

**DR. S. K. SHARMA, Principal Scientist (Plant Physiology)**

E-Mail: sksharma@cssri.ernet.in ; [dr\\_sksharma@yahoo.co.in](mailto:dr_sksharma@yahoo.co.in)



**Employment Record & Experience** (Starting from the present position)

Designation	Pay scale	Nature of Work	Organization	Institution & Place of Posting	Period (From –to)
Principal Scientist	16400-22400	Research	ICAR	CSSRI, Karnal	28 July 1998 –to date
Senior Scientist	12000-18300	Research	ICAR	CSSRI, Karnal	1.1.1986 to
Scientist S-2	1100-1600	Research	ICAR	CSSRI, Karnal	1.1.1984 to 31.12.1985
Scientist S-1	700-1300	Research	ICAR	CSSRI Karnal	31.3.1978 to 31.12.1983

**Academic Qualifications**

Level	Degree	University	Year	Subjects with major field	Fellowship/Scholarship	Class/ Division/ Grade/ Marks
Graduation	B.Sc (Hons) Botany	Punjab Agril. Univ., Ludhiana	1973	Botany, Zoology. Chem. Biochem.	Punjab State Merit Scholarship	FIRST 3.05/ 4.00
Masters	M.Sc (Hons) Botany	Punjab Agril. Univ.	1975	Plant Physiology	ICAR Jr. Fellowship	FIRST 3.45/ 4.00
Ph. D	Ph. D (Plant Physiology)	Haryana Agril. Univ., Hisar	1980	Plant Physiology (Stress Physiology), Biochem.	UNDP Sr. Fellowship	FIRST 3.47/ 4.00
Other	One Year Cert. Course in German	Punjab Univ., Chandigarh	1972	German	-	Second

**AREAS OF RESEARCH**

Physiological mechanisms of stress and Improving Tolerance to salinity, sodicity and waterlogging stresses in wheat, chick pea , pigeon pea, Biodiesel and Bioenergy Plants (Jatropha, Pongamia, Edible Cactus and agroforestry species) over the last thirty years.

- ◆ **PHYSIOLOGICAL MECHANISMS IN WHEAT** – Our efforts involved collection, evaluation and their evaluation identified the presence and availability of the genotypic range of salt tolerance in wheat. Identification of Kharchia lines as donors of salinity and alkalinity tolerance in wheat, their mechanisms of tolerance and their use for studies on mechanisms of salt tolerance was the initiative leading to development of wheat varieties like KRL 1-4 and KRL 19, having tolerance to salinity and sodicity stresses and released for cultivation in these stress situations.
- ◆ **PHYSIOLOGICAL MECHANISMS IN CHICKPEA & PIGEONPEA** -In this programme identification of the genotypic range of salt tolerance in chickpea and pigeonpea crops, undertaken in association with Dr. R.P. Dua, Plant Breeder, lines having higher salt tolerance were identified e.g. **CSG 88101** was registered with NBPGR as a donor for salt tolerance under INGR No. 98008 published in the Indian Journal of Plant Genetic Resources Vol. 11 (1). 1998. This along with CSG 8927 is used as a Check variety at national and international levels. A chickpea variety **CSG 8962** (Karnal Chana 1) was released as a variety suitable for moderately saline and alkaline areas by Central Variety Release Committee.
- ◆ Biodiesel and Bioenergy Tree species
  - **BIOSAFOR**- Biosaline Agroforestry for remediation of salt affected lands program funded by the European Union and is an international consortium project involving 10 organizations from 7 countries with CSSRI budget of 1.2 Million Euros.
  - **Programme on biomass, and biodiesel** plant species in salt affected soils on *Jatropha curcas*, *Pongamia pinnata* and *Prosopis* species has shown lot of promise. This is a major initiative of the institute involving a multi-disciplinary team of 10 scientists from Karnal and the three Regional Research stations.
- ◆ **PHYSIOLOGY OF WATERLOGGING IN SODIC SOILS** -Field and laboratory research on waterlogging tolerance of wheat in alkali soils by us has contributed to an understanding of some of the major constraints limiting wheat production in neutral and sodic soils under both waterlogged and drained conditions. Waterlogging exacerbates the adverse effects of element/microelement toxicities (Al, B, Na, Mn and Fe) on wheat growth and grain yield and element/microelement toxicities are indicated across many areas in India.

- **CSG 88101** was registered with NBPGR as a Donor and Check variety for salt tolerance in chickpea under INGR No. 98008 published in the Indian Journal of Plant Genetic Resources Vol. 11 (1). 1998. This along with CSG 8927 is used as a Check variety at national and international levels.
- Based on the work done on chickpea physiological mechanisms and evaluation of germplasm jointly with Dr. R.P. Dua (Pulses Breeder) a chickpea variety **CSG 8962** (Karnal Chana 1) was released as a variety suitable for moderately saline and alkaline areas by Central Variety Release Committee.

### **In-service Awards/Recognition**

- ❖ Fellow of Indian Society for Plant Physiology awarded by Indian Society of Plant Physiology- National Society for Individual Contributions in 2007.
- ❖ Vice President of the Indian Society for Plant Physiology for year 1991-92

- ❖ Consulting Editor for Indian Journal of Plant Physiology
- ❖ Chairman, Institute Biosafety Committee for CSSRI appointed by Department of Biotechnology
- ❖ Member, CSSRI Institute Management Committee appointed by ICAR
- ❖ Chairman, Organization Committee for the Second Review and Annual Meeting of the International Consortium BIOSAFOR Programme at CSSRI Karnal and funded by European Union organized in Feb. 2008.
- ❖ Member Secretary, Senior Officers Meeting, CSSRI, Karnal during 2007.
- ❖ Reviewer for the following NAAS listed journals:
  - CAB International- International Journal- International journal
  - Crop Science- International journal
  - Irrigation Science- International journal
  - Archives of Agronomy and Soil Science- International journal
  - Indian Journal of Plant Physiology- National journal
  - Indian Journal of Agricultural Sciences - National journal
  - Indian Journal of Pulses Research - National journal
  - Journal of Plant Biology, India - National journal
  - Indian Farming - National journal

### **Projects Handled**

- Effects of saline conditions on metabolism and osmotic relations at different plant growth and development stages. 1980 to 1983 as P. I. (INSTITUTIONAL)
- Synthesis and distribution of phenols, organic acids and other metabolites (S. K. Sharma, A. R. Bal and Ali Qader) as P. I. from 1980 to 1983. (INSTITUTIONAL)
- Studies on Osmotic Adjustment Mechanisms in Wheat under Salt stress. 1984- 1992 as P. I. (INSTITUTIONAL)
- Evaluation and Development of Plant Genetic Resources Tolerant to Salinity, Sodicity, Sodicity and Waterlogging 1989- 1990. R. P. Dua and **S. K. Sharma** (INSTITUTIONAL)
- Mechanisms of Ion Uptake, Growth, Photosynthesis and Osmotic relations under salt stress in Wheat and Gram (1993- 2005). As P. I. (INSTITUTIONAL)
- Mechanisms of ion uptake, growth, photosynthesis and osmotic relations under salt stress in wheat and gram 1993 to 2006. as P. I. (INSTITUTIONAL)
- ICAR Cess Fund Project “Improving salt tolerance of chickpea and pigeonpea crops using physiological mechanisms” - **EXTERNALLY FUNDED**
- ACIAR-ICAR Project “Physiological and genetic approaches for the development of waterlogging tolerance in wheat on sodic/alkaline and neutral soils in India & Australia” from 2000 to 2006 as Co-P.I. (**SPONSORED FOREIGN FUNDED**)
- Programme on Biomass and Biodiesel for Energy Production from Salt Affected Lands on *Jatropha curcas* and *Pongamia pinnata* (Biodiesel Plants) and Edible Cactus (*Opuntia*) species has been taken up. It is a multi-disciplinary project involving 10 scientists from CSSRI Karnal and its regional research stations at Lucknow, Bharuch and Canning and studies are underway in pots, sand tanks and fields for the last two and half years from 2006 onwards as **P. I.** (INSTITUTIONAL)

- BIOSAFAR Project -Biosaline (Agro)Forestry: Remediation of Saline Wastelands through Production of Renewable Energy, Biomaterials and Fodder” Programme funded by the European Union involving a Consortium Research Programme of seven countries i.e. India, Pakistan, Bangladesh and ICBA Dubai, UAE from Asia, Netherlands, Germany and Spain and Ten research organizations and universities. Started in Dec. 2007 as P.I. (**SPONSORED –FOREIGN FUNDED by European Union**)
  - I am also associated as **Co-P.I.** with the following multi-disciplinary projects:
    - Evaluation of **Resource Conservation Technologies in Rice – Wheat** Cropping System.
    - Evaluation of **medicinal plants** for saline, alkali lands and irrigation with saline waters.
    - Rice Biotechnology project funded by Department of Biotechnology. (**EXTERNALLY FUNDED**)

#### **Special Attainments**

- Invited as a Visiting Scientist by the Department of Agronomy and Range Science, University of California, Davis twice in 1996 for 4 months and again in 2002 for 1 month. This provided me the opportunity to work and develop linkages with very eminent scientists and doyens of salinity research in a very prestigious University in USA as it is among the top FIVE Universities. I worked with Profs. A. Lauchli, Sham S. Goyal and D. W. Rains and published two outstanding papers and one monograph on salinity and a special Issue of Journal of Crop Production as a Co-Editor.
- **CSG 88101** was registered with NBPGR as a donor variety for salt tolerance in chickpea under INGR No. 98001 published in the Indian Journal of Plant Genetic Resources Vol. 11 (1). 1998. This along with CSG 8927 is used as a Check variety at national and international levels.
- Based on the work done on chickpea physiological mechanisms and evaluation of germplasm jointly with Dr. R. K. Dua (Pulses Breeder) a chickpea variety **CSG 8962** (Karnal Chana 1) was released as a variety suitable for moderate saline and alkaline areas by Central Variety Release Committee.
- Member of Monitoring Team for the International Network for Genetic Enhancement and Rice Travellers Workshop for India and Pakistan by IRRI, Manila from Sept. 29 to Oct. 6, 1989.

<b>TOTAL PUBLICATIONS:</b>	<b>104</b>
<b>Books</b> :	<b>4 including 2 Internationals published in USA</b>
<b>Research papers</b> :	<b>52</b>
<b>Reviews / Book chapters etc. :</b>	<b>7</b>
<b>Symposia / Seminar / Conferences Papers:</b>	<b>28</b>
<b>Reports</b> :	<b>10</b>
<b>Bulletins</b> :	<b>3</b>

**Trainings attended in the relevant field of specialization** (Mention Title, Duration, Institution, location etc.)

Title	Duration	Institution	Year
Training Programme on Use of Radio-isotopes	Two weeks	Bhabha Atomic Research Center, Trombay at NDRI, Karnal for Two weeks	1980
Advanced Training in Irrigation Physiology	Three Months	Plant Water Lab., Univ. of California, Davis, California, USA	1990
Research Attachment on physiological Mechanisms of Tolerance to Salinity in Chickpea	Four Months	Salinity Lab., Univ. of Sussex, Falmer, Brighton, UK	1994
International Training on the Mechanisms of Tolerance of Crops to Waterlogging & Flooding.	Two Weeks	Jointly organized by Crawford Organization, Australia and International Rice Research Institute, Manila, Phillipines at Las Banos, IRRI	1995
Physiological Mechanisms and Improvement of Salt tolerance and Yield Potential in Chickpea	Two weeks	Salinity Lab., Univ. of Sussex, Falmer, Brighton, UK	1998
International Training Programme on Technical & Scientific Writing	One Week	British Council Division, UK High Commission	1996

## **BOOKS**

- 1) Crop Production in Saline Environments. S. S. Goyal, **S. K. Sharma** and D. W. Rains (Eds.). 2003. Haworth Press, New York, USA. Pp. 427.
- 2) Crop Production in Saline Environments. S. S. Goyal, **S. K. Sharma** and D. W. Rains (Eds.). 2003. Journal of Crop Production. Vol. 7(1-2). Haworth Press, New York, USA.

3) Salinity Management in Agriculture. S. K. Gupta, **S. K. Sharma** and N. K. Tyagi (Eds.). CSSRI Karnal. pp. 386.

4) Plant Growth and Saline Environments. **S. K. Sharma** and I.C. Gupta. 1986. Agro- Botanical Publishers, Bikaner. pp. 172.

### **LIST OF SELECTED 25 PAPERS OF DR. S. K. SHARMA**

1. Setter, Tim, Irene Waters, **Sharma, S. K.**, Singh, Neeraj Kulshreshtha, Yaduvanshi, N. Ram, P. C. Singh, B. Rane, J., McDonald, G., Hossein Khabaz-Saberi, Biddulph, Ben, Wilson, Robin., Barclay, Iain., McLellan, Robyn and Cakir, Mehmet. 2008. Review of wheat improvement for waterlogging tolerance in Australia and India: the importance of anaerobiosis and element toxicities associated with different soils. *Annals of Botany* 102: 15-25. DOI :10.1093/aob/men 137. NAAS Rating 8.8, NAAS No. A122
2. S. Kukreja, A. S. Nandwal, N. Kumar, S. K. Sharma, **S. K. Sharma**, V. Unvi and P. K. Sharma. 2005. Response of chickpea roots to short-term salinization and desalinization, plant water status, ethylene evolution, antioxidant activity and membrane integrity. *Physiol. Mol. Biol. Plant.* 49 (2): 305- 308. NAAS Rating = 8.1. NAAS NO. 274 (Earlier name *Biol. Plant.*).
3. S. Kukreja, A. S. Nandwal, N. Kumar, S. K. Sharma, **S. K. Sharma**, V. Unvi and P. K. Sharma. 2005. Plant water status, H<sub>2</sub>O<sub>2</sub> scavenging enzymes, ethylene evolution and membrane integrity of *Cicer arietinum* L. as affected by salinity. *Biol. Plant.* 49 (2): 305- 308. NAAS Rating = 8.1. NAAS NO. 274
4. Sharma, S.K. 1996. Soil salinity effects on transpiration and net photosynthetic rates, stomatal conductance and Na<sup>+</sup> and Cl<sup>-</sup> content in durum wheat. *Biologia Plantarum.* 38(4): 519-523. NAAS Rating = 8.1. NAAS NO. 274
5. Sharma, S.K. 1996. Significance of rates of uptake and distribution of Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> in governing plant salt tolerance in genotypes of wheat differing in salt tolerance. *Biologia Plantarum.* 38(2): 261-267. NAAS Rating = 8.1 NAAS NO. 274.
6. Sharma, S.K. and Kumar, S. 1992. Effect of salinity on Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> content in different organs of chickpea and the basis of ion expression. *Biol. Plant.* 34(3-4): 311-317. NAAS Rating = 8.1. NAAS NO. 274.
7. Gupta, S.K. and **S.K. Sharma**. 1990. Response of crops of high exchangeable sodium percentage. *Irrigation Science.* 11: 173-179. NAAS Rating = 8.1 NAAS NO. 846
8. Sharma S.K. 1986. Mechanisms of tolerance in rice varieties differing in sodicity tolerance. *Plant and Soil* 93:141-145. NAAS Rating = 8.3 NAAS NO. 1383.
9. Sharma, S.K. and Garg, O.P. 1984. Nitrate reductase and nitrite reductase activities and leaf diffusivity resistance in wheat under water deficits. *Biol. Plant* 26 (2):151-153. NAAS Rating = 8.1. NAAS NO. 274.
10. Sharma, S. K. and Goyal, S. S. 2003. Progress in Salinity Resistance Researches : Integration of Physiological and Genetic and Breeding Approaches. *Journal of Crop Production Special Issue on Crop Production in Saline Environments.* S. S. Goyal, S. K. Sharma and D. W. Rains (Eds.). Haworth Press, New York, USA. Vol. 7 (1): 387- 407. NAAS NO. Not Available.
11. Sharma, S. K., Singh, Dharmendra and Dua, R. P. 2000. Pod setting in relation to different crossing procedures in *desi and kabuli* genotypes of chickpea (*Cicer arietinum*). *Ind. J. Agric. Sci.* 70 (9): 621- 623. NAAS Rating = 8.1 NAAS NO. 717.
12. Goyal, S. S., **Sharma, S. K.**, Rains, D. W. and Lauchli, A. 1999. Long term reuse of drainage waters of varying salinities for crop irrigation in a cotton-safflower rotation system in the San Joaquin valley of California- a nine year study: I. Cotton (*Gossypium hirsutum* L.). *Journal of Crop Production- Special Issue on Water Use in Crop Production.* Ed. M.B. Kirkham. Vol. 2 (2): 181-214. NAAS NO. Not Available
13. Goyal, S. S., **Sharma, S. K.**, Rains, D. W. and Lauchli, A. 1999. Long term reuse of drainage waters of varying salinities for crop irrigation in a cotton-safflower rotation system in the San Joaquin valley of California- a nine year study: II. Safflower (*Carthamus tinctorius* L.). *Journal of Crop Production.* Ed. M.B. Kirkham. Vol. 2 (2): 215-229. NAAS NO. Not Available.

14. Sharma, S.K. 1997. Plant growth, photosynthesis and ion uptake in chickpea as influenced by salinity. *Indian J. Plant Physiol.* 2(2): 171-173. NAS Rating= 4.0. NAAS NO. 764.
15. Sharma, S.K. 1995. Effect of short-term exposures of salinity in wheat. *Ind. J. Plant Physiology.* 38 (3): 223-235. NAS Rating= 4.0. NAAS NO. 764.
16. Sharma, S.K. 1995. Effects of salinity on growth performance and internal distribution of Na, Cl and K in *Vicia faba L.* *Indian J. Plant Physiol.* 37(1): 69-72. NAS Rating= 4.0. NAAS NO. 764.
17. Sharma, S.K. 1993. Role of ionic distribution in growth and salt tolerance of *Vicia faba*. *J. Plant Physiology & Biochemistry*, 18(2):1-7. NAS Rating= 4.0. NAAS NO. 1102.
18. Sharma, S.K. 1991. Effect of exchangeable sodium on growth, yield and ionic relations in wheat genotypes differing in sodicity resistance. *Indian J. Plant Physiology* 34(4): 355-362. NAS Rating= 4.0. NAAS NO. 764.
19. Sharma, S.K. 1990. Effect of salinity on internal distribution of Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> and the mechanism of injury in chickpea. *Plant Physiology & Biochemistry.* 17(1): 41-47. NAS Rating= 4.0. NAAS NO. 1102.
20. Sharma, S.K. and Kumar, S. 1990. Effect of salinization on growth and distribution of Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> in different genotypes of chickpea. *Indian J. Plant Physiology.* 33(4):269-274. NAS Rating= 4.0. NAAS NO. 764.
21. Sharma, S.K. 1989. Effect of salinity on growth, ionic and water relations of three wheat genotypes differing in salt tolerance. *Indian J. Plant Physiology.* 32(3): 200-205.
22. Sharma, S.K. 1987. Mechanisms of tolerance in wheat genotypes differing in sodicity tolerance. *Plant Physiology & Biochem.* 14(1): 87-94. NAS Rating= 4.0
23. Sharma, S.K., Joshi, Y.C., and Bal, A.R. 1984. Osmotic and specific ion effects in salt sensitive and salt resistant wheat varieties. *Ind. J. Plant Physiol.* 27:153-159.
24. Sharma, S.K. and O.P. Garg. 1985. Salinity induced changes in plant growth and activities of glutamate dehydrogenase, aspartate and alanine aminotransferases in wheat. *Indian J. Plant Physiology.* 28(4):407-412. NAS Rating= 4.0
25. Joshi, Y.C., Qadar, A. and Sharma, S.K. 1984. Preliminary studies on root growth of halophytes and glycophytes under sodic soil conditions. *Indian J. Agric. Sci.* 55(6):434-437. NAS Rating= 4.0

## **BOOK CHAPTERS, MANUALS AND REVIEWS**

1. S. K. Sharma. 2006. Waterlogging Tolerance under Neutral and Alkali Soils in Wheat and Other Cereals: Physiological Mechanisms and Prospects for Improvement- A Review Paper. In *Plant Molecular Physiology: Current Scenario and Future Projections- Feestschrift in honour of Prof. C. P. Malik*. Pp. 201- 214. Aavishkaar Publishers, Jaipur.
2. Sharma, S. K. and Goyal, S. S. 2003. Progress in Salinity Resistance Researches : Integration of Physiological and Genetic and Breeding Approaches. In: *Crop Production in Saline Environments*. S. S. Goyal, S. K. Sharma and W. Rains (Eds.). Haworth Press, New York, USA. Pp. 387- 407.
3. Sharma, S. K. 1993. Physiological aspects of crop response to saline/sodic irrigation. II. Plant water and ionic relations. In *Advances in Research on Sustainable Irrigation in Saline Environment*. CSSRI, Karnal. Tyagi, N. Kamra, S.K., Minhas, P.S. and Singh, N.T. (eds.) Pp. 84-95.
4. Sharma, S. K. 1993. Plant responses to salt stress. In *Advanced Plant Physiology* by H.N. Krishnamoorthy. Pp. 407-514. Atma Ram and Sons, Delhi.
5. Sharma, S. K. 1993. Osmoregulatory mechanisms - Their role and extent in governing plant salt resistance. In *Management of salt-affected soil and waters*. Eds. L.L. Somani and K.L. Totawat, Agrotech Publishing Academy, Udaipur. Pp. 231-261.
6. Sharma, S. K. 1988. Recent Advances in afforestation of salt affected soils in India. *Advances in Forestry Research in India*. Vol.2:17-31.