Waseem Hussain

Lead-Rainfed Rice Breeding (Scientist-I)
Rice Breeding Platform
International Rice Research Institute

NCBL Building
Room no. 235
Los Banos, Laguna, Philippines
waseem.hussain@irri.org
Website: https://whussain2.github.io/

Research Interests

Interested in the development of improved germplasm and products. Keen to integrate and utilize multi-disciplinary approach and tools to modernize the breeding programs, and for speedy development of the products and efficient management of resources.

Teaching Interests

IRRI does not have any mandate on teaching. I am passionate about teaching and strongly believe that transferring knowledge through teaching, interactions and discussions can transform the young brains into great intellectuals that can make this world better. Created open-source education and knowledge platform related to plant breeding and quantitative genetics and open to world (https://github.com/whussain2/R-for-Plant-Breeding)

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

Professional Positions

Rice Breeder (Scientist-I)

September 2019 to present
Rice Breeding platform
International Rice Research Institute, Los Banos, Philippines.

100% Research

Wheat Breeder (Associate Scientist-II)
May 2017 to December 2017
Maharashtra Hybrid Seed Company (MAHYCO), Aurangabad, Jalna, India
100% Research

Research Experience

Postdoctoral Research Associate
March 2018 to July 2019
Department of Animal Sciences and Agronomy and Horticulture, University of Nebraska – Lincoln

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

Research Fellow (INSPIRE Fellowship)
March 2012 to December 2013
Agricultural University, CSKHPKV, Palampur India

Graduate Research Assistant (M.S.)
June 2009 to December 2011

Publications

Under Preparation

1. **Hussain W**[*] and Bhonsale S. 2020. Seamless data analysis, visualizations and sharing: Perspective from IRRI's Rice breeding program. Target Journal: *Rice.*
2. Roselyne, J.U., Bartholome, J., **Hussain, W.**, Mbute, F.N., Miano, D.W., Prakash, P., Murori, R., Rutkoski, J.E., Biswas, P.S., Juan D. Arbelaez, J.D. and Cobb, J.N. 2020. Optimization of indica rice (*Oryza sativa L.*) breeding program: Designing a core panel as a future breeding germplasm resource. Target Journal: *PNAS*
3. **Hussain, W.**, Belamkar, V., Guttieri, M.J., Poland, J and Baenziger, P.S. 2020. 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

1. Dhatt, B[*]., Paul, P[*]., Sandhu, J[*]., **Hussain, W**[*]., Irvin, L., Zhu, F., Adviento-Borb, M., Lorence, A., Staswick, P., Yu, H., Morota, G. and Walia, H. 2020. Allelic variation in rice fertilization independent endosperm 1 contributes to grain width under high night

temperature stress. *New Phytologist* (Provisionally accepted, in second revision) * **Equal author contribution**

2. **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**.** *The Plant Genome.* https://doi.org/10.1002/tpg2.20011
3. Paul, P., D.K. Dhatt, J. Sandhu, **W. Hussain**, L. Irvin, G. Morota, P. Staswick, and Walia. H. 2018. Divergent phenotypic response of rice accessions to transient heat stress during early seed development. *Plant Direct. https://doi.org/10.1002/pld3.196*
4. 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. *Molecular Breeding.* https://link.springer.com/article/10.1007/s11032-018-0901-3
5. **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*. https://doi.org/10.1002/pld3.91
6. 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. *Euphytica*. https://link.springer.com/article/10.1007/s10681-018-2245-9
7. **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.* https://doi.org/10.3198/jpr2017.11.0085crmp
8. 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*. https://www.g3journal.org/content/8/8/2735
9. **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*. https://www.nature.com/articles/s41598-017-16006-z
10. 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*. https://doi.org/10.1016/j.compag.2016.08.021
11. 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*. 10.5958/2395-146X.2016.00031.4

12. 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*. https://doi.org/10.1080/09064710.2015.1095939

13. 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. https://link.springer.com/article/10.1007/s40011-014-0427-3 *** Corresponding author**

14. 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.*

15. 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*. https://link.springer.com/article/10.1556/CRC.2014.0017

16. 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*. https://doi.org/10.15835/nsb437873

17. **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*. https://core.ac.uk/download/pdf/25757766.pdf

18. Sanghera, G. S., Wani, S. H., **Hussain, W**., and Singh, N. 2011. Engineering cold stress tolerance in crop plants. *Current Genomics*. 12, 30–43. 10.2174/138920211794520178

Book Chapters

1. Chaudhary, H.K., Badiyal, A., **Hussain, W**., Jamwal, N.S., Kumar, N., Sharma, P and Singh, D. (2019). *In: book: Genomics Assisted Breeding of Crops for Crop Stresses, Vol, II*. Innovative Role of DH Breeding in Genomics Assisted-Crop Improvement: Focus on Drought Tolerance in Wheat. Springer*, pp 69-90.* https://link.springer.com/chapter/10.1007/978-3-319-99573-1_5

2. Rana,M., Sood, A., **Hussain, W**., Kaldate, R., Sharma, T.R., Gill, R.K., Kumar, S., Singh, S. (2019). *In: Mohar Singh (eds): Lentils: Potential Resources for Enhancing Genetic Gains*: Gene Pyramiding and Multiple Character Breeding, 2019, Pages 83-124. https://doi.org/10.1016/B978-0-12-813522-8.00006-6

3. Sanghera, G.S., Wani, S.H., **Hussain, W**., and Singh, N.B. (2015). *In book: Advances in Genome Science*: Genetic Engineering for Cold Stress Tolerance in Crop Plants. Edition: Volume 4, Publisher: Bentham Science, Editors: Atta-ur-Rahman, pp. 173-201. 10.2174/9781681081731116040010

4. 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.* Wheat, Springer, pp 1-26. https://link.springer.com/chapter/10.1007/978-1-4614-9572-7_1
5. **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.

Teaching Experience (https://whussain2.github.io/teaching/)

Teaching Experience 1

- Lecture on GWAS and practical demonstration on course **ASCI 944/STAT 844-Quantitative Methods for Genomics of Complex Traits** taught by Dr. Gota Morota.

Teaching Experience 2

- Lecture on R data visualizations in Rclub hosted by students in the Agronomy and Horticulture department, University of Nebraska, Lincoln.

Teaching Experience 3

- Two lectures on genomic predictions and GWAS in the course **STAT 892-007- Integrative Data Science for Plant Phenomics** taught by multiple instructors.

Talks

1. Strategies for maintaining genetic variation while maximizing genetic gain in a modern rice breeding program.
   June 17, 2019
   Invited talk at IRRI, Rice Breeding Platform
2. ShinyAim: Shiny-Based Application of Interactive Manhattan Plots for Longitudinal GWAS.
   November 06, 2018
   Conference Talk at ASA, CSSA Meeting (2018), Baltimore, Maryland
3. Shiny Based Imaging GWAS Server.
   May 05, 2018
   Invited Talk at University of Nebraska Department of Statistics, Lincoln, Nebraska
4. 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
5. 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

6. 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
7. 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
8. 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

1. Open Science Grid User School Travel Grant Award 2018.
2. Travel Grant Award Kansas State Plant Breeding Symposium-2017.
3. International Conference on Quantitative Genetics Fellowship Award-2016.
4. Best Oral Presentation Award, UNL Plant breeding Symposium-2016.
5. Indian Council of Agricultural Research (ICAR)-International Fellowship (2014-2017).
6. Inspire Fellowship (Ministry of Science & Technology, Department of Science & Technology, India (2012-2104).
7. University Merit Certificate (M.Sc. Plant breeding &Genetics) (2011).
8. Qualified ASRB National Eligibility Test 2012, 2013 and 2014 for Assistant Professorship.

Research Grants Funded

1. ICAR International Fellowship for Ph.D. Research (https://icar.org.in/)
   Jan. 2014- Dec. 2016
   Indian Council of Agricultural Research, $80,000
   Proposal: Using Advanced Genomic Tools to Improve Wheat Under Drought Conditions.

2. INSPIRE Fellowship for Ph.D. Research (https://online-inspire.gov.in/)
   June 2012-Dec. 2013
   Department of Science and Technology, India, $16,000
   Proposal: Diversity analysis and mapping of powdery mildew resistance in oats.

Professional Training

1. 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.
2. 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.
3. Workshop 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.
4. Short term bioinformatics training (RNA-seq and DNA-seq). ArrayGen Technologies, India, Pune. 23 Oct-21 Nov. 2017.
5. Next-generation Plant and Animal Breeding Program. Animal Science Department, University of Nebraska, Lincoln. March 21- 25, 2016.
6. From raw sequence to annotated genome-a systems biology tutorial. University of Nebraska Lincoln, Oct. 2015.
7. Understanding genome-wide association studies and other big data biological applications. University of Nebraska, Lincoln. June 23-24, 2014.
8. Fundamental writing skills workshop researchers. University of Nebraska, Lincoln. Sept 2015.
9. Write wining grant proposals, University of Nebraska, Lincoln, March 18, 2016.

Leadership Roles

1. A representative of Department of Agronomy and Horticulture Seminar Committee in the year 2019.
2. A representative of Department of Agronomy and Horticulture Safety Committee in the year 2015.
3. Member of organizing a committee of UNL plant breeding symposium-2016.
4. Managing 2015- World Food Prize Nebraska Youth Institute in Department of Agronomy and Horticulture.
5. Poster Judge (Undergraduate and Graduate) at University of Nebraska, Lincoln Spring Research Fair-2018.
6. Poster Judge at ASA, CSSA Annual meetings in Baltimore, Maryland-2018.

Professional Experience

- Associate Editor: Agronomy Journal (March 2018 to present).
- Reviewer: Agronomy Journal (American Society of Agronomy); PlosOne; BMC Genetics; 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.
- **R for Plant Breeding**: This is an open source-resource to learn the Plant Breeding and Genetics related data analysis and visualizations (https://github.com/whussain2/R-for-Plant-Breeding)

Posters and Conferences

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.

6. 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.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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

- GBS data analysis and SNP calling
- Big data handling and analysis
- Cloud computing
- Quantitative Genetics: QTL Mapping, GWAS, Genomic selections etc.
- Statistical tools: R and SAS
- Operating Systems: LINUX, OS X, Windows
- Content-description Languages: XHTML, CSS, LATEX, Markdown

Wet Lab Skills

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

References and additional information available upon request