by Qualitas Training Division, Qualitas Systems, Registered Consultants with Ministry of Science & Technology, Govt. of Pakistan
- \* Digital Library Training Workshop scheduled Biological Sciences Resources Online, by HEC, at University of Punjab, Lahore-Pakistan, on 2<sup>nd</sup> June, 2005.
- \* In-house seminar on “ISO 1725 Lab. certification” held at NIBGE on 22<sup>nd</sup> September, 2005, organized by Directorate of Quality Assurance PAEC-Pakistan
- \* In-house Digital Library Training Workshop by HEC, at NIBGE, Faisalabad-Pakistan, on 14<sup>th</sup> December, 2005.

#### **Participation In National & International Conferences:**

- \* 7<sup>th</sup> Plant Science Conference of Plant Scientists, 14-16 November, 2000, Botany Department, University of Punjab, Lahore.
- \* International Workshop on Conservation Agriculture for Food Security and Environment Protection in Rice-Wheat Cropping System, Lahore, Pakistan. February 6-9, 2001.
- \* National workshop on Technologies for Sustainable Agriculture, 24-26 September, 2001, NIAB, Faisalabad, Pakistan.
- \* 9<sup>th</sup> International Congress of Soil Science 18-20 March, 2002, NIAB, Faisalabad, Pakistan.
- \* First National Conference of Biology 28-30 March, 2002 by Biological Society of Pakistan, Lahore.
- \* 7<sup>th</sup> International Conference on Trends in Biochemistry and Molecular Biology. April 2-5, 2003 at Lahore.
- \* Workshop on Production Technology for Wheat and Sugarcane Crop Improvement (AARI), Faisalabad. June 05, 2003.
- \* First National Conference on Agricultural Biotechnology. 16-18 August, 2004, Nathiagali, Pakistan.

- \* 14<sup>th</sup> International Congress on Nitrogen Fixation. Oct. 27-Nov. 1, 2004, Beijing, China
- \* First International Conference on Mango and Datepalm Culture and Export. June 20-23, 2005. Institute of Horticultural Sciences, Univt. of Agriculture, Faisalabad.
- \* International Symposium on “Biofertilizer and Biocontrol Technology” at University of Punjab, Lahore-Pakistan, 25-27 July, 2005.
- \* International Seminar on Rice Crop, Oct. 2-3, 2005, Kala Shahkaku – Lahore.
- \* 9<sup>th</sup> National Conference of Plant Scientists, February, 13 – 15, 2006, at The Institute of Botany, University of Sindh, Jamshoro – Pakistan.
- \* International Symposium on Applications of Plant Sciences in Emerging Scenario, March 20 – 22, 2006, at Dept. of Botany, GC University, Faisalabad – Pakistan.
- \* Workshop on Microscopy, Dundee, Scotland, UK

### **Publications:**

#### ***Ph.D Thesis:***

**Hameed, S.** (2004). Molecular Characterization and Significance of Rhizobial Exopolysaccharides. Quaid-i-Azam University, Islamabad, PAKISTAN

#### ***M.S. Thesis:***

**Hameed, S.** (1986). Involvement of Microbodies in Symbiotic Nitrogen-Fixing *Arachis hypogaea* L. (peanut) Root Nodules. Memorial University of Newfoundland, NFLD, CANADA.

#### ***Research Papers:***

1. Hameed, S. and A. k. Bal, 1985. Involvement of microbodies in peanut - *Rhizobium* symbiosis. In: Nitrogen Fixation Research Progress. H.J. Evans, P.J. Bottomley and W.E. Newton (eds.), P 310, Martinus Nijhoff Publishers, USA.
2. Bal A. K. and S. Hameed, 1987. Cytochemical localization of lipolytic activity in the nitrogen-fixing root nodules of peanut (*Arachis hypogaea* L.). In: Proceedings of the Microscopical Society of Canada. pp 15-16 Univ. of Manitoba, Canada.
3. Bal A. K., S. Hameed and S. Jayaram, 1989. Ultrastructural characteristics of the host symbiont interface in nitrogen-fixing peanut nodule. Protoplasma. 150: 19-26.
4. Mirza M.S., S. Hameed and A.D.L. Akkermans. 1994. Genetic diversity of *Datisca*-compatible *Frankia* strains determined by sequence analysis of PCR-amplified 16S rRNA gene. Appl. Environ. Microbiol. 60 (7): 2371-2376.
5. Hameed, S., F.Y. Hafeez, M.S. Mirza, K.A. Malik and A.D.L. Akkermans. 1994. Confirmation of an isolate from *Datisca cannabina* as atypical *Frankia* strain using PCR amplified 16S rRNA sequence analysis. Pak. J. Bot. 26 (2): 247-251.
6. Hafeez F.Y., M.A. Khan, S. Hameed, E. Rasul and K.A. Malik. 1995. Use of Gus marked *Rhizobium* and *Bradyrhizobium* strains for studying the effect of temperature on infection process. Pak. J. Bot. 27 (1): 55-62.
7. Hafeez, F.Y., T. Ahmed, S. Hameed, S.K.A. Danso and K.A. Malik. 1998. Comparison of direct and indirect methods of measuring nitrogen fixation in field grown chickpea genotypes. Pak. J. Bot. 30 (2): 199-207.
8. Hameed, S., F.Y. Hafeez and K.A. Malik. 1998. Nitrogen-fixation and mycorrhizal association in leguminous and non-leguminous trees in saline environment. In: Management of nitrogen fixation by trees for enhancing soil fertility and soil conservation in fragile tropical soils. IAEA-TECDOC.
9. Hafeez, F.Y., S. Hameed and K.A. Malik. 1998. Evaluation of *Frankia* and *Rhizobium* strains as inoculum for fast growing trees in saline environment. In: Management of nitrogen fixation by trees for enhancing soil fertility and soil conservation in fragile tropical soils. IAEA-TECDOC.
10. Hafeez, F.Y., S. Hameed, and K.A. Malik. 1999. *Frankia* and *Rhizobium* strains as inoculum for fast growing trees in saline environment. Pak. J. Bot. 31(1): 173-182.
11. Hafeez, F.Y., S. Hameed, T. Ahmed, and K.A. Malik. 2001. Competition between effective and less effective strains of *Bradyrhizobium* spp. for nodulation on *Vigna radiata*. Biol. Fert. Soil. 33(5): 382-386.
12. Hafeez, F.Y., S. Hameed, A.H. Zaidi and K.A. Malik. 2002. Biofertilizers for Sustainable Agriculture. In: Techniques for Sustainable Agriculture (F. Azam, M. M. Iqbal, C. Inayatullah and K. A. Malik, Editors), pp. 67-73. ISBN, NIAB, Faisalabad, Pakistan.
13. Hameed S., S. Yasmin, K.A. Malik, Y. Zafar and F.Y. Hafeez. 2004. *Rhizobium*, *Bradyrhizobium* and *Agrobacterium* strains isolated from cultivated legumes. Biol. Fert. Soil. 39(3): 179-185.

14. Naureen, Z., S. Yasmin, S. Hameed, K.A. Malik and F.Y. Hafeez (2005). Characterization and screening of bacteria from maize grown in Indonesian and Pakistani soils. *J. Basic Microbiol.* 45 (6): 447 - 459
15. Hameed S., F. Mobeen, K. A. Malik and F. Y. Hafeez (2005). Nodule co-occupancy of *Agrobacterium* and *Bradyrhizobium* with potential benefit to legume host. In: *Biological Nitrogen Fixation, Sustainable Agriculture and the Environment*. Y. P. Wang et al, (eds.) pp. 295-296, Springer, The Netherlands.
16. Malik K. A., F. Y. Hafeez, M. S. Mirza, S. Hameed, G. Rasul and R. Bilal (2005). Rhizospheric plant – microbe interactions for sustainable agriculture. In: *Biological Nitrogen Fixation, Sustainable Agriculture and the Environment*. Y. P. Wang et al, (eds.) pp. 257-260, Springer, The Netherlands.
17. Hameed S. and J. Iqbal. 2006. Transmission electron microscopy and immunogold labeling. In: *International Symposium on Applications of Plant Sciences in Emerging Scenario*, March 20 – 22, 2006, at Dept. of Botany, GC University, Faisalabad, pp. 54-56.
18. Iqbal, Z., S. Hameed, S.M.N. Abbas, A.A. Dasti, A. Saleem, N. Mushtaq and F.Y. Hafeez. Immunoelectron microscopy to localize the antigenicity of fungus *Fusarium mangiferae* in malformed buds of mango. *Molecular Plant Pathology* (submitted).
19. Iqbal N., M.Y. Ashraf, F. Javed, M. Ashraf and S. Hameed. 2006. Cotton leaf curl virus: Ionic status of leaves and symptoms development. *J. Integ. Plant Biol.* 48: 558-562.
20. Tariq M, S. Hameed, K.A. Malik and F.Y. Hafeez. 2007. Plant root associated bacteria for zinc mobilization in rice. *Pak. J. Bot.* 39 (1): 245-253
21. Mubeen F., A. Aslam, M.A. Sheikh, T. Iqbal, S. Hameed, K.A. Malik and F.Y. Hafeez. 2006. Response of wheat yield under combined use of fungicides and bio-fertilizer. *Int. J. Agric. Biol.* 08-5: 580-582

**Posters/Research Papers Presented in Conferences:**

1. Hafeez, F.Y., S. Asad, S. Hameed, T. Ahmad and K.A. Malik. 1993. Evaluation of indigenous and exotic *Rhizobium* and *Frankia* strains for efficient N<sub>2</sub>-fixation by fast growing trees. Poster Abstract P.33. In *Proceeding of 10th Australian Nitrogen Fixation Conference*, Brisbane, Australia.
2. Mirza M.S., S. Hameed and A.D.L. Akkermans. 1993. Use of 16S rRNA-targeted oligonucleotide probes and sequence analysis to determine genetic diversity among uncultured *Frankia* strains. In: *Proceeding of symposium on Microbes in Engineered Ecosystems* (April 18-21, 1993), Wageningen, The Netherlands.
3. Hameed, S., F.Y. Hafeez, M.S. Mirza, A.D.L. Akkermans, and K.A. Malik. 1993. Confirmation of *Datisca cannabina* isolate as atypical *Frankia* strain using PCR amplified 16S rRNA gene analysis. In: *Proceeding of the International Symposium on Biotechnology for Sustainable Development*, Dec. 15-20, 1993 NIBGE, Faisalabad, Pakistan. (Abstract p-109).
4. Hafeez, F.Y., M.A. Khan, S. Hameed, E. Rasul and K.A. Malik. 1993. Use of Gus marked *Rhizobium/Bradyrhizobium* strains for studying the temperature effect on infection process. In: *Proceeding of the International Symposium on Biotechnology for Sustainable Development*, Dec. 15-20, 1993 NIBGE, Faisalabad, Pakistan (abstract p-107).
5. Hameed, S., F.Y. Hafeez, T. Ahmad and K.A. Malik. 1995. Selection of thermostable (*Bradyrhizobium*) strain for mungbean. In: *Fifth National Conference of Plant Scientists*. 28-30 March, 1995. NARC, Islamabad. Poster Abst. No. 174. pp. 112.
6. Malik, K.A., F.Y. Hafeez, S. Hameed, S. Ali, S. Mirza, T. Mahmood, T. Ahmad, F. Khan, I. Haq, G. Rasul, S. Mehnaz, N. Hamid and U. Hassan. 1997. Biofertilizer: Its development, use and economic importance in cereal and leguminous crops. *First National Symposium on Biotechnology for Sustainable Development* held at Government College, Lahore from 24-25 November, 1997. Abstract p. 58.
7. Hameed, S., F.Y. Hafeez, M.S. Mirza, S. Ali and K.A. Malik. 1998. Biofertilizer: its development, use and economic importance in cereal and leguminous crops. *6th National Conference of Plant Scientists* held at University of Peshawar, 20-22 October, 1998.
8. Hameed, S., F.Y. Hafeez and K.A. Malik. 1998. Nitrogen fixation and mycorrhizal association in leguminous and non-leguminous trees in saline environment. *7th International Congress of Soil Science* held at University of Agriculture, Faisalabad, 9-12 December, 1998. Abstract p. 24.
9. Hafeez, F.Y., S. Hameed, M.S. Mirza, S. Ali and K.A. Malik. 1998. Biofertilizers for cereals and legumes. *7th International Congress of Soil Science* held at University of Agriculture, Faisalabad, 9-12 December, 1998.
10. Iqbal, N., S. Hameed, J. Iqbal, F. Javed, F.Y. Hafeez and Y. Zafar. 2000. Ultrastructure of Cotton (*Gossypium hirsutum* L.) Infected with Cotton Leaf Curl Virus. *7th Plant Science Conference*, 14-16 November, Lahore.
11. Hameed, S., R. Sardar and F.Y. Hafeez. 2000. (*Bradyrhizobial*) Polysaccharides for strain identification and characterization. *7th Plant Sci. Conference*, 14-16 Nov., Lahore.

12. Sardar, R., S.Hameed and F.Y. Hafeez. 2000. Phytohormone production by (*Brady*)*rhizobium* Strains and their effect on nodulation and nitrogen fixation in *Vigna radiata*. 7th Plant Science Conference, 14-16 November, Lahore.
13. Naeem, F., M. Akram, S. Hameed, F. Y. Hafeez. 2000. Ultrastructural studies of *Pisum sativum* root nodules under low temperature stress. 7th Plant Science Conference, 14-16 November, Lahore.
14. Mubeen, F., S. Hameed, S.Yasmeen and F. Y. Hafeez. 2000. 16S rRNA Sequence Analysis Used for the Isolation and Identification of Different Rhizobial Strains. 7th Plant Science Conference, 14-16 November, Lahore. (**First prize on poster**)
15. Yasmeen, S., S. Hameed, D. Hussain, Y. Zafar, K.A. Malik and F. Y. Hafeez. 2000. Random Amplified Polymorphic DNA (RAPD) technique for polymorphism among (*Brady*)*rhizobium* strains. 7th Plant Science Conference, 14-16 November, Lahore.
16. Hafeez, F.Y., S.H. Raza, S. Hameed, T. Shah and K.A. Malik. 2000. Effect of indole acetic acid production by (*Brady*)*rhizobium* on root colonization and growth of wheat. 8th International Symposium on Nitrogen Fixation with Non-Legumes, 3-7 December, 2000, University of Sydney, Australia.
17. Mubeen, F., A. Hussain, S. Hameed, K.A. Malik and F.Y. Hafeez. 2002. Evaluation of Biofertilizer (*Biopower*), Effective Microorganisms (EM) and Chemical Fertilizers on Growth of Maize. Paper presented in 9<sup>th</sup> International Congress of Soil Science 18-20 March, 2002, NIAB, Faisalabad, Pakistan. Abst. p. 32.
18. Hafeez, F.Y. M. Gull, M. Saleemi, S. Talib, S. Hameed and K.A. Malik. 2002. Effect of Phosphate-Solubilizing Bacteria on the Growth of Chickpea, Lentil and Wheat, Isolated from Different Crops. Poster presented in 9<sup>th</sup> International Congress of Soil Science 18-20 March, 2002, NIAB, Faisalabad, Pakistan. Abst. p. 37.
19. Naeem, R., A.H. Zaidi, S. Hameed and F.Y. Hafeez. 2002. Screening of *Rhizobium leguminosarum* Strains for Bacteriocin Production and its Biochemical Characterization. Paper presented in 9<sup>th</sup> International Congress of Soil Science 18-20 March, 2002, NIAB, Faisalabad, Pakistan. Abst. p. 36.
20. Hameed, S, I.M. Roberts, K.A. Malik and F.Y. Hafeez. 2002. Immunogold labelling of plant growth promoting rhizobacteria and their localization in wheat and rice root rhizosphere. Paper presented in 9<sup>th</sup> International Congress of Soil Science 18-20 March, 2002, NIAB, Faisalabad, Pakistan. Abst. pp. 36-37.
21. Hameed, S., I.M. Roberts, K.A. Malik and F.Y. Hafeez. 2002. Ultrastructural Localization of Plant Growth Promoting Rhizobacteria in Wheat and Rice Root Rhizosphere. Paper presentation in First National Conference of Biology 28-30 March, 2002 at Biological Society of Pakistan, Lahore.
22. Hameed, S., F. Mubeen, K.A. Malik and F.Y. Hafeez. 2003. Molecular and Immunogold Labeling to confirm co-occupancy of *Agrobacterium* with *Rhizobium* strain in legume roots. Poster presented in 7<sup>th</sup> International Conferene on Trends in Biochemistry and Molecular Biology. April 2-5, 2003 at Lahore. Abst. p. 96.
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