ACKNOWLEDGEMENT

I bow down with humility before almighty God for his abundant blessings, guidance without which none of this would have been possible.

I take this great opportunity to express my profound and heartfelt thanks to my esteemed gratitude to Dr. Banwari Lal Suman, Principal Scientist, Agronomy IGFRJ, Jhansi, chairman of my advisory committee, for valuable advice, inestimable help and inspiring guidance throughout the course of this investigation and meticulous preparation of thesis.

I also express my deep sense of gratitude to Dr. K. A. Singh, Director and Dr. P. S. Pathak, former Director, IGFRJ, Jhansi for providing necessary arrangement to conduct this research.

It is a great pleasure to my deep sense of gratitude to Late Dr. P. D. Gupta, Former Head, division of Agricultural Engineering, Dr. P. K. Pathak, Senior Scientist (AS&IP), Dr. P. N. Dwivedi, Senior Scientist Animal Nutrition, Dr. R. K. Agrawal, Senior Scientist, Agronomy and Mr. Ashok Kumar Varshney Senior Scientist Agricultural statistics, being member of my advisory committee. I wish to thank Dr. S. B. Tripathi, Head, division of crop production, for extending laboratory facilities in crop production and seed technology divisions.

I wish to thank Dr. G. P. Lodhi Ex-Dean, Post Graduate, Studies, Chaudhary Charan Singh Haryana Agril. University, Hisar and Dr. (Mrs.) Manju Suman, senior scientist, division of Social Sciences for their constant advice and encouragement during the course of my work. My sincere thanks to Dr. Chandra Shekhar Sahay, scientist senior scale, division of Agricultural engineering, for his help and cooperation during my research work.

I would like to thank Dr. M. S. Sharma Senior Farm Manager, IGFRJ for providing facility of farm input during my research work. My sincere thanks to Mr. Harshesh Pandey, Mr. N. C. Srivas, Dr. D. K. Singh, Mr. Kanhai Singh, Dr. G. R. Deshmukh, Mr. S. D. Singh, Mr. S. A. Vishwakarma, Mr. Haider Ali, Mr. Aanand Khare, Mr. Rajesh Singh, Mr. Ganga Sagar Yadav and all technical staff of farm and FOSU sections for their help in field experiment, laboratory, data collection along with moral support.

I am also thankful to Mr. Sree Ansh Kumar Dwivedi, Senior Personal Secretary to Head Division of Agril. Engg. Mr. Tejram (senior clerk), division of Agril. Engineering, Mr. Hari Prakash Gupta, Mr. Hari Narayan Yadav, Mr. Narayan, Mr. Raghubher Yadav, Mansharam, Phool Singh and Shatendra, and Devendra for assistance in field observations, soil and plant samples collection and data recording.

I would like to thank to Mr. N. S. Pahile, Head Library services IARJ, New Delhi, (Mrs.) Seema, Khatri Senior Technical officer, Center library, IGFRJ and other library
members for help in collection of literature during the course of work. I must thank for the photography services rendered by Mr. Ashok Kumar Singh, photographer of IGFRJ.

My sincere thanks to Dr. Tikam Singh Senior Scientist, Soil Science and Agricultural Chemistry Division, Mr. Veer Bahadur Singh, Senior Research Associate, Plant Pathology division, Mr Ram Bhaj Baudh, Mr Aditya Suman IARI, New Delhi for their help in collection of reviews from IARI Library and Prof. M.M. Rajput Agriculture Economics B. N. P. G. College Rath Hamirpur, U.P.

To me research is not one man's endeavour at each stage of work a group of friends and my junior's shared my labour and supported me and I would like to thanks them reg. Mr. Manish Srivastava, Manoj Kumar (SRF), CP division, Mr. Gainda Singh, Mr. Pram Veer Singh, Mr. Sanjeev Kumar, Mr. Pramod Kumar, Mr. Amar Singh, Mr. Bharat Singh, Mr. Rupendra Singh, Mr. Rajendra Kumar, Mr. B.L. Yadav, Mr. Vijay Singh, Mr. Shri Pat, Mr. Lalla, Mr. Sahid Ali Siddqui, Mr. Ankit Agrawal, Mr. Ramesh chandra, Mr. Yougandre Singh, Mr. Sanjay Prajapati, Mr. Lavkush Bhushan, and Mr. Arvind Singh.

I want to pay my heartiest gratitude to my respected Dadda Shri Ram Sewak and Smt. Tlsa Rani and, respected parents Shri Shiv Nath Singh and Smt. Chandra Kali, uncle Dr. G. N. Lodhi Principal (Retd). B. N. V. P. G. College, Rath, Hamirpur and aunt Smt Shanti Devi for their inspiration, encouragement and financial support during the course of this investigation.

The help, encouragement and all round support by elder brother’s Shri Brij Kishore and his wife Smt Laxmi Devi, Shri Bal Chandra and his wife Smt. Kerti Devi, Er. Raj Kumar and his wife Smt Ranjna, Younger brother Uday Veer Singh and his wife Smt. Meena, Kuldeep Singh, Kulraj Singh and sister Km. Ranjana Singh.

I would like to thank my wife Smt. Ranu Singh for her cooperation in thesis work and son Srajan Singh who badly miss me for the time being during my busy schedule.

I am thankful to Dr. R. K. Bhatt for arranging my Synopsis Seminar and Dr. S. B. Maiti and Dr. M. M. Roy for arranging my Ph. D. thesis seminar in June, 2008.

I must thank to Mr. Shalendra Saxena for his help in thesis work and computer works. Last but not the least, my sincere thanks to Mr. Vibhu Jain, computer and cyber shops, Sipri Bazar, Jhansi to patiently and neatly typing and preparing of diagrams of my thesis.

Place: Jhansi
Date: June, 2008

(Ashok Kumar Singh)