Waseem Hussain

Postdoctoral Research Associate
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Research Interests

Incorporating quantitative genetics, genomics, bioinformatics, statistics and high-throughput phenotyping to bridge the gap between phenotype and genotype. The primary research areas I want to focus is a characterization of alleles, cloning and isolation of genes, and integration through marker-assisted breeding. Identification and mapping of genomic regions (via linkage and association) with emphasis on abiotic and biotic stresses, and integration of genomic selection/predictions in cultivar and hybrid development using advanced genomic and phenotyping tools.

Education

Ph.D. in Agronomy (Plant Breeding & genetics); May 2017

University of Nebraska Lincoln USA

- Dissertation: "*Development of High-Density Linkage Map and QTL Mapping for Agronomic Traits in Bread Wheat Evaluated Across Multiple Rainfed Environments*"
- Advisor: Prof. P. Stephen Baenziger

M.S. in Agriculture (Plant Breeding & Genetics); Dec. 2011

Shere-I-Kashmir Univ. of Agric. Sci. and Technol. Kashmir, India

- Dissertation: "*Studies on heterosis and combining ability for hybrid rice development under temperate conditions*"
- Advisor: Dr. Gulzar Singh Sangehra

B.S. in Agriculture, June 2009

Sher-I-Kashmir Univ. of Agric. Sci. and Technol. Kashmir, India

Research Experience

Postdoctoral Research Associate

March 2018 to Current:
Department of Agronomy and Horticulture, University of Nebraska - Lincoln

- Supervisors: Gota Morota and Harkamal Walia

- Responsibilities:
    - Quantitative genetic analysis of longitudinal high-throughput image data of night temperature stress in wheat and rice.
    - Perform genome-wide analysis and genomic predictions of high-throughput image data combined with high dimensional genomic, transcriptomic and metabolomics data.
    - Modelling variance-heterogeneity in genome-wide association studies using novel statistical tools.
    - Develop R-packages and Shiny applications.

Research Associate Scientist-II (Wheat Breeder)
May 2017 to December 2017:
Maharashtra Hybrid Seed Company (MAHYCO), Aurangabad, Jalna, India

- The goal was to develop wheat lines and hybrids using advanced statistical and genomics tools.

Ph. D (ICAR International Fellow and Graduate Research Assistantship)
January 2014 to April 2017:

- Focused on the development and evaluation of RIL mapping population related to drought tolerance.
- Development of high-density linkage map based on SNPs derived from genotyping by sequencing.
- Genome-wide QTL mapping for various agro-physiological traits phenotyped across a wide range of environments.
- High-throughput phenotyping in wheat and soybean using newly developed phenotyping platforms.
- Genome selection/predictions in Nebraska Wheat breeding program.
- Gained proficiency in statistical analysis and programming including Unix operating system, Perl languages, GBS data analysis, and statistical analysis using R packages and SAS software.
- Conducted extensive field trials, crossing, phenoyping and data collections across multiple environments for the four years.
- Analyzed multi-environment phenotypic data in ASREML package in R and incorporating spatial corrections using mixed linear models and generate variance components.
- BLUP/BLUE estimates for genomic selections and QTL mapping.
- Molecular mapping of Tan spot resistance in wheat.

Research Fellow (INSPIRE Fellowship)
December 2011 to December 2013
Agricultural University, CSKHPKV, Palampur India.

- Diversity analysis in oats, screening and molecular mapping of powdery mildew resistance in oats.
- Double haploid breeding in wheat using *Imperata cylindrica* grass.

Graduate Research Assistant (M.S.)
June 2009 to December 2011
- Identification of potential restorers for newly developed temperate CMS lines and identify the heterotic combinations.

Publications

Under Preparation

- Hussain, W., Walia, H., Jarquin, D., and Morota, G. 2019. **Variance-heterogeneity genome-wide mapping for cadmium in wheat (*Triticum Aestivum* L.) revealed novel genomic regions and candidate genes.** Target Journal: *BMC Plant Biology.*
- Hussain, W., Belamkar, V., Guttieri, M.J., Poland, J and Baenziger, P.S. 2019. **Genotyping-by-sequencing derived high-density linkage map reveled novel genomic loci and candidate genes for plant height in wheat (*Triticum Aestivum* L.)** Target Journal: *The Plant Journal.*

Peer-Reviewed articles

- Kariyawasam, G. K., **Hussain, W**., Easterly, A., Guttieri, M., Belamkar, V., Poland, J., et al. 2018. **Identification of quantitative trait loci conferring resistance to tan spot in a bi-parental population derived from two Nebraskan hard red winter wheat cultivars.** *Mol Breeding*. 38.

- **Hussain, W**., Campbell, M., Walia, H., and Morota, G. 2018. **ShinyAIM: Shiny-based application of interactive Manhattan plots for longitudinal genome-wide association studies.** *Plant Direct*. 2: e00091.

- Sallam, A., Mourad, A. M. I., **Hussain, W**., and Stephen Baenziger, P. 2018. **Genetic variation in drought tolerance at seedling stage and grain yield in low rainfall environments in wheat (*Triticum aestivum L.*).** *Euphytica*. 214:169.

- **Hussain, W**., Guttieri, M. J., Belamkar, V., Poland, J., Sallam, A., and Baenziger, P. S. 2018. **Registration of a bread Wheat recombinant inbred line mapping population derived from a cross between 'Harry' and 'Wesley'.** *Journal of Plant Registrations*. 12:411–414.

- Hussain,W., Baenziger, P.S., Belamkar, V., Guttieri, M.J., Venegas, J.P., Easterly, A., Sallam, A., and Polland, Jesse. 2017. Genotyping-by-sequencing derived high-density linkage map and its application to QTL mapping of flag leaf traits in bread wheat. *Scientific Reports*.

- Belamkar, V., Guttieri, M. J., Hussain, W., Jarquín, D., El-basyoni, I., Poland, J., et al. 2018. Genomic selection in preliminary yield trials in a winter wheat breeding program. *G3: Genes|Genomes|Genetics*. 8:2735–2747.

- Bai, G., Ge, Y., Hussain, W., Baenziger, P. S., and Graef, G. 2016. A multi-sensor system for high throughput field phenotyping in soybean and wheat breeding. *Computers and Electronics in Agriculture*. 128:181–192.

- Badiyal, A., Chaudhary, H. K., Jamwal, N. S., Bhatt, A. K., and Hussain, W. 2016. Comparative assessment of different auxin analogues on haploid induction in triticale x wheat derived backcross generations. *Agricultural Research Journal*. 53:157.

- Jamwal, N. S., Chaudhary, H. K., Badiyal, A., and Hussain, W. 2016. Factors influencing crossability among triticale and wheat and its subsequent effect along with hybrid necrosis on haploid induction. *Acta Agriculturae Scandinavica, Section B — Soil & Plant Science*. 66:282–289.

- Sood, V. K., Rana, I., Hussain, W., and Chaudhary, H. K. 2016. Genetic diversity of genus *Avena* from North Western-Himalayas using molecular markers. *Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci*. 86:151–158.

- Chaudhary, L., Sood, V.K., and Hussain, W.2015. Genetic analysis for grain and forage yield and its component traits in genus *Avena* under North western Himalayas. *Range Management and Agroforestry*. 35:2.

- Badiyal, A., Chaudhary, H. k., Jamwal, N. s., Hussain, W., Mahato, A., and Bhatt, A. k. 2014. Interactive genotypic influence of triticale and wheat on their crossability and haploid induction under varied agroclimatic regimes. *Cereal Research Communications*. 42:700–709.

- Sanghera, G. S., and **Hussain, W**. 2012. Heterosis and combining ability estimates using line x tester analysis to develop rice hybrids for temperate conditions. *Notulae Scientia Biologicae*. 4:131–142.

- **Hussain, W**., and Sanghera, G. S. 2012. Exploitation of heterosis in rice (*Oryza sativa L.*) using CMS system under temperate conditions. *Electronic Journal of Plant Breeding*. 3(1):695-700.

- Sanghera, G. S., Wani, S. H., **Hussain, W**., and Singh, N. 2011. Engineering cold stress tolerance in crop plants. *Curr. Genomics*. 12, 30–43.

Book Chapters

- Rana,M., Sood, A., **Hussain, W**., Kaldate, R., Sharma, T.R., Gill, R.K., Kumar, S., Singh, S. (2019). In: Mohar Singh (eds), *Gene Pyramiding and Multiple Character Breeding*, Lentils: Potential Resources for Enhancing Genetic Gains, 2019, Pages 83-124.

- Sanghera, G.S., Wani, S.H., **Hussain, W**., and Singh, N.B. (2015). *Genetic Engineering for Cold Stress Tolerance in Crop Plants*. In book: Advances in Genome Science, Edition: Volume 4, Publisher: Bentham Science, Editors: Atta-ur-Rahman, pp. 173-201.

- Chaudhary, H.K., Kaila, V., Rather, S.A., Badiyal, A., **Hussain, W**., Jamwal, N.S., and Mahato, A. (2013). In: Pratap and J. Kumar (eds.), *Alien Gene Transfer in Crop Plants, Volume Achievements and Impacts*. Springer, pp 1-26.

- **Hussain, W**., Sanghera, G.S., Jamawal, N.S, and Badiyal,A. (2013). *Crop improvement through genomic interventions in sustainable way*. In: Malik CP, Sanghera GS and Sharma P(ed) Crop improvement: An integrated approach. MD Publications Pvt Ltd, New Delhi. pp 61-68. ISBN 978-81-7533-456-4.

- Dar, S.H., **Hussain, W**., and Sanghera, G.S. (2013). *Advances in hybrid rice technology through applications of novel technologies*. In: Malik CP, Sanghera GS and Sharma P(ed), Crop improvement: An integrated approach. MD Publications Pvt Ltd, New Delhi. pp 1-12.

Talks

- ShinyAim: Shiny-Based Application of Interactive Manhattan Plots for Longitudinal GWAS.
  November 06, 2018
  Conference Talk at ASA, CSSA Meeting (2018), Baltimore, Maryland

- **Shiny Based Imaging GWAS Server.**
  May 05, 2018
  Invited Talk at University of Nebraska Department of Statistics, Lincoln, Nebraska

- **Genotyping-by-sequencing Derived High-Density Linkage Map and its Application to QTL Mapping of Flag Leaf Traits in Bread Wheat.**
  April 05, 2017
  Invited Talk at Plant Breeding and Genetics Symposium, Manhattan, Kansas

- **New tools to Understand and Improve Wheat in Genomics Era.**
  February 10, 2017
  Invited Talk at Maharashtra Hybrid Seed Company (MAHYCO) India, Dawalwadi, Jalna, Maharashtra, India

- **Development of High-Density Linkage Map in Wheat and Genome-Wide QTL Mapping for Plant Height.**
  March 29, 2016
  Invited symposium Talk at Nebraska Plant Breeding Symposium 2017, Lincoln, Nebraska

- **Association Mapping and its Role in Crop Improvement**
  August 05, 2014
  Ph.D seminar talk at University of CSKHPKV, Palampur India Deptt. of Crop Improvement, Palampur, India

- **Genetics and Molecular Basis of Heterosis in Crops**
  June 03, 2009
  M.Sc Seminar Talk at University SKUAST-K, Deptt. of Plant Breeding & Genetics, Srinagar, J and K, India

Fellowships and Awards

- Open Science Grid User School Travel Grant Award 2018.

- Travel Grant Award Kansas State Plant Breeding Symposium-2017.

- International Conference on Quantitative Genetics Fellowship Award-2016.

- Best Oral Presentation Award, UNL Plant breeding Symposium-2016.

- Indian Council of Agricultural Research (ICAR)-International Fellowship (2014-2017).

- Inspire Fellowship (Ministry of Science & Technology, Department of Science & Technology, India (2012-2104).

- University Merit Certificate (M.Sc. Plant breeding &Genetics) (2011).

- Qualified ASRB National Eligibility Test 2012, 2013 and 2014 for Assistant Professorship

Professional Training

- Software Carpentry Workshop on computational skills, including task automation, version control, and modular programming. Learn Bash, Git and Python. Holland Computing Center, University of Nebraska, Lincoln. August 13 & 14, 2018.

- Open Science Grid (OSG) User School 2018: Workshop on High Throughput Computing and Running Large Scale Computing Applications at University of Wisconsin Madison. July 9-13.

- Work shop Series on Unix Shell, Git and use of HCC's High-Performance Computing, High Throughput Computing and Cloud computing resources. Holland Computing Center, University of Nebraska Lincoln. June 05-26, 2018.

- Short term bioinformatics training (RNA-seq and DNA-seq). ArrayGen Technologies, India, Pune. 23 Oct-21 Nov. 2017.

- Understanding genome-wide association studies and other big data biological applications. University of Nebraska, Lincoln. June 23-24, 2014.

- Fundamental writing skills workshop researchers. University of Nebraska, Lincoln. Sept 2015.

- Write Wining Grant Proposals, University of Nebraska, Lincoln, March 18, 2016.

Leadership Roles

- A representative of Department of Agronomy and Horticulture Safety Committee in the year 2015.

- Member of organizing a committee of UNL plant breeding symposium-2016.

- Hosted 2015- World Food Prize Nebraska Youth Institute in Department of Agronomy and Horticulture.

- Poster Judge (Undergraduate and Graduate) at University of Nebraska, Lincoln Spring Research Fair-2018.

- Poster Judge (Undergraduate) at ASA, CSSA Annual meetings in Baltimore, Maryland-2018.

Professional Memberships

- ASA, CSSA, and SSSA since June-2014.

- National Association of Plant Breeders since Feb. 2018.

- American Society of Plant Biologists since April 2018.

Professional Experience

- Associate Editor: Agronomy Journal (March 2018 to present).
- Peer Reviewer: Agronomy Journal (American Society of Agronomy); PNAS, Biological Sciences, India; Physiology and Molecular Biology of Plants and Agronomy (MPDI).

Open Source Contributions

ShinyAIM: Shiny-based Application of Interactive Manhattan Plots for Longitudinal GWAS available at https://chikudaisei.shinyapps.io/shinyaim/ and GitHub for direct download https://github.com/whussain2/ShinyAIM.

Posters and Conferences

- Lata, S., Guleria, S.K., Thakur, K., Kumari, R., Rana, M., and **Hussain, W**: Introgression of *Opaque2* Gene Through Marker-Assisted Backcross Breeding in Elite Maize Inbred Lines. 13th Asian Maize Conference and Expert Consultation on Maize for Food, Feed, Nutrition and Environmental Security, Ludhiana, India October 8-10,2018. P140.

- Venegas, J.P., Graybosch, R., **Hussain, W**., Bai, G., St Amand, P., Baenziger, P.S., Blecha, S: High-Density Linkage Map Construction and Mapping of Mutant Low Phytate QTLs in Winter Wheat (*Triticum Aestivum L.*) Using Genotyping-By-Sequencing (GBS). ASA, CSSA and SSSA Tampa, Florida, Oct. 22-25, 2017.

- Rana, M., Verma, P., **Hussain,W**., Kaldate, R., Shikha, D., Kaachra, A., Chahota, R.K., Bhatia,S., and Sharma, T.R: Molecular Mapping of QTLs for Drought Tolerance and Yield Traits in Lentil. InterDrought-V, Hyderabad International Convention Center (HICC), At Hyderabad India, 21-25 Feb. 2017.

- Belamkar, V., Guttieri, M.J., El-Basyoni, I., **Hussain, W**., Poland, J., Jarquín, D., Lorenz, A.J., Baenziger, P.B: Translating Genomic Research into Cultivar Development in the Nebraska Wheat Program. Plant and Animal Genome Conference XXIV, San Diego, CA; 01/2017.

- Sallam, A., **Hussain, W**., Belmaker, V., and Baenziger, P.S: QTL Mapping for Traits Associated with Drought Tolerance and Combined Drought and Heat Tolerance in Seedling Winter Wheat. Plant and Animal Genome Conference, San Diego, CA; 01/2017.

- **Hussain, W**.,Stephen, P.B., Belamkar, V., Guttieri, M.J., Easterly, A., Venegas, J.P., Guedira, G.B., Poland, J: Development of High Density Linkage Map and Genome-Wide QTL Mapping for Grain Yield in Wheat Across Multiple Rainfed Environments. ASA, CSSA and SSSA Minneapolis, Nov. 6-9, 2106.

- Sallam, A., **Hussain, W**., Belmaker, V., and Baenziger, P.S: Molecular Genetic Dissection to Improve Seedling Drought Tolerance in Winter Wheat Using QTL Mapping. At: Nebraska City, USA, Conference: Plant Science Retreat-october 2016.

- Kariyawasam, G., **Hussain, W**., Easterly, A., Guttieri, M.J., Belamkar, V., Venegas, J.P., Baenziger, P.B., Poland, J., Faris, J., Xu, S., Rasmussen, J., and Liu, Z: QTL Mapping of Resistance to Tan Spot in a Winter Recombinant Inbred Line Population Derived from Cross between Harry and Wesley. Conference: American Phytopathological Society Annual Meeting-2016, At Tampa, Florida.

- **Hussain, W**., Baenziger, P.B., Belamkar, V., Guttieri, M.J., Easterly, A., Venegas, J.P., Guedira, G.B., Poland, J: SNP Discovery in Wheat RIL Population Using Genotyping-by-Sequencing and Genome-Wide QTL Mapping for Plant Height. Conference: 5th International Conference on Quantitative Genetics, At Madison, Wisconsin, USA.

- Belamkar, V., Guttieri, M.J., El-Basyoni, I., **Hussain, W**., Poland, J., Jarquín, D., Lorenz, A.J., Baenziger, P.B: Genomic Selection Shows Promise for Improving Winter Wheat: Insights from the University of Nebraska-Lincoln Wheat Breeding Program. Conference: 5th International Conference on Quantitative Genetics, At Madison, Wisconsin, USA.

- Belamkar, V., Guttieri, M.J., El-Basyoni, I., **Hussain, W**., Poland, J., Jarquín, D., Lorenz, A.J., Baenziger, P.B: Integration of Genomic Selection in the Nebraska Wheat Breeding Program. Plant and Animal Genome Conference XXIV, San Diego, CA; 01/2016.

- **Hussain, W**., Stephen, P.B, Guttieri, M.J., Easterly, A., Venegas, J.P., Guedira, G.B., Poland, J: Mapping QTLs for Plant Height Variation in RIL Population Derived from Cross Between Harry X Wesley Semi-Dwarf Wheat Lines. ASA, CSSA and SSSA Minneapolis, Nov. 15-18, 2105.

Skills

Quantitative Skills
- Genotyping-by-sequencing data analysis and SNP calling
- Trained to perfom RNA-seq data anlysis
- Quantitative Genetics
  - QTL Mapping: R/qtl, R/ASMap, IciMapping etc.
  - Genome-wide Association Mapping: Plink, TASSEL, BGLR, rrBLUP, GAPIT, FarmCPU etc.
  - Genomic Selections: BGLR, rrBLUP etc.
- Statistics
  - R

- o   SAS
- o   ASReml
- o   Python

Wet Lab Skills

- DNA extractions, PCR, real-time PCR, electrophoresis, SSR marker and KASP marker genotyping

Computational Skills

- Operating Systems: LINUX, OS X, Windows
- Big data analysis, high-throughput and cloud computing, linux shell and git.
- Latex and R Markdown
- Perl

Teaching Experience

Teaching Experience 1

- This lecture was one of the lectures in course **ASCI 944/STAT 844 Quantitative Methods for Genomics of Complex Traits** taught by Dr. Gota Morota. In this lecture I talk about **basic concepts in GWAS**, **how to correct for population stratification**, and **statistical models to run GWAS** and also showed **practical demonstration** how to perform **GWAS in R-software**.

Teaching Experience 2

- This lecture was delivered in Rclub hosted by students in the Agronomy and Horticulture department, University of Nebraska, Lincoln. In this lecture I discussed about **data visualizations in ggplot**, **interactive visualizations using plotly**, **multiple plots in same panel**, **correlations** and **correlation heat maps**.

References

Dr. P. Stephen Baenziger

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