

1st AUS-PAK International Conference on
WHEAT FOR FOOD SECURITY



March 24-25, 2019

Organized by

Institute of Plant Breeding and Biotechnology

MNS-University of Agriculture Multan



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Executive Summary

Wheat is the most important grain and a staple food for more than one third of the world population. Globally its yield stagnation especially in the backdrop of climate change scenario is challenging the food security of wheat dependent populations. Keeping in view the above importance of wheat crop, the Institute of Plant Breeding and Biotechnology, MNS-University of Agriculture, Multan, in collaboration with the University of Sydney Australia, KWS UK, Department for International Development (DFID), Wheat Research Institute (AARI), Faisalabad, and University of Agriculture Faisalabad, organized an “International Conference on Wheat for Food Security” on March 24-25, 2019. The conference provided a platform to foster important discussions on wheat breeding and its management in changing climate. The foreign delegates from Australia, Canada and United Kingdom and national keynote speakers from different institutes participated in the conference. Other stakeholders included academia, researchers, government officials, industry representatives, agri-entrepreneurs, farmers etc. It was realized that wheat hybrids are better in yield, disease resistance and climate smart over OPVs. The complexity of wheat diseases establishment makes it essential for us to seek a holistic approach for their control. Such an approach includes breeding for durable disease resistance; developing appropriate crop management practices, including nutrient applications; monitoring pathogen diversity; and applying recent advances in biotechnology to overcome disease losses. The use of genomic tools including marker assisted breeding and genomics selection may be encouraged for designing comprehensive selection strategies. The germplasm exchange may be promoted with other breeding programs from very different environments. For improving yield and sustainability, there is need of precision agriculture and better crop management.

Mr. Syed Fakhar Imam (Chairman Kashmir Committee and progressive grower) talked about the issues of climate change. The Chief Guest Dr. Muhammad Akhtar Malik (Provincial Minister for Energy) congratulated Prof. Dr. Asif Ali, Vice Chancellor, MNS-UAM on holding International Conference Week. This conference opened the new avenues of research collaborations to address challenges to our food security.

RECOMMENDATIONS

The recommendations derived from the technical sessions were as follows.

- **Hybrid cultivars** with improved yield and other favorable agronomic traits may be promoted for cultivation on large area to boost the national yield.
- Emphasis should be given for identification of diverse sources of **disease resistance** in the wheat germplasm and its incorporation to adapted cultivars.
- The genetic improvement of wheat for leaf and root architecture to confer **drought and heat tolerance**.
- In the scenario of climate change, **short duration cultivars** may be developed and provided to the farmers to attain the better yield.
- **Value addition** in wheat may be focused to earn more economic benefits.
- To speed up the breeding program, **advanced and modern breeding methods** may be preferred for the development of varieties well adapted to the changing climate.
- **Site-specific village-based seed production** and dissemination systems may be developed in partnership with farmers
- **International and regional cooperation** should be enhanced to facilitate human resource development, sharing of information and plant materials, online data management and improvement in breeding and seed production system.

BACKGROUND

World population is expected to reach 9 billion by 2050 and climate change is now a reality rather than a myth. Food production systems are most vulnerable to climate change and it is a serious threat to food security especially in the developing countries. Pakistan is steadily among the top ten most prone countries to climate change and has witnessed adverse impacts due to climate extremes in recent past. Wheat accounts for one-fifth of the world's food and is second only to rice as a source of calories for developing country consumers. Demand for wheat in the developing world is projected to increase 60% by 2050. Feeding a growing world population is one of the great challenges of our time. It is a challenge that will be exacerbated in the years ahead by the impacts of climate change and the decline of arable land worldwide. The work of wheat researchers is more important than ever in managing the biotic and abiotic stresses that threaten wheat production, and in improving livelihoods and food security for smallholder wheat farmers. Innovations in technology can only be as good as the germplasm available. Germplasm evaluation and searching for useful alleles in the wheat gene pool, including wild relatives, genebank accessions, and mutant populations will be a major endeavor for future wheat improvement, particularly for adaptation to stressful environments. Access to germplasm and open germplasm exchange among researchers and breeders must be maintained and stimulated, in order to allow for long term mutual progress in wheat improvement. 1st AUS-PAK International Conference on Wheat for Food Security aims to bring together scientists, research scholars and progressive farmers on single platform to share and enhance the knowledge to address the problems of wheat production through innovative technologies of breeding and biotechnology. Conference will be held to promote interdisciplinary dialogues regarding the contemporary issues in wheat. This event will provide the awareness about technological advances in agriculture to cope with the rising problems for wheat production. International scientists from different countries including Australia, Canada and UK participated in this conference.

LIST OF INTERNATIONAL KEYNOTE SPEAKERS

Sr. No.	Name	Country	Affiliation	Field Of Interest
1	Prof. Dr. Richard Trethowan	Australia	Director, IA Watson Research Centre, The University of Sydney Australia	wheat breeding and genetics. He currently leads various national and international initiatives that aim to improve crop productivity in stressed environments.
2	Prof. Dr. Harbans Singh Bariana	Australia	Professor School of Life and Environmental Sciences The University of Sydney Australia	Cereal Rust Genetics, His research experience covers genetics and cytogenetics of rust resistance, genetic and biochemical control of wheat quality, molecular mapping and marker development & validation in wheat
3	Dr. Thistlethwaite Rebecca Janettee	Australia	Postdoctoral Research Associate. The University of Sydney Australia	“Identification of genetic variation in heat stress and mechanisms of tolerance in wheat”
4	Dr. Nicholas Bird	UK	Research Scientist, KWS, UK	Molecular Wheat Breeding
5	Dr. Harpinder Singh Randhawa	Canada	Research Scientist Agriculture and Agri-Food Canada	His breeding program integrates conventional breeding approaches along with marker assisted breeding, doubled haploid and other novel technologies for cultivar development

LIST OF NATIONAL KEYNOTE SPEAKERS

Sr. No.	Name	Affiliation	Field of Interest
1	Dr. Javed Ahmad	Director, Wheat Research Institute, AARI, Faisalabad	Wheat breeding for biotic and abiotic stresses
2	Prof. Dr. Aftab Bashir	Professor Deptt. of Biological Sciences, Forman Christian College Lahore	Enhancing wheat yield and developing resistance against biotic and abiotic stresses using transgenic technologies & OMICS
3	Dr. Mehboob-ur-Rahman	Plant Genomics & Mol. Breeding Lab., National Institute for Biotechnology & Genetic Engineering	Development of early maturing, drought and heat tolerant wheat varieties using DNA fingerprinting approaches
4	Dr. Muhammad Ramzan Khan	Principal Scientific Officer National Institute for Genomics and Advanced Biotechnology (NIGAB), NARC Islamabad	Genome informatics (NGS applications including RNA-seq, ChIP-seq etc.) of plants for expression variations and comparative genomics
5	Dr. Rizwana Maqbool	Assistant Professor University of Agriculture Faisalabad	Marker Assisted Background Selection (MABS)
6	Dr. Awais Rasheed	Assistant Professor Quaid-i-Azam University, Islamabad Adjunct Associate Scientist International Maize and Wheat Improvement Center (CIMMYT)	Molecular wheat breeding for abiotic stresses. GWAS, KASP application in wheat

LIST OF DIGNITARIES

Sr. No.	Name
1	Dr. Akhtar Malik (Provincial Minister for Energy)
2	Mr. Syed Fakhar Imam (Chairman Kashmir Committee)
3	Dr. Ata ur Rehman, (Graham Centre for Agricultural Innovation, Charles Sturt University Australia)
4	Mr. Qasim Langah (Member Provincial Assembly)
5	Syed Ibn-e- Hussain (Retired D.I.G. Railway Police)

Day-2 Monday March 25th, 2019

1st Aus-Pak International Conference on Wheat for Food Security

Session 1: Advanced Technological Developments in Wheat Breeding

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Prof. Dr. Richard Trethowan

Co-chair: Dr. Harpinder Singh Randhawa

Rapporteurs: (i). Dr. M. Mahmood Ahmed (ii) Dr. Ummara Waheed

Moderator: Ms. Sidra Jamil

Time	Topic	Name of Scientist
10:00 am	Integrated approaches for wheat breeding to mitigates production risk	Dr. Harpinder Singh Randhawa
10:20 am	Accurate, high-throughput field-based phenotyping for heat tolerance: a prerequisite for effective wheat improvement	Dr. Rebecca Thistlethwaite
10:40 am	Wheat Pre-Breeding in a commercial context	Dr. Nicholas Bird
11:00 am	Development of wheat transgenics for drought tolerance	Prof. Dr. Aftab Bashir
11:30 am	Tea Break	

Session 2: Advanced Technological Developments in Wheat Breeding

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Dr. Rebecca Thistlethwaite

Co-chair: Prof. Dr. Aftab Bashir

Rapporteurs: (i). Dr. M. Mahmood Ahmed (ii) Dr. Ummara Waheed

Moderator: Ms. Sidra Jamil

Time	Topic	Name of Scientist
12:00 pm	Marker assisted background selection, a method for plant breeding in changing climate	Dr. Rizwana Maqbool
12:20 pm	Development and application of new genomics platforms for wheat breeding and pre-breeding	Dr. Awais Rasheed
12:40 pm	Utilization of NGS-based exome capture assay for identifying important genes in hexaploid wheat	Dr. Momina Hussain
01:00 pm	Transcriptomic analyses and editing of root architecture genes in wheat for yield enhancement leading to food security	Dr. Muhammad Ramzan Khan
01:20 pm	Identification of Chromosomes Associated with Callus Induction in Hexaploid wheat	Dr. Ummara Waheed
01:40 pm	Lunch	

Session 3 Climate Smart Breeding - biotic and abiotic Stresses**Venue: Computer Lab, MNS University of Agriculture, Multan****Chair:** Prof. Dr. Harbans Singh Bariana**Co-chair:** Dr. Nicholas Bird**Rapporteurs:** (i). Dr. Zulqarnain Khan (ii) Mr. M. Amir Bakhtavar**Moderator:** Ms. Saima Rasheed

Time	Topic	Name of Scientist
12:00 pm	Past, present and future of application of genomics in wheat to deliver triple rust resistant cultivars	Prof. Dr. Harbans Singh Bariana
12:20 pm	Prickle hairs help in water-channelling of fog droplets for self-irrigation in wheat	Ms. Sadia Hakeem
12:40 pm	Genome wide association mapping for terminal drought stress in bread Wheat	Mr. Muhammad Ali Sher
01:40 pm	Lunch Break	

Session 4: Climate Smart Wheat Management**Venue: Seminar Hall MNS University of Agriculture, Multan****Chair:** Dr. Harpinder Singh Randhawa**Co-chair:** Dr. Ata ur Rehman**Rapporteurs:** (i). Dr. M. Mahmood Ahmed (ii) Dr. Ummara Waheed**Moderator:** Ms. Sidra Jamil

Time	Topic	Name of Scientist
02:30 pm	High temperature stress in wheat and role of plant growth regulators	Dr.. Muhammad Zahid Ihsan
02:50 pm	Comparative performance of locally developed advance lines and exotic advance lines of bread wheat under irrigated conditions of Faisalabad	Mr. Muhammad Owais
03:10 pm	Impact of varietal yield improvement research in wheat in Punjab, Pakistan	Dr. Nasir Nadeem
03:30 pm	Impact of improved wheat seed adoption on livelihood of farmers in remote areas of Sindh-Pakistan	Mr. Muhammad Fahad Irfan
03:50 pm	Impediment effect of chemical agents (additives) on gluten development in cookie dough	Dr. Shabbir Ahmad
04:10 pm	Impact of germinating barley flour addition in wheat flour on quality of biscuits and bread	Mr. Muhammad Abdullah
Concluding session		

AARIVAL OF GUESTS



INAUGURAL CEREMONY

The inaugural session of the conference was started with the verses of the Holy Quran.

Dr. Akhtar Malik (Provincial Minister for Energy), Mr. Syed Fakhar Imam (Chairman Kashmir Committee), Mr. Qasim Langah (Member Provincial Assembly), Syed Ibn-e- Hussain (Retired D.I.G. Railway Police), foreign delegate (Canada, Australia, UK), Vice Chancellor MNS-UAM, Researchers, government officials, industry representatives, agri-entrepreneurs and other agricultural research stakeholders and progressive farmers participated in the conference.

Prof. Dr. Asif Ali,

Vice Chancellor MNS-UAM welcome all the participants of conference especially chief guest Dr. Akhtar Malik (Provincial Minister for Energy), Mr. Syed Fakhar Imam (Chairman Kashmir Committee), foreign delegate and other national keynote speakers and private sector representatives. After that Dr. Asif Ali gave brief introduction of the



conference week. He said that MNS-University of Agriculture Multan is organizing this conference week in which three international conferences will be conducted. He also mentioned about the success of hybrid wheat production project in Pakistan that was in collaboration of DFID. He said that this project will help to improve food and nutritional security in Pakistan. He appreciated the KWS and Dr. Richard Trethowan with overwhelming tribute on their great efforts in the development of successful hybrid wheat development. After that Dr. Asif Ali highlighted the success of pulses project that is run by the MNS-University of Agriculture Multan in collaboration with the ACIAR. He also mentioned the importance of fodders for improving livestock and dairy industry. He also thanked to the sponsors including DFID, ACIAR, PARB, PSF, The University of Sydney and Charles Sturt University for sponsoring these projects. He also appreciated and congratulated to the organizers of the International conferences.

Prof. Dr. Richard Trethowan, Director, IA Watson Research Centre, The University of Sydney, Australia gave presentation about the potential of hybrid wheat in Australia and beyond. He appreciated the University leadership for making huge progress in short period of time. He said that



Pakistan is at front of Hybrid Wheat. He talked about trends in global and Australian wheat yield and emphasized that rate of yield increase in traditional self-pollinated wheat is becoming stagnant and there is need to shift towards hybrid wheat system. For improving yield and sustainability we have to move towards digital agriculture, better crop management. To improve yield potential research is needed for more efficient photosynthesis, high yielding wheat through empirical selection and hybrid vigour in wheat. Dr. Richard appreciated the work of Dr. Norman Darvey (Cytogeneticist and plant breeder in University of Sydney) for the development of system for Hybrid wheat production. He gave brief methodology of Hybrid wheat production system. The challenges to commercially viable Hybrid wheat production are that plant breeders have eliminated heterotic pools by crossing the 'best' with the 'best' and Hybrid wheat breeding not dissimilar to breeding hybrid maize. There are also challenges of finding Hybrid vigor. He emphasized that finding rust resistant F_1 hybrids are essential. The cost of breeding F_1 hybrids can be significantly reduced, however seed production limitations remain the same. Prospects of production hybrid durum wheat was also discussed in question answer session.

Dr. Aziz Ur Rehman

Botanist, Wheat Research Institute (AARI) Faisalabad in place of Dr. Javed Ahmad gave talk on drought tolerance in wheat. Dr. Aziz gave overview of decreasing per capita availability of water and emphasized about the importance of breeding for drought tolerant wheat. He said that different ideotypes that needs to be considered while breeding for drought tolerance include bold seed size, coleoptile length, early ground cover, stem reserves remobilization, spike photosynthesis, water relation traits, leaf anatomy, stay green and high tiller survival. He also talked about



selection criteria for drought tolerant wheat. Then he gave overview of breeding program of wheat Research institute for developing drought tolerant wheat.

Prof. Dr. Zulfiqar Ali from Institute of Plant Breeding and Biotechnology gave presentation on “Architecting wheat for self irrigation”. He said that drought stress is a major challenge to wheat production especially in Rain fed areas having 18% share in total wheat acreage in Pakistan. He explained the idea of fog capturing wheat varieties and angle of <13.7 is helpful for the drop of water droplets that are produced from gaseous water on the leaf surface. Then he explained the project activities and shared the results of his project. Dr. Zulfiqar said that we are also working on breeding system for fog capturing wheat varieties and F_1 generation has shown promising results.

Mr. Syed Fakhar Imam

addressed to the audience. He talked about the issues of climate change and said that Pakistan is among the top most effected countries of the world which are being affected by the climate change. He also emphasized the need of research to improve per acre yield of wheat. He said that to reduce import bill of pulses and edible oil, there is a need to improve our research through international collaboration. He



Dr. Muhammad Akhtar Malik

(Provincial Minister for Energy)

expressed his views about the International Conference week and congratulated Prof. Dr. Asif Ali, Vice Chancellor MNS-UAM and organizing committee for organizing International workshop. He emphasized on growers, university and



international collaboration to meet food security. He said that research and development is needed to combat the issues of climate change. He appreciated the university for taking lead and organizing workshops for increasing international collaboration and to learn from the experience of foreign scientists. He also thanked foreign scientists for visiting the Pakistan.

Prof. Dr. M. Hammad Nadeem Tahir gave vote of thanks to the honorable guests and international scientists. He also appreciated the efforts of organizing team and university leadership for support to organize the conference week. Dr. Hammad also thanked to the sponsors of the international conference week and with these words he concluded the opening session of international conference week.

FIELD VISIT



Session 1. Advanced Technological Development in Wheat Breeding

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Prof. Dr. Richard Trethowan Co-chair: Dr. Harpinder Singh Randhawa

Dr. Harpinder Singh Randhawa

Research Scientist Agriculture and Agri-Food Canada gave oral talk on “Integrated approaches for wheat breeding to mitigate production risk”. In his talk he explained that Canadian wheat is recognized globally for premium end-use quality and is the second largest exporter after the US. He was of the view



that wheat varieties could be classified based on their end-use functionality; factors such as protein content, gluten strength, kernel hardness and color which determine suitability for its end-use e.g. bread, noodles, semolina, pastries, confectionery, and other food uses. He emphasized that the rate of yield increase need to be accelerated world targets for food production are to be met. He explained that why Canadian wheat breeding programs have given special emphasis to improve agro-ecological adaptation, resistance to biotic and abiotic stresses, early maturity, and end-use quality of wheat. The key message of his oral talk was that the breeding for disease and insect resistance should be a major objective in all breeding programs as it offers the most efficient and economical type of control which, in turn, reduces input costs and environmental impacts by avoiding the use of chemicals. Before ending his talk, he suggested that use of genomic tools including marker assisted breeding and genomics selection should be encouraged for designing comprehensive selection strategies.

Dr. Rebecca Thistlethwaite

Postdoctoral Research Associate (The University of Sydney Australia) gave presentation on “Accurate, high-throughput field-based phenotyping for heat tolerance: a prerequisite for effective wheat improvement”. In her talk, she explained that how the high



temperature stress during the reproductive growth stages could have devastating effects on wheat yield. She was of the view that when the temperatures exceed 28°C during pollen formation, the anthesis could decrease the grain yield upto 4% for every 1°C rise in ambient temperature. She also shared outcomes of an experiment which comprised a population of 1500 wheat genotypes specifically selected to have putative heat tolerance.

She described that she evaluated a subset of 200 lines that best captured the genetic diversity within the set was maintained across years and evaluated at multiple sites (Western Australia and Victoria, Australia). She preferred to use Genotype by-environment (G×E) genomic selection models which make use of Environmental Covariates (ECs) were used to substantially increase the prediction accuracies for yield, screenings and other traits. Portable field heat chambers were specifically designed for use in field plots and were used to apply a heat stress 5°C above ambient temperature She was overwhelmed to share that this approach provided a novel method to predict heat susceptible lines. In addition, the approach could assess the validity of screening for heat tolerance using delayed sowing.

Dr. Nicholas Bird

Research Scientist, KWS, UK gave his oral talk on “Wheat Pre-Breeding in a commercial context”. He was of the view that private breeding companies are often accused of narrowing the genetic diversity in crops and having a short-term time horizon. In contrast to this view, KWS pushes to maintain



long-term access to useful and adapted genetic diversity a commercially focused pre-breeding

program has been added alongside commercial line breeding programs. He emphasized that scientific knowledge about exclusive development of new breeding parents should be the objective at KWS' rebreeding program.

He described that identified new parental lines must be adapted to the local environment, carry identifiable novel genetic diversity, and importantly yield on par with existing varieties. He demonstrated that by taking a breeder's approach to pre-breeding, he could cross with exotic germplasm and via field selection and use of genomic tools, achieve breeding parents which fit the strict criteria of the commercial line breeders and enter their crossing block. Moreover, access to exotic and well-characterized germplasm could play a vital role in any' pre-breeding program. He relied on the germplasm exchange with other breeding programs from very different environments, but also on public (pre-) breeding programs such as those at NIAB in the UK and CIMMYT. He demonstrated how they have already used germplasm from these institutions to generate lines currently being used in their commercial crossing block. At the end, he stated that investing in a focused pre-breeding program, KWS has ensured that our commercial breeders have access to novel genetic diversity to keep pushing yield potential.

Prof. Dr. Aftab Bashir

Professor Department of Biological Sciences Forman Christian College Lahore, presented oral talk on topic "Development of wheat transgenic for drought tolerance. He said that wheat is the most extensively grown cereal crop and meets nutritional requirements of a major part of global population. Climate change resulting



in global warming and water scarcity is currently the major threat to crop productivity. Out of the key abiotic stresses, drought and salinity are the key stresses of wheat in Pakistan, while increase in environmental temperature is the forthcoming issue. It is imperative to combat these stresses by developing salt and drought tolerant wheat varieties. Briefing about his experiment, he narrated that a construct harboring isopentynyl transferase (IPT) gene was developed for *Agrobacterium*-mediated transformation in wheat. The IPT gene cassette was constructed with a stress inducible promoter (Dehydrin). The construct was assembled in pSB219, a plant

expression vector containing herbicide tolerance (Bar) gene for transgenic selection. Thereafter, the transformations were done in 10,000 immature embryos. The putative transgenics were initially screened by two rounds of selection on media containing BASTA (2mg/L and 3mg/L). Integration of IPT gene expression cassette was primarily determined by PCR using gene junction primers and further confirmation by PCR product sequencing. The T plants of six selected transgenic 1 events were grown under controlled conditions in green house. Transgenic lines were screened on the basis of gene specific PCR and BASTA leaf paint assay. PCR positive plants were subjected to RT-PCR by extracting total RNA and synthesizing cDNA from leaves. The expression level of IPT was detected by qRT-PCR. The transgenic wheat lines will be evaluated for stress response during the selection of homozygous lines.

Session 2. Advanced Technological Development in Wheat Breeding

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Dr. Rebecca Thistlethwaite

Co-chair: Prof. Dr. Aftab Bashir

Dr. Rizwana Maqbool

Assistant Professor, PBG, University of agriculture Faisalabad gave an oral talk on the topic “Marker assisted background selection, a method for plant breeding in changing climate”. She briefly explained that how the changing climatic factors such as drought and high temperature increases the yield losses in agriculture. In



such circumstances, the demand of sustainable food production could be achieved with fast breeding approaches. While telling about her experiment, she narrated that Soft White Spring (SWS) wheat (*Triticum aestivum* L.) germplasm 'GSSC-2' carrying two gene for imidazolinone (imazamox) resistance was previously developed at the Department of Crop and Soil Sciences, Washington State University, Pullman, WA, USA. The germplasm 'GSSC-2' was derived from a cross between SWS wheat cultivar 'Louise' and Rod-two-gene Clearfield using modified marker assisted background selection (MABS) and forward breeding approaches. Polymorphic simple sequence repeat (SSR) markers were used on 340 backcross derived progeny, which

resulted into three plants with recovery of 93 % of the recurrent parent genome (RPG) in BC₂ generation in addition to two-gene (Ahasl-D1 and Ahasl-B1) for herbicide resistance. In addition, she emphasized that the agronomic performance and quality assessment data indicated that 'GSSC-2' was equal or superior to the recurrent parent. She was confident that the line will serve as SWS source for two-gene imidazolinone herbicide resistance. In such way, the advanced and modern method of fast breeding approach would be highly useful for the development of varieties in this changing climate.

Dr. Awais Rasheed

Assistant Professor, Quaid-i-Azam University Islamabad, Adjunct Associate Scientist International Maize and Wheat Improvement Center (CIMMYT) gave an oral talk on “Development and application of new genomics platforms for wheat breeding and pre-breeding”. He was of the view that functional markers



(FMs) are the most valuable markers for crop breeding. Low cost and high-throughput genotyping for FMs could provide an excellent opportunity to effectively practice marker-assisted selection in breeding. Based on FMs, he developed and validated competitive allele specific PCR (KASP) assays for genes that underpin economically important traits in bread wheat including adaptability, grain yield, quality, and biotic and abiotic stress resistances. Finally, a KASP platform with a robust marker toolkit for high-throughput and cost-effective screening of 90 functional gene/loci in wheat was developed. He further described the three advantages of KASP platform (1) high-throughput, 1536 cultivars can be genotyped with 142 available markers in 2-3 days; (2) low-cost, 9 cents USD per data point including DNA extraction; (3) good quality, highly consistent with normal PCR markers. He emphasized that KASP could be a potential application in wheat breeding to accelerate the characterization of crossing parents and advanced lines for marker-assisted selection of known genes. In addition, they have also developed new 55K and 15K wheat SNP arrays, and a targeted genotyping-by-sequencing (GBS) platform. Such genotyping platforms have significant potential to apply for academic wheat research and applied breeding.

Ms. Momina Hussain PhD Scholar National Institute of Biotechnology and Genetic Engineering gave an oral talk in place of Dr. Mehboob ur Rahman on “Utilization of NGS-based exome capture assay for identifying important genes in hexaploid wheat”. She was of the view that rust diseases—the most



detrimental phenomenon, substantially depressed yield worldwide including Pakistan. Her research group induced mutations in wheat variety “NN-Gandum-1” using chemical mutagen for improving its resistance to leaf and yellow rust. While telling about her research, she described that 0.8% EMS was found optimum for supporting 45-55% germination of NN-Gandum-1. Out of these, 17 lines were identified which shown resistance to leaf rust and yellow rust diseases. In addition, she emphasized on these lines and subjected to next generation sequencing (NGS)-based exome capture assay. About 104,779 SNPs were identified in all wheat sub genomes (A, B and D). The highest number of SNPs were mapped to chr.2B (14,273 SNPs). She filtered 101 SNPs which can affect gene function. She identified one putative SNP detected in Lr21. This SNP was located in a NBS domain of chr.1BS at 3.4 Mb position. These lines were again screened for resistant to the rust diseases in the national wheat disease screening nursery (NWDSN) trials, PGMB-15-30 (N1-252) demonstrated high resistance to LR and YR in three provinces of Pakistan. She concluded her talk by narrating that mutagens are extremely important in creating novel genetic resource which can be exploited getting insights into the genetic circuits of various genes.

Dr. Muhammad Ramzan Khan

Principal Scientific Officer National Institute for Genomics and Advanced Biotechnology (NIGAB), NARC Islamabad Principal Scientific Officer National Institute for Genomics and Advanced gave an oral talk on



“Transcriptomic analyses and editing of root architecture genes in wheat for yield enhancement leading to food security”. He

described that how root architecture is a prime target trait for enhancement of yield in wheat using genome editing approaches. His research envisaged to 1) sequencing of 6 wheat cultivars from NARC (Blue Silver, Local White, and Chakwal 50) and INRES Bonn University (Batis, Synthetic 22, UZ-11-CWA-8) through RNA-Seq; 2) analyze the RNA-Seq data using genome informatics tools for unveiling the molecular basis (gene expression) of phenotypic variations, and to edit the selected root architecture genes for yield enhancement. He applied bioinformatics tools such as Bowtie and TopHat for alignment; Cufflinks and Cuffdiff for expression and CummeRbund in R package for data visualization and variation analysis. His experiment results showed that Blue Silver and Local White revealed 107600, 112278 SNPs with heterozygosity of 22.2, 19.29%, respectively. Interestingly, DRO1 and RPK1 exhibited variations in expression. In addition, structural and functional analysis demonstrated that evolution of Deeper Rooting-1 like paralogs entails the C-terminus mutations as well as gain and loss of auxin response elements.

Dr. Ummara Waheed

Assistant Professor IPB² MNS-University of Agriculture Multan gave an oral talk on “Identification of Chromosomes Associated with Callus Induction in Hexaploid wheat”. She was of the view that a major limitation in the wheat tissue culture is the inadequate understanding of



genetic control of callus induction and regeneration. To overcome the problem many researchers tried to explore the chromosomal control governing the tissue culture response with varying degree of success. She explained that how she tried to determine the effect of whole genome on callus induction response using chromosomal substitution lines. She utilized twenty reciprocal sets of chromosomal substitution lines to evaluate callus induction potential of each chromosome. She found that callus induction response was mainly influenced by chromosomes 1A and 2A, 3B and 7B and 2D, 4D and from genome A, B and D. Her experiment results suggest that substitution of chromosome have a marked effect on the callus induction response in hexaploid wheat. She emphasized that chromosomes which are identified for the control of callus induction response could be valuable source to reveal genes regulating tissue culture response. She concluded that her study would unfold the genetic complexities governing the wheat *in vitro* studies.

Session 3. Climate Smart Breeding - biotic and abiotic stresses

Venue: Computer Lab, MNS University of Agriculture, Multan

Chair: Prof. Dr. Harbans Singh Bariana Co-chair: Dr. Nicholas Bird

Prof. Dr. Harbans Singh Bariana

Professor School of Life and Environmental Sciences, The University of Sydney Australia gave an oral talk on “Past, present and future of application of genomics in wheat to deliver triple rust resistant cultivars”. He was of the view that rust diseases of wheat, caused by *Puccinia*



spp., are known to cause severe yield losses worldwide. Breeders succeeded in producing wheat cultivars with combinations of at least two effective rust resistance genes. He described that how molecular mapping of crop plant genomes has revolutionized the discovery and characterization of genetically diverse sources of resistance in many crops. Moreover, he elaborated that the genomic resources have facilitated the identification of marker-trait associations. In addition, these aided in better understanding of genetic basis of complex agronomic traits through QTL mapping. He reckoned that jump from hybridization technology based restriction fragment length polymorphism (RFLP) markers to polymerase chain reaction (PCR) based microsatellite/simple sequence repeat (SSR) system has made plant breeders interested in marker-assisted selection for disease resistance. In addition, he admired that development of non-gel based competitive allele specific PCR (KASP) technology and high throughput specialized SNP chips have changed the landscape of plant breeding. He was confident that combination of high throughput genotyping and bio-informatics technologies could have further enhanced ability to understand genetics of host-pathogen interactions and molecular basis of resistance genes in a rapid manner. Overall, his presentation covered up-to-date discovery, characterization and deployment of genetically diverse sources of rust resistance, with more emphasis on stripe rust, the most important disease of wheat worldwide, from a range of genetic resources including the Watkins Collection of landraces collected in early part of the 20th century.

Ms. Sadia Hakeem MSc. (Hons)

Scholar IPB² MNS-University of Agriculture Multan gave an oral talk on “Prickle hairs help in water-channelling of fog droplets for self-irrigation in wheat”. First, she briefed that how plants and animals have developed mechanisms of tolerance for their survival in changing climate



conditions especially for drought and rising temperature. She was of the view that species inhabitant of arid zones has developed some unique structures to collect and intake air moisture for their survival in hot and dry climates. She further elaborated her point of view by giving example of *Syntrichia caninervis*, one of the most abundant moss that thrives in extreme weather condition with little water sources such as fog, dew and snow. It developed tiny hairs at the end of each leaf to collect moisture from humid air. She further explained that how prickle hairs, a key feature of wheat leaf surface could help gather fog droplets and directing these droplets towards root zone. While discussing about Pakistan environment, she briefed that there are regular foggy events occurring during wheat crop growth phases while scarcity of irrigation water supply noted in Pakistan during this period. Thus, prickle hairs could substantially help wheat plant to survive during drought conditions by collecting fog water at critical growth stages due to unavailability of irrigation source. She told that wheat germplasm containing a total of 1796 genotypes was evaluated for presence and intensity of prickle hairs on leaf surface. A scale was devised to characterize this novel leaf trait phenotypically. Finally, 466 genotypes having dense prickle hairs on abaxial, adaxial and edges of leaf surface were identified and evaluated for fog capturing capacity and associated with other yield related traits.

Mr. Muhammad Ali Sher

Lecturer IPB² MNS-University of Agriculture Multan. He gave an oral talk on the topic “Genome wide association mapping for terminal drought stress in bread Wheat”. He was of the view that drought stress adversely affects the plant growth and development all over the



world and thus reducing the crop yield. He emphasized that drought stress during grain filling stage severely reduces the grain yield. Moreover, water soluble carbohydrates (WSC) in stems could play an important role in buffering grain yield in wheat against abiotic stresses. He revealed that knowledge of genes controlling WSC was very limited. His research was about genome-wide association study (GWAS) using a high-density 90K SNP array to better understand the genetic basis underlying WSC along with other plant morphological traits. The dispersion of genotypes on score plot of drought stress depicted that the genotypes N-10, N-35, Punjab 11, T.D.1 and B101 were the most drought tolerant genotypes whereas the genotypes Satluj 86, CROWS, BWP-97 and Kohistan 97 were the most drought sensitive genotypes. His results showed a highly positive and significant association among grain yield per plant and translocation efficiency, stem reserve mobilization 1000 grain weight, grain yield per plant. He emphasized that these traits should be considered as important target traits during selection to enhance the final yield. He used SNPs for grain yield which were distributed on the chromosome 1, 2, 3, 5 and 7. He described that how the highest value for R^2 was observed for SNP *w SNP_Ex_c10251_16815792* on chromosome 2. Similarly, he reported significant associated SNP for stem reserve mobilization on the chromosome 1, 2, 3, 5 and 7. In his report, he critically stated that his study provided useful information for dissection of stem reserve, yield-related traits and valuable genetic loci for marker-assisted selection in Pakistani wheat breeding program.

Session 4. Climate Smart Wheat Management

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Dr. Harpinder Singh Randhawa Co-chair: Dr. Ata ur Rehman

Dr. Muhammad Zahid Ihsan

Assistant Professor Cholistan Institute of Desert Studies, Islamia University Bahawalpur gave an oral talk on “High temperature stress in wheat and role of plant growth regulators”. Firstly, he briefed that millions of hectares of cultivated land are under threat of high temperature stress due to changing climatic. He was of the view that effect of heat stress varies with plant growth stage, intensity



and duration of heat stress period and crop management strategies. He reported that his experiment was performed to evaluate the adverse effects of high temperature stress on wheat and the role of plant growth regulators in managing heat stress. In his experiment, he applied heat stress as day/night temperature °C of H = 42/38 for 2 days (d), H = 42/38 for 1 d, H = 38/34 for 2 d, H = 38/34 for 1d, H = 34/30 for 2 d. He reported that he applied various combinations of seven plant growth regulators at a concentration of 300 ppm each prior to heat stress application. He noticed that adverse effects of heat stress increased with an increase in temperature (above 34 °C) and stress duration. He told that crop failed to bear grains at 42 °C. His research found that Application of plant growth regulators mitigated adverse effects of heat stress to some extent. He emphasized that no plant growth combination were able to recover the plant for grain setting at severe heat stress.

Mr. Muhammad Owais

Assistant Research Officer, Wheat Research Institute Faisalabad gave an oral talk on “Comparative performance of locally developed advance lines and exotic advance lines of bread wheat under irrigated conditions of Faisalabad”. He employed the advance lines of bread wheat, selected from diverse breeding



programs, evaluated for yield and agronomic traits at Wheat Research Institute, Faisalabad under irrigated conditions. During the year 2016-17, one hundred and sixty-four advance lines were tested which included 78 lines derived from institute's own hybridization program and 86 lines belonged to exotic material from CIMMYT. About sixty-seven lines (30 from local material and 37 from exotic material) were selected on the basis of their grain yield and associated traits: days to 50 % heading, days to maturity, plant height, leaf rust reaction, yellow rust reaction and grain yield which ranged from 90-109 days, 142-149 days, 95-130 cm, 0-20MSS, 0-20MSS and 4138- 6038 kg ha⁻¹, respectively. The highest yield of 6038 kg/ha was produced by V-16134. The selected 67 advance lines were again evaluated during the year 2017-18 at the same place and data for same traits were recorded. Only seven advance lines were selected for multi-location yield evaluation throughout Punjab province of Pakistan (the target cultivated area) to study their adaptability to different agro ecological zones. Selected lines exhibited the range of above mentioned traits as 102- 107 days, 138-143 days, 95-120

cm, 0-5MSS, 0-10MRMS and 4743-5894 kg ha⁻¹, respectively. During this year, V-16024 produced the highest grain yield of 5894 kg/ha which was from locally developed breeding material. His results from two years study suggested that breeding material developed from both sources (local and exotic) was of immense importance from breeding point of view as mega environment for both breeding institutes lied in the same latitude range so mutual exchange of breeding material between two institutes brought more success in this part of the subcontinent.

Dr. Nasir Nadeem Associate Professor, Department of Agribusiness and Applied Economics, MNS-University of Agriculture Multan. He presented oral talk on topic “Impact of varietal yield improvement research in wheat in Punjab, Pakistan”. His research emphasized the economic impact of breeding research in wheat in Punjab,



Pakistan. His study utilized the data on varietal distribution of wheat crop in Punjab from 1990-91 to 2013-14. He adopted the economic Surplus Model to assess the economic benefits from breeding research. The results of the study indicate that breeding research in wheat is still generating enormous benefits. On an average, wheat breeding research in Punjab had been adding Rs.30.5 billion annually as an additional gain since 1990-91 to 2013-14. This study further explores that 435 kg per hectare additional wheat of worth Rs. 4749 per hectare had been reaped annually by the farmers of Punjab.

Mr. Muhammad Fahad Irfan

Research Officer International Maize and Wheat Improvement Center (CIMMYT) gave oral talk on “Impact of improved wheat seed adoption on livelihood of farmers in remote areas of Sindh-Pakistan”. Firstly, he briefed that wheat is the major staple crop of Pakistan which is cultivated under



irrigated as well as rain fed conditions in all provinces of the country. His research attempted to dig out the impact of improved wheat varieties on wheat productivity in Sindh province. His collected data from 150 wheat growers belonging to six districts of upper and lower Sindh i.e. Hyderabad, Tando Allahyar, Tando Muhammad Khan, Matiari, Umer kot, and Benazirabad out of which 55 percent received certified seed under AIP (Agricultural Innovation program) assistance (beneficiary farmers) and 45 percent respondents cultivated their own wheat varieties. Moreover 18% of the respondents were female farmers. According to his results, yield of the AIP distributed wheat varieties was 10-13 percent higher, resulted into higher food security levels (4-5%) and higher household income (PKR 3700-4800) per acre. He also estimated that the cost benefit ratio for beneficiary farmers as 2.01, quite more than cost benefit ratio for non-beneficiaries (1.67). He reported that other commonly grown varieties were Abdul Sattar, Anmol, Bhakkar, Inqalab, Sehar and TJ83. He emphasized that boosting wheat productivity in the region was mandatory to replace conventional varieties with higher yielding wheat varieties.

Dr. Shabbir Ahmad

Assistant Professor Department of Food Science and Technology MNS-University of Agriculture Multan, presented on topic “Impediment effect of chemical agents (additives) on gluten development in cookie dough”. According to his views, cookie quality is compromised in Pakistan due to unavailability of specific flour for



bakery products. He was of the view that mixed wheat flour with varying quality parameters could have an impact on bakery industry from economic point of view as it affects the sale and recipe of the product. He emphasized that cookie with more spread factor and less hardness is preferred, which can be prepared from soft wheat flour (having low protein and gluten contents). During his talk, he reported that wheat flour from two local mills having moisture (13.45-15.55 %), ash (0.93-0.95%), protein (12.07-12.40%), wet gluten (28.08- 30.94%) were utilized in cookie preparation. He utilized chemical additives like Sodium Stearoyl 2-Lactylate (SSL), L-Cysteine and Lecithin @ 0.5, 1 and 1.5% level for each additive. His results showed that rheological attributes i.e. farinographic parameters of wheat flours ranged from 60-60.70% (WA), 3.50- 4.50 min. (DDT), 11.50-13.50 (DS) and mixolab parameters C1 (behavior during

mixing), C3 (starch gelatinization), C4 (amylase activity) and C5 (starch retrogradation) were ranged from 1.06-1.17N, 1.798-1.769N, 1.414-1.393N and 2.859-2.912N, respectively. He also observed the quadratic trend with levels of additives and physical parameters like diameter, thickness, spread factor, textural hardness of cookies with optimum results @ 1% for each additive. Conclusively, he emphasized that SSL could be added in mixed wheat flour @ 0.5 to 1% in order to get cookies of good quality.

Mr. Muhammad Abdullah

gave an oral talk on “Impact of germinating barley flour addition in wheat flour on quality of biscuits and bread”. He reported that he used germinated barley flour @ 0, 5, 10, 15 and 20% in the straight grand flour of a wheat variety Anaj-17 and assessed its impact on the quality of biscuits & bread. He revealed that chemical analysis of various flour blends (barley and wheat) showed that with the increase of germinated barley flour protein, gluten content and falling number value was decreased while the minerals contents increased significantly. In his views, the color of the biscuits changed from creamy white to dreary brunette and the texture became hard. As the germinated barley flour content increased to 15%, barley flour blend biscuits showed product acceptability by the judges. In addition, the flour blends rheology revealed that water absorption capacity and stability reduced as the barley flour increases while there was no effect on extensibility of dough. He concluded that the germinated barley flour addition at 20% level for bread production imparted poor loaf volume, poor crumb and pore structure.

POSTER PRESENTATIONS

No.	Title
Theme-I: Advanced Technological Developments in Wheat Breeding	
1	Improving nitrogen use efficiency in wheat (<i>Triticum aestivum</i> L.) through transgenic expression of codon optimized alanine aminotransferase gene Moddassir Ahmed , Nasir Ahmad Saeed, Yasin Ashraf, Zahid Mukhtar and Shahid Mansoor
2	Analysis and cloning of rubisco hybrid promoter isolated from <i>Zea mays</i> Ammara Masood and Hira Mubeen
3	Targeting yield potential of wheat through translational research Usman Aslam
Theme-II: Climate Smart Breeding - Biotic and Abiotic Stresses	
4	Incidence of barley yellow dwarf virus PAV infecting wheat crop in Pakistan Abdul Qadir , Anjum Munir, Shahid Hameed, M. Inam-ul-Haq, Muhammad Ali, M. F. Abbas and Abdul Ghani
5	Estimation of combining ability effects in bread wheat genotypes Ali Bakhsh , Irum Aziz, Sohail Kamran and Sanober Gul
6	Detection of durable resistance against stripe rust and assessment of genetic diversity in wheat advance material. Amir Afzal , Abid Riaz, Farah Naz, Muhammad Kausar Nawaz Shah, Sayad Rashad Ali and Muhammad Ijaz
7	Graphical analysis to study genotype × trait relationship in some bread wheat cultivars using gge biplot Fahim Ullah Khan and Fida Mohammad
8	Isolation, characterization and screening of plant growth promoting rhizobacteria capable of providing relief in salinity stress Hina Javed , Aneela Riaz, Fraza Ijaz, M. Amjad Qureshi, M. Asif Ali, M. Saleem Akhtar and Fakhir Mujeeb
9	Screening of wheat germplasm against brown/leaf rust of wheat M. Hasnain Iqbal , Muhammad Hussain, Babar Iqbal, Nazir Javed, Huma Abbas, Muhammad Kamran, Sajid Aleem Khan and Muhammad Haseeb Ahmad
10	Breeding for durable rust resistance Mehvish Makhdoom , Amna Kanwal, Iqra Ghafoor, Javed Ahmad and Makhdoom Hussain
11	Combining Ability Studies of Some Temperature Stress Adapted Traits of Hexaploid Bread Wheat in Hot Irrigated Dry Climate Muhammad Irshad , Zubeda Parveen, Abdul Ghaffar, Niaz Hussain, Muneer Abbas, Muhammad Aslam, Khalid Hussain and Muhammad Ajmal
12	Screening of wheat varieties/Lines against Leaf Rust disease Muhammad Junaid, Muhammad Sajjad, Huma Abbas , Nazir Javed, Muhammad Kamran, Shamroz Khan, Akbar Sajjad and Abdul Jabbar
13	Breeding Wheat for the Changing Climate Quahir Sohail
14	Physico-chemical, Morphological and Functional Characteristics of Spring Wheat (<i>Triticum aestivum</i> L.) Varieties.

	Raina Ijaz , Javeria Ejaz and Saima Rafiq
15	Evidence of climate resilient hybrid development in wheat (<i>Triticum aestivum</i> L.) for food security. Kashif Rashid , Hafeez Ahmad Sadaqat, Sultan Mahmood, Muhammad Tariq Khan and Zeeshan Qadeer
16	Evaluation of exotic germplasm of wheat (<i>Triticum aestivum</i> L.) for genetic parameters Muhammad Irfan , Saba Tabasum, Shaista Suleman, Saif Ullah I and M. Arslan Khalid
17	Wheat rust surveillance in Punjab Faqir Muhammad , Makky Javed, Javed Ahmed, Muhammad Ijaz and Saeed Ahmad
18	Evaluation of wheat advanced lines/varieties for seedling and adult plant resistance to leaf rust Muhammad Makky Javaid , Faqir Muhammad, Majid Nadeem, Javed Ahmad, Nadeem Ahmed, Aziz ur Rehman, Muhammad Zulkiffal, Sabina Asghar, M. Husaain, Makhdoom Hussain and Nasir A Saeed
19	Effect of Fluoride Resistant Bacteria on Wheat (<i>Triticum aestivum</i>) Rameen Fatima and Asma Zulfiqar
20	Vacuolar pyrophosphatase (HVP1) gene from barley enhances salinity stress tolerance in wheat Rana Fiaz Ul Haq , Muddassir Ahmed, Nazish Anam, Zunaira Arshad, Mark Tester, Showkat Ali, Shahid Mansoor and Nasir A. Saeed
21	Evaluation of Wheat germplasm under Faisalabad condition Sadia Ajmal , Aziz ur Rehman, Saima Gulnaz, Aneela Ahsan, Sabina Asghar, Muhammad Zulkiffal and Javed Ahmad
22	Wheat disease management through marker assisted selection and understanding pathogen population structure Sajid Ali , Muhammad Rameez Khan, Aamir Iqbal, Muhammad Arif, Zainab Iftikhar, Zahoor Ahmad Swati and Muhammad Imtiaz
23	New crop ideotypes for adaptation to changing climate Majid Nadeem , Nadeem Ahmad, Ghulam Mehboob Subhani, Javed Ahmad, Aziz ur Rehman, Saleem-ur-Rahman, Muhammad Hammad Tanveer, Yasir Ramzan and Muhammad Owais
24	Genetic analysis of spring wheat (<i>Triticum aestivum</i> L.) under terminal heat stressed condition for yield and contributing traits Shadab Shaukat , Abdus Salam Khan, Atif Ali, Makhdoom Hussain, Javed Ahmed, Majid Nadeem and Jahanzaib Farooq
25	Landraces of wheat (<i>Triticum aestivum</i> L.) revealed diversity for rust resistance in molecular, histochemical and phenotypic studies Shahid Iqbal Awan , Luis A. J. Mur, Syed Dilnawaz Ahmad, Muhammad Tariq Khan
26	Screening of wheat varieties/Lines against Loose Smut disease Shamroz Khan, Faqeer Muhammad, Muhammad Arshad, Huma Abbas , Nazir Javed, Muhammad Kamran, Makky Javed, Muhammad Junaid and Muhammad Haseeb Ahmad

27	Field evaluation of wheat germplasm against rust disease Tanzeel Arif Bhatti ¹ , Arshad Mehmood ² , Huma Abbas , Nazir Javed, Muhammad Kamran, Sajid Aleem Khan and Akbar Sajjad
28	Genetic analysis of yield related traits in 5×5 diallel crosses of spring wheat (<i>Triticum aestivum</i> L.) Umara Sahar Rana, Muhammad Abubakkar Azmat and Abdus Salam Khan
29	Response of Different Wheat Genotypes to Water Stress at Different Growth Stages Zahid Akram, Rimsha Amjad, Qadeer Ahmad , Zahid Hussain Shah and Muhammad Naeem
30	Impact of leaf and stem rust on yield and yield contributing traits in Wheat Amna kanwal , Iqra Ghaffoor, Mehvish Makhdoom, Aziz ur rehman, and Javed Ahmad.
31	Physio-chemical mechanisms of wheat mediating defence response under drought stress Aneela Ulfat , Syed Abdul Majid, Amjad Hameed, Khawaja Shafique Ahmad, Ambreen Wazarat, Sadaf Shamim, Hira Shair, Asia Bibi and Sidra Rafique
32	Assessment of Nitrogen Use Efficiency (NUE) of some wheat (<i>Triticum aestivum</i> L.) Genotypes Iqra Fatima, Inamullah , Aftab Afzal, Hakim Khan and Mohammad Islam
33	Self resistance in wheat against grain aphid (<i>Sitobion avenae</i> F) (<i>Homoptera: Aphididae</i>) relates to amino acids concentration in wheat genotypes Shabab Nasir
34	Promising advanced lines of Wheat Research Institute, Faisalabad Abdullah , Javed Ahmad, Aziz ur Rehman, Muhammad Zulkiffal, Majid Nadeem, Muhammad Hammad Tanveer and Waseem Sabir
35	Effect of sewage water on morphological parameters of different wheat varieties Rao Sohail Ahmad Khan , Zunaira Aslam, Marya Bibi, Adnan Khan Niazi, Abu Bakar and Umer Farooq
36	Screening of spring wheat genotypes through photosynthetic indices conferring drought tolerance at seedling stage Hafiz Ghulam Muhu-Din Ahmed , Muhammad Abu bakkar Azmat, Muhammad Rizwan, Rana Haroon Maqsood, Abdul Qadeer, Amjad Saeed and Muhammad Ali sher
37	Severity of yellow rust in F ₁ progenies of eight Pakistani wheat varieties under irrigated and rainfed conditions Sher Nawab Khan , Ghulam Hassan, Muhammad Rameez Khan and Sajid Ali
Theme-IV: Climate Smart Wheat Management	
39	Effect of PGPR and zinc biofortification on growth and yield of wheat crop Aneela Riaz , Munazza Rafique, M.Amjad Qureshi, M.Aftab, Fakhir Mujeeb, and Saleem Akhtar
40	Improving the productivity of wheat by the application of silicon under stress condition Farrukh mahboob , Nida Fatima and M. Arslan khalid

41	Enhancing the efficacy of metribuzine in combination with different adjuvants against weeds of wheat Ghulam Ishaq, Muhammad Ather Nadeem, Rizwan Maqbool , Muhammad Asaud ul Islam and Rao Muhammad Ikram
42	Allelopathic Effect of Aqueous extract of Wheat (<i>Triticum aestivum</i> L.) Straw on Different Weed Species Iqtidar hussain , Ikram Ullah Khan, Adnan Noor, Shah, Abdul Aziz Khakwani and Ejaz Ahmed Khan .
43	Morphophysiological and molecular characterization of bread wheat for drought stress tolerance Israr Ahmad , Sana Tariq, Zahra Younas, Uzma Haleem and Sami Ullah Khan
44	Bed planting of wheat a step towards improvement in wheat water productivity Mubbashir Gul , Nabeel Ahmad Ikram, Muhammad Ghous, Farman Anwar and Muhammad Younis
45	Wheat aphid and its management Muhammad Saleem , Javed Ahmad, Aziz-ul-Rehman and Muhammad Latif
46	Growth and agronomic traits of some bread wheat (<i>Triticum aestivum</i> L.) varieties under elevated levels of mercury and lead. Rafia Abid and Seema Mahmood
47	Influence of Aerial Application of Salicylic Acid on biomass production, ion uptake to Improve Salt Tolerance in Wheat (<i>Triticum aestivum</i> L.) Sibgha Noreen , Amina Shaheen and Seema Mahmood
48	Effect of Heat Stress and Its Mitigation Strategies by Seed Treatment and Foliar Application in Wheat (<i>Triticum aestivum</i> L.) Muhammad Waqar Nasir , Azra Yasmeen, Muhammad Imran and Toth Zoltan
49	Effect of Seed priming with Boron on the Growth and Germination of seedlings of Wheat (<i>Triticum aestivum</i>) I Rameen Fatima, and Asma Zulfiqar
Theme-V: Wheat Economics and Quality	
50	Role of effective and economical chemical weed management in enhancing wheat grain yield and improving food security Tahir Hussain Awan , Shawaiz Iqbal, M. Usman Saleem, Usama Bin Khalid and Nadeem Iqbal
51	Wheat varieties with high yield and durable rust resistance transformed food deficiency to food surplus in Punjab Pakistan Aziz ur Rehman, Javed ahmd, GM Subhani, Nadeem Ahmad, Faqir Muhammad, Majid Nadeem, Manzoor Hussain and Abid Mahmood
52	Wheat Transcription Factor analysis, An Insight into Nutritional Quality Ammara Masood and Hira Mubeen
53	Durum Wheat Pasta: A highly Nutritional Alternate to the Conventional Pakistani Pasta industry Hira Shair , Isra Shair, Sadaf Shamim, Anjum Javed, Muhammad Abdullah, Javed Ahmed, Muhammad Abrar and Abid Mahmood
54	Preparation of food product from natural indigenous sources for cure of diabetes

	Mehwish Aslam, Ammara Masood, Mushtaq A. Saleem, Alim Un Nisa and Hira Mubeen
55	Impact of Climate Change on Livelihood of Wheat Farmers in District Chakwal Syed Asif Ali Naqvi , Syed Ale Raza Shah Bukhari and Bilal Husain
56	Risk analysis of Pakistan's wheat supply chain and food security Dr Abou Bakar and Mehwish Sabir
57	Utilization of wheat and its ingredients as functional ingredient for processing novel foods Awais-Ur-Rehman, Muhammad Shahbaz , Umar Farooq, Shabbir Ahmad, Fahim Nawaz, Shamas Murtaza, Ambreen Naz, Waqas Ahmad, Muhammad Aways, Nauman Farid and Waqas Hayder

CONCLUDING SESSION

Venue: Seminar Hall MNS University of Agriculture, Multan

The concluding session was started with the recitation of few verses from the Holy Quran.

Prof. Dr. Asif Ali, Vice-Chancellor MNSUAM concluded the session and appreciated the efforts of the organizers from MNSUAM, and particularly the Institute of Plant Breeding and Biotechnology MNSUAM for their extensive exercise to make this event a success. He acknowledged all the public sectors those have sponsored this event



including Punjab Agriculture Research Board, Department for International Development (DFID), KWS, UK, The University of Sydney Australia, Pakistan Science Foundation. He hoped that, by organizing such conferences, we will be able to propose a way forward on how academia and research institutions can play a positive to mitigate the food security problems. He said that this conference will open new ways for the success of sustainable wheat production between Pakistan and Australia.

Prof. Dr. Harbans Singh Bariana

(The University of Sydney Australia) presented the recommendations derived from the technical sessions during the conference. Furthermore, he urged to adapt techniques to resist against the changing climate conditions through plant breeding and biotechnological advancement. He suggested that this was the right time that academia and research



institutes come forward because coordinated efforts were needed to enhance the crop production and to tackle the issues of climate change. He also stressed on the enhancement of cooperation and coordination between plant breeders to strengthen the links between plant

breeders, bio-technologists, geneticists and scientists working on plant sciences to increase the crop production.


Distribution of Souvenir



LIST OF PARTICIPANTS


Pandal Wing A 24-03-2019

Attendance Sheet



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March 24-25, 2019

MNS-University of Agriculture Multan, Pakistan



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71)	Muhammad Akram	PA. Syed Fakhrulmomin	0307-7820073	[Signature]
72)	Hafiza Tahira Gul	MNSUAM		[Signature]
73)	Miluh Bibi	MNSUAM	0300-7849801	[Signature]
74)	Saima Rasheed	"	0300-6909924	[Signature]
75)	Banish Saefar	MNSUAM	0302-7558536	[Signature]
76)	Sadaf Zahra	NIBGE	0336-592412	[Signature]
77)	Sana Zulfiqas	NIBGE	0394-7771011	[Signature]
78)	Saman	BZU	0301-6919501	[Signature]
79)	Gul-e-Zahra	PU, UIR	0365-1723875	[Signature]
80)	Dr. AMAR MATLOOB	MNS-UAM	0333-2926990	[Signature]
81)	M. Shabbir	MNS-UAM	0301-5864173	[Signature]
82)	Abdul Mannan	MNS-UAM	0334-5035290	[Signature]
83)	M. Abu Bakr	MNSUAM	0332-6278073	[Signature]
84)	M. Ali Sher	MNSUAM	0345-2127487	[Signature]
85)	Waseem Abbas Khan	MNSUAM	0309-0972935	[Signature]
86)	Rabia Parvez	MNSUAM	03041283456	[Signature]
87)	Roania Nazir	MNSUAM	0308-7216615	[Signature]
88)	Anam Gabal	MNSUAM	0303-8759436	[Signature]
89)	Komal Shahzadi	MNSUAM	0342-7189561	[Signature]
90)	Saima Sumreen	MNSUAM	0304-0015538	[Signature]
91)	Farzana Rafeeq	MNSUAM	0308-4012709	[Signature]
92)	Samina Perveen	MNSUAM	0334-6142342	[Signature]
93)	Bisma Riaz	MNSUAM	0345-2308189	[Signature]
94)	Barkha Binyameen	MNSUAM	0306-8014478	[Signature]
95)	Tahira Sahoor	MNSUAM	0303-0531215	[Signature]
96)	Barera Zahra	MNSUAM	0307-4533933	[Signature]

Pandal Wing B

24-03-2019

Attendance Sheet




Aus-Pak International Conference on Wheat for Food Security
March 24-25, 2019



MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
1	Zulfiqar Ali	UAM	061-9201684	[Signature]
2	M. Hammad Nadeem	Prof. UAM	0300-7535708	[Signature]
3	Dr. Alamgir Khan	Associate Prof	0307-7899220	[Signature]
4	Faqeer Nusrat Hussain	F.P.C.A.L	0333-7025701	[Signature]
5	NAVEED Asmat Khan	Assoc. Prof. UAM	0300/9688170	[Signature]
6	Dr. Muhammad Emran	SFS-UAM	0333-8912074	[Signature]
7	Dr. M. Asif Raza	Vet. Science MNSUAM		[Signature]
8	Dr. Shah Rukh	SES-UAM	03365132003	[Signature]
9	M. Nadeem Khan	MNS-UAM	03006389565	[Signature]
10	Aftab Ahmad Sh.	Solex Chemicals	0300-8630155	[Signature]
11	Dr. Aslam Yousuf	Hi Seed Seeds	03008733490	[Signature]
12	Munir-ud-Din Khan	C.R.S. Multan	0301-7499408	[Signature]
13	Dr. Shamas Munir	UAM	0333-9927309	[Signature]
14	Dr. M. Shahbaz	UAM	0333-6588618	[Signature]
15	Muhammad Ali Bazz	PRO	0300-6375786	[Signature]
16	Dr. Faleeh Javed	Assistant Prof. Agr	0335-7293739	[Signature]
17	Muneez Pump	Vice-Chairman	0306-7351746	[Signature]
18	Ch. Sharif Arain	Chairman	03008638755	[Signature]
19	M. AMIR BAKHTAVAR	Lecturer MNSUAM	0333-169807	[Signature]
20	Shahid Iqbal	Assistant Prof. MNSUAM	0332-6341576	[Signature]
21	Dr. Zulqurnain Khan	Assist. professor	0302-5880755	[Signature]
22	Dr. Abdul Razzaq	Assiste. Apr	0307-7157144	[Signature]
23	Israr Hussain	Lecturer-CS	0334-6006797	[Signature]
24	Dr. Ayesha Hakin	Assistant Prof. CS	0333-4952281	[Signature]
25	Adnan Altab	Lecturer CS	03018780389	[Signature]
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27	HIRA MARYAM	MSC. STUDENT	0345-2656116	[Signature]
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29	Nadia Ayoub	M.Sc Student	0303-6438332	[Signature]
30	Amber Fatima	M.Sc. student	03486946283	[Signature]
31	Sabiba Kiaz	M.Sc. student	03470719766	[Signature]
32	Saba Aslam	Msc. student UAM	0301-3648779	[Signature]


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Attendance Sheet

Aus-Pak International Conference on Wheat for Food Security
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MNS-University of Agriculture Multan, Pakistan



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33	Hira Tasleem	MNSUAM	0336-069377	Hira
34	Zarina - Amjad	MNSUAM	0304-5336534	Zarina
35	Fatima Tariq	MNSUAM	0302-7428667	Fatima
36	Sana Ayaz	MNSUAM	ii	Sana
37	Nageen Nasir	MNSUAM	_____	Nageen
38	Shafiq Chughtai	MNSUAM	_____	Shafiq
39	Wajid Khan	MNSUAM	_____	Wajid
40	M. Adnan Hussain	MNSUAM	03046919450	Adnan
41	M. Usman	MNS-UAM	0307-568240	Usman
42	M. Zaheer Zafar	'' ''	0346-2688279	Zaheer
43	M. Arslan	''	0301-7905010	Arslan
44	Zain Abbas	''	0346-1268505	Zain
45	M. Waqar Hassan	MNS-UAM (IPB)	0304-4130905	M. Waqar
46	Muhammad Rauf Shah	MNS-UAM (IPB)	0305-4818571	M. Rauf
47	Muhammad Hamam	MNS-UAM (IPB)	0302-6346037	Muhammad
48	Muhammad Ageel	Lab. Attendant	0306-2753880	Ageel
49	Muhammad Bin Mushtaq	MNS-UAM (IPB)	_____	Muhammad
50	M. Waseem Shahzad	MNS-UAM (IPB)	_____	Waseem
51	Ameer Hamza	MNS-UAM (IPB)	_____	Ameer
52	M. Asif Munsoor	MNS-UAM-IPB	_____	Asif
53	Mehwish Kifayat	UAM-(IPB)	_____	Mehwish
54	Faiza Afzal	UAM-(IPB)	_____	Faiza
55	M. Bilal	MNS-UAM-	0306-7429411	Bilal
56	Sanaul Murtaza	student (UAM)	0346-7707558	Sanaul
57	M. Saad	MNSUAM	03026311681	Saad
58	M. Zubair	MNSUAM	03365835390	Zubair
59	Dr. M. Arslan Khan	MNS-UAM	0347-7644959	Dr. Arslan
60.	Mr. Asif Mahmood Asif	MNS-UAM.	0345-7221054	Asif
61.	M. Adnan Rehman	Four Brothers	03008827001	Adnan
62.	M. Majid Ali	MNS-UAM	0311-8542225	Majid
63.	Hamza Ahmad Qureshi	MNS-UAM	0309-5200099	Hamza
64.	DR. Abid Hussain	DSES/MNS-UAM	0312-6116677	Dr. Abid

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Attendance Sheet



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MNS-University of Agriculture Multan, Pakistan



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4	Ssrar Hussain	ACIAR Project	0300 5145890	[Signature]
5	M. Saad Ahmad	PSG, UAF	0300-0448797	[Signature]
6	Dr. M. Asif Raza	MNSUAM	0333 5552614	[Signature]
7	M. WAQAR NASIR	U. P, Hungary	0346 7117617	[Signature]
8	Shahrad Ahmed	MNSUAM	0333-0540543	[Signature]
9	Gheulam Haider	MNSUAM	0300 6344474	[Signature]
10	M. Ashfaq (S.O)	CRS-BWP	0321-6715123	Ashfaq
11	M. Muhammad Majid Asif	MNSUAM	0311-8542225	[Signature]
12	SULTAN MAHMOOD	BZU, Multan	0300 7297087	[Signature]
13	M. Umar Farooq	MNSUAM	0311-0618386	[Signature]
14	M. Zubair	MNSUAM	0303-8774942	[Signature]
15	Faizal Bhatti	MNSUAM	0300-7829922	[Signature]
16	Shouab Hussain	MNSUAM	0304-7886255	[Signature]
17	Sajan Ahmed	MNSUAM	0705-7911389	[Signature]
18	Majid Ali	MNSUAM	0345-7022090	[Signature]
19	M. Usaid	MNSUAM	0332-6187484	[Signature]
20	Mughis Ahmad	MNSUAM	0310-1042787	[Signature]
21	Mirza Nig	"	0304-1272072	[Signature]
22	M. Saad	MNSUAM	0302-6311881	[Signature]
23	Fahad Aziz	MNSUAM	0303-9883819	[Signature]
24	Hafiz M. Nazim Raza	MNSUAM	0306-5513972	[Signature]
25	M. Nadeem	MNSUAM	0304-7373655	M. Nadeem
26	Sufyan Raza	"	0308-6378057	[Signature]
27	Sammal Abbas	"	0300-7732014	[Signature]
28	M. Tanveer Anayat	"	0306-7740381	[Signature]
29	Abdul Mateen	"	0306-5151502	[Signature]
30	Munawar Saad	"	0310-6273027	[Signature]
31	M. Faizun	"	0308-0683978	[Signature]

Attendance Sheet

'Aus-Pak International Conference on Wheat for Food Security
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MNS-University of Agriculture Multan, Pakistan



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34	M. Zain	"	03166573006	[Signature]
35	Muhammad Bilal	"	0303-023828	[Signature]
36	M. Bilal	MNSUAM	0306-7429411	[Signature]
37	Muhammad Saeed	"	0304-6183532	[Signature]
38	Maria Mazahir	"	0305-1718270	[Signature]
39	M. Sufjan Ashad	"	0303-7511989	[Signature]
40	Naveed Raza	"	0311-6083141	[Signature]
41	ALI Buxhan Khan	"	0300-7487825	[Signature]
42	Shahid Dost M	"	0302-4699265	[Signature]
43	M. Hussain	"	03097828710	[Signature]
44	Mudassir Manzoor	"	03013722887	[Signature]
45	M. Rizwan	"	0317-6637737	[Signature]
46	M. Junaid	"	0305-1170891	[Signature]
47	Tawaid Hossain	"	0301-8547768	[Signature]
48	M. Azam Khan	"	0340-7151995	[Signature]
49	M. Faisal Nadeem	"	03067550615	[Signature]
50	Bilal Hassan	BRAA MNSUM	0311-825641	[Signature]
51	M. Usman	MNSUAM	03075682150	[Signature]
52	M. Arslan	MNSUAM	0309-7905010	[Signature]
53	Adnan Yousof	MNSUAM	0309-7698594	[Signature]
54	Qamar Abbas	MNS-UAM	0303-0788889	[Signature]
55	M. Arshad Hanif	MNS-UAM	03037483610	[Signature]
56	Ali Ammar	"	0333-6147062	[Signature]
57	Dr. Amir Hussain	MNSUAM	0300-7317877	[Signature]
58	Taimur Khan	UAM	0345-8463358	[Signature]
59	Shoaib Ahmad Khan	MNSUAM	03056794040	[Signature]
60	Roshan Ali	MNS-UAM	0306-1365190	[Signature]
61	M. Ali Imran	MNS-UAM	0304-6544968	[Signature]
62	M. Shahzad 4th ser	MNS-UAM	0308-8664178	[Signature]
63	Ali Usman 4th s	MNSUAM	0306-0581330	[Signature]

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MNS-University of Agriculture Multan, Pakistan



Sr.NO.	Name	Organisation	Contact No./ Email	Signature
64	SHOAIB NASIR	MNS-UAM	Shoaib.nasir@uam.edu.pk	Shoaib
65	M. Amir	MNS-UAM	0317-6698881	M. Amir
66	Arbab-U. Hassan	MNS-UAM	0300-8992474	Arbab
67	USMAN Khan	MNS-UAM	0333695890	USMAN
68	M. Ayyaz	MNS-UAM	0345-2011755	M. Ayyaz
69	M. Nadeem	MNS-UAM	0509-1112129	M. Nadeem
70	M. Ubaid Ullah	MNS-UAM	03052101550	M. Ubaid
71	Adeel Khan	MNS-UAM	0302-9835172	Adeel
72	M. Saif Bhatti	MNS-UAM	0311-6904538	M. Saif
73	Rana Arslan	MNS-UAM	0309-8299775	Rana
74	Syed Mairam Hassan	MNS-UAM	0311-5573638	Mairam
75	Taweeq Haidar	MNS-UAM	03083735033	Taweeq
76	Maken Hamba	" "	0344-0226780	Maken
77	Syed M. Hamba	MNS-UAM	0303-6557862	Syed M. Hamba
78	Muhammad Shahid	MNS-UAM	0309-6304843	Muhammad
79	Muhammed Fahad Iqbal	CIMMYT	0345-862446	Fahad
80	M. UZAIR	MNS-UAM	0301-5496262	M. UZAIR
81	Babbar Abbas	MNS-UAM	03447207311	Babbar
82	M. Saad Bin Saif	MNS-UAM	0306-1904418	M. Saad
83	M. Bilal Ilyas	MNS-UAM	03007915218	M. Bilal
84	Rashid Ghalib	MNS-UAM	0305-9391924	Rashid
85	Muhammad Mehtan	" "	" "	Muhammad
86	A. Shehzad Khan	" "	0302-2401546	A. Shehzad
87	M. Bilal Aslam	MNS-UAM	" "	M. Bilal
88	Aby Bakar Siddique	MNS-UAM	" "	Aby Bakar
89	Bilal Hassan	MNS-UAM	" "	Bilal
90	Mahmood Saifdar	MNS-UAM	0304-1571741	Mahmood
91	Haris Jamil	MNS-UAM	0207-7340032	Haris
92	M. Zia-ur-Rehman	" "	0302-4439488	M. Zia-ur-Rehman
93	Muhammad Sajid	UAM	0305-4142639	Muhammad
94	Saif-ur-Rehman	MNS-UAM	0315-7531825	Saif-ur-Rehman

Attendance Sheet

Aus-Pak International Conference on Wheat for Food Security
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MNS-University of Agriculture Multan, Pakistan



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95	M. Faisal	MNS-UAM	0344-7273244	Faisal
96	M. AMIR BARTHAAR	MNSUAM (Lecturer)	0333-1629807	Amir
97	Gulam Mustafa	MNSUAM (Student)	0306-5693116	Gulam
98	Bilal Mansoor	MNSUAM (Student)	0307-570776	Bilal
99	M. Mahmood Ahmed	MNSUAM	0316611501	Mahmood
100	Muhammad Shan	MNS-UAM	0304-5828344	Shan
101	M. Aluman Khaleel	MNSUAM (CPBG)	0308-4269372	Aluman
102	H. M. Waqar	MNSUAM	0304-1414475	Waqar
103	Taheera Tariq	MNSUAM		Taheera
104	Falima Ikram	"		Falima
105	Sidra Asghar	"		Sidra
106	Qura Ahmad	"		Qura
107	Azeej Fatima	"		Azeej
108	Noorutain	"		Noorutain
109	ROOP ZATRA	"		Roop
110	Sidra Rasheed	"		Sidra
111	Tahira Saboor	"		Tahira
112	Sadaq Baiool	"		Sadaq
113	Faiza Ajjal	"		Faiza
114	Mehwish Kifayat	"		Mehwish
115	Tooba Ishfaq	"		Tooba
116	Seema Kanwal	"		Seema
117	Rafia Abid	BZU Multan	0314-5140885	Rafia
118	Shazia Ghaffar	BZU Multan	03475363636	Shazia
119	Barkha Binyameen	MNSUAM	03068014478	Barkha
220	Banera Zahoor	MNSUAM	03074533933	Banera
221	Saba Aslam	MNSUAM	0301-3648779	Saba
222	Rabia Shabir	MNSUAM	0321-6393861	Rabia
223	Sadia Shabir	MNSUAM	0321-6393861	Sadia
224	Tehseem Fatima	MNSUAM		Tehseem
225	Maria Rabnawaz	MNSUAM		Maria
226	Waiza Imran	MNSUAM	03067578967	Waiza

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Attendance Sheet



Aus-Pak International Conference on Wheat for Food Security
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MNS-University of Agriculture Multan, Pakistan

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4	Muhammad Owais	WRI, Faisalabad	0333-8961931	[Signature]
5	M. Makky Javed	WRI, Faisalabad	0333-8967048	[Signature]
6	Shahid Liaqat	MNSUAM	0332-6080543	[Signature]
7	M. Farukh Tafaq Khan	MNS-UAM	0306 5510843	[Signature]
8	Ali Ammar	MNS-UAM	0333-6147062	[Signature]
9	M. Waleem Akram	MNSUAM	0303-6707073	[Signature]
10	Hamza Ahmad Qureshi	MNSUAM	0309 200099	[Signature]
11	Ahman Iqbal	MNSUAM	0304-0726833	[Signature]
12	Dr. Ali Bakhsh	Ghazal University	03356893312	[Signature]
13	Sultan Mahmood	BZEI Multan	03007297087	[Signature]
14	M. SHAHZAD	MNSUAM	0301-407943	[Signature]
15	M. Waleem Shahjad	MNSUAM	0334-7837844	[Signature]
16	Mohammad Sajid	MNSUAM	0305-446689	[Signature]
17	Saf-ur-Rahman	MNSUAM	0315-7531825	[Signature]
18	Haveed Laman	student MNSUAM	0313-9884141	[Signature]
19	Muhammad Shan	MNSUAM	0304-5828360	[Signature]
20	Anees-ur-Rahman	UAF	0304-5104939	[Signature]
21	M. Abu Saleh	MNSUAM	0332-6278077	[Signature]
22	Tania Sabhar	MNSUAM	0308-5078957	[Signature]
23	Noor-U-Ain	MNSUAM		[Signature]
24	Bareera Zahara	"	0307-4533933	[Signature]
25	Fatima Gulzar	MNSUAM	03070170880	[Signature]
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28	Faija Afzal	MNSUAM	" "	[Signature]
29	Mehwish Kifayat	MNSUAM	" "	[Signature]
30	Tahira Saboor	MNSUAM	" "	[Signature]
31	Barkha Binjameen	MNSUAM	0306 8014478	[Signature]
32	Rabia Shabir	MNSUAM	0321-6393861	[Signature]

(computer lab)

25-05-2019 (Session I)



Attendance Sheet

Aus-Pak International Conference on Wheat for Food Security
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MNS-University of Agriculture Multan, Pakistan



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04	Japria Ahmad	"		[Signature]
05	Ghulam Mustafa	MNSUM (IPBB)	0306-5693116	[Signature]
06	Wasim Akbar	MNSUM (IPBB)	0302-786409	[Signature]
07	BILAL Mansoor	MNSUM (IPBB)	0310-618028	[Signature]
08	M. Saeed Ahmad	PBG - UAE	0300-0448797	[Signature]
09	M. Zeeshan Zafar	PRG - MANSUM	0346-2688279	[Signature]
10	M. Rehan Asghar	PBG - MNSUM	rehana.asghar@um	[Signature]
11	Abdul Rehman	Plant Path, UAF	0300-9784702	[Signature]
12	M. Shahid	SST (MNSUM)	0305-6294787	[Signature]
13	Amees Hamza	SST (MNSUM)	0308-9062066	[Signature]
14	M. Saleed el	SST (MNSUM)	0311-6793647	[Signature]
15	Muhammed Bilal	SST (MNSUM)	0306-0783878	[Signature]
16	Shoaib Hussain	SST (MNSUM)	0304-7886255	[Signature]
17	Faisal Jaleel	SST (MNSUM)	0308-8824995	[Signature]
18	M. Umar Farooq	Biotech bth (MNSUM)	0311-0618386	[Signature]
19	M. Ayyaz	Bio-tech	0345-7011755	[Signature]
20	Sadid Hakeem	M.Sc. PBG	0337-6148552	[Signature]
21	Saba Aslam	M.Sc. PBG	0301-3648779	[Signature]
22	Sabiba Fiaz	M.Sc. PBG	0347-0719766	[Signature]
23	Nadia Ayub	M.Sc. PBG	0303-8438332	[Signature]
24	Dr. M. Ashraf	PhD	0312-5251187	[Signature]
25	M. Majeed Javed	WRI, FS U	0333-8963028	[Signature]
26	Dr. Zulqurnain Khan	IPBB	0302-5880755	[Signature]
27	Mahmood Alam Khan	IPBB	0300-6884448	[Signature]
28	Zulqurnain Ali	PBG - UAM	061-9201684	[Signature]
29	Hafiz M. Awan	MNSUM (IPBB)	0302-9892754	[Signature]

Seminar Hall Session 3

25-03-2019

Attendance Sheet



'Aus-Pak International Conference on Wheat for Food Security
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MNS-University of Agriculture Multan, Pakistan





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03	M. AMIR BAKHTIAR	MNSUAM (Agron)	0333-1628807	[Signature]
04	Muhammad Shan	MNSUAM (Biotech)	0304-5828344	[Signature]
05	M. SHAHZAD	MNSUAM	0301-4079435	M. SHAHZAD
06	BILAL Mansoor	MNSUAM (IPB)	0310-618028	[Signature]
07	Naveed Raman	Student (MNSUAM)	0313-9884141	[Signature]
08	M. Shahid	Student (MNSUAM)	0305-6294787	[Signature]
09	M. Saleem Ch	" "	0311-6798642	[Signature]
10	Ameer Hamza	MNSUAM	0302-9068066	[Signature]
11	Amir Afzal	" " " "	0300-2186400	[Signature]
12	Naeem iqbal	" " " "	0302-9599467	[Signature]
13	Hafiz Muhammad Babar	B.Z.U (PBG)	0304-7576193	[Signature]
14	Imran Ullah	MNSUAM (PBG)	0307-6863000	[Signature]
15	M. Numan Khalid	B.PBG (Student)	0335-7080901	[Signature]
16	Hafiz Muhammad Waqas	" " " "	0303-0340336	[Signature]
17	Fauzan Iqbal	MNSUAM	0336-7745904	[Signature]
18	Muhammad Kasim	MNSUAM	0233-2105728	[Signature]
19	Hamza Ahmad Qureshi	MNSUAM (IPB)	03095200099	[Signature]
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Seminar Hall Session 3 25-03-2019 (Session I) (computer lab)

Attendance Sheet

Aus-Pak International Conference on Wheat for Food Security
March 24-25, 2019

MNS-University of Agriculture Multan, Pakistan

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Seminar Hall Session 3 25-03-2019

Attendance Sheet



'Aus-Pak International Conference on Wheat for Food Security
March 24-25, 2019



MNS-University of Agriculture Multan, Pakistan

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پاکستان بہت زیادہ ماحولیاتی تبدیلیوں کا شکار ہے: سید فخر امام

پاکستان میں 37 فیصد زرعی رقبے پر گندم کاشت کی جاتی ہے: ممبر قومی اسمبلی کا خطاب

ملتان (سپورٹس رپورٹر) ایم این ایس زرعی یونیورسٹی کے زیر اہتمام ہفتہ انٹرنیشنل کانفرنس کے پہلے روز گندم اور فوڈ سکیورٹی کے بارے میں آسٹریلیا پاکستان انٹرنیشنل کانفرنس کا انعقاد کیا گیا، صدارت ممبر قومی اسمبلی و چیئر مین کشمیر کمیٹی سید فخر امام نے کی، کانفرنس کے مہمان خصوصی صوبائی وزیر توانائی پنجاب ڈاکٹر اختر حسین ملک اور رینار ڈ آئی جی ریلوے پولیس سید ابن حسین تھے۔ کانفرنس میں آسٹریلیا سے آئے ہوئے زرعی سائنسدانوں نے خصوصی طور پر شرکت کی۔ سید فخر امام نے کانفرنس سے خطاب کرتے ہوئے کہا کہ پاکستان میں 37 فیصد زرعی رقبے پر گندم کاشت کی جاتی ہے۔ پاکستان بہت زیادہ ماحولیاتی تبدیلیوں کا شکار ہے۔ صوبائی وزیر ڈاکٹر اختر حسین ملک نے کہا کہ اس کانفرنس سے آسٹریلیا کی ٹیکنالوجی سے ہمارے ملک کے کاشتکار روشناس ہو سکیں گے۔ اس موقع پر وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی ممبر صوبائی اسمبلی قاسم خان ددیگر موجود تھے۔



ملتان: ایم این اے سید فخر امام انٹرنیشنل کانفرنس کا افتتاح کرتے ہوئے

جلد نمبر 45 پیر 16 رجب المرجب 25، 1440 مارچ 2019ء 11 جیت 2073 ب صفحہ 12 قیمت 15 روپے شمارہ نمبر 199

آبادی میں غذائی ضروریات کیلئے کنڈر کیساتھ متبادل فصلوں کی کاشت ضروری ہے

ہم کسانوں کے مسائل حل کرنے کے لیے اقدامات کر رہے ہیں تاکہ زرعی جامعہ صبح معنوں میں اپنا کردار ادا کر سکے: ڈاکٹر آصف علی پروچیکٹ ایف اے کیلئے شروع کیا لیکن سیاستدانوں اور انتظامیہ کی تاہلی کی وجہ سے کام ہوا اب پاکستان میں کامیابی سے جاری ہے: ڈاکٹر آصف علی



ملتان (آفتاب نیوز) ایم این ایس زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس و ایک کا آغاز کر دیا گیا۔ انٹرنیشنل کانفرنس و ایک کے پہلے روز پہلی آسٹریلیا پاکستان انٹرنیشنل کانفرنس آن کنڈم اور فوڈ سکیورٹی کا انعقاد کیا گیا۔ کانفرنس کی صدارت مہر قوی آسٹریلیا و چیمبر مین ٹھیکری سید خیر ام نے کی جب کہ تقریب کے مہمان خصوصی صوبائی وزیر پوناہی پنجاب ڈاکٹر اختر حسین ملک اور ریٹائرڈ آئی جی ریلوے پولیس سید ابن حسین تھے جبکہ آسٹریلیا سے آنے والے زرعی سائنسدانوں نے خصوصی باتی سلسلے 11 بجے نمبر 61

ملتان ایم این ایس زرعی یونیورسٹی میں انٹرنیشنل کانفرنس کا افتتاح سید خیر ام ڈاکٹر آصف علی و دیگر کر رہے ہیں

بقیہ 61

طور پر حرکت کی کانفرنس کا افتتاح کرتے ہوئے سید خیر ام نے کہا کہ 1947 سے اب تک ہماری آبادی دو گنی ہے اور زیادہ ہوگی ہے جب کہ اس کے ساتھ ساتھ آبادی کی ضروریات کو پورا کرنے کے لیے ہمارے پاس زمین کی پیداوار میں اضافہ ضروری ہے۔ پاکستان میں 37 فیصد زرعی رقبے پر کنڈم کاشت کی جاتی ہے۔ پاکستان بہت زیادہ ماحولیاتی تبدیلیوں کا شکار ہے اس حوالے سے پاکستان کا نام پہلے پچھے سات ممالک میں آتا ہے۔ انہوں نے کہا کہ برازیل میں بہت زیادہ مقدار میں سویا تین اگایا جاتا ہے اب یہ ہمارے زرعی ماحولیاتی کی زندگی بچانے کے لیے ضروری ہے۔ انہوں نے مزید کہا کہ موجودہ حکومت زراعت کی اہمیت کو مد نظر رکھ کر اقدامات کر رہی ہے جس کے نتیجے میں تازہ مائے آسمان کے لیے ہے جب کہ پاکستان میں کانفرنس کے مہمان خصوصی صوبائی وزیر ڈاکٹر اختر حسین ملک نے کانفرنس سے خطاب کرتے ہوئے کہا کہ زرعی یونیورسٹی نے کنڈم پر انٹرنیشنل کانفرنس کا انعقاد کروا کر اہم اقدام اٹھایا ہے۔ انہوں نے کہا کہ اس کانفرنس کے انعقاد سے ہمارے آسٹریلیا کے ساتھ تعلقات مزید بہتر ہونگے اور آسٹریلیا کی ٹیکنالوجی سے ہمارے ملک کے کاشتکار روڈ شاپ ہو سکیں گے۔ انہوں نے مزید کہا کہ حکومت پاکستان اور خصوصاً حکومت پنجاب شجر زراعت کی اہمیت کو سمجھتے ہوئے ملی اقدام کر رہی ہے۔ کانفرنس سے خطاب کرتے ہوئے ڈاکٹر چائلر جامعہ پروڈیوڈاکٹر آصف علی نے کہا کہ ہم کسانوں کے مسائل حل کرنے کے لیے اقدامات کر رہے ہیں تاکہ زرعی جامعہ صبح معنوں میں اپنا کردار ادا کر سکے۔ انہوں نے کہا کہ آسٹریلیا کی کانفرنس کا انعقاد ہونا ایک اہم اقدام ہے۔ انہوں نے مزید کہا کہ جامعہ صبح معنوں کی جانب سے کانفرنس کے انعقاد پر ہم فائز مرزوں کا انعقاد کروانگے جس میں ان کانفرنس سے حاصل ہونے والی سفارشات اور تجاویزات اردو میں کسانوں کو پڑھ کر سنائی جائیں گی۔ کانفرنس سے خطاب کرتے ہوئے ڈاکٹر چائلر نے کہا کہ کانفرنس کے انعقاد سے کانفرنس کے انعقاد کا مقصد کنڈم کی فصل اور مختلف فصلوں کو درجنوں مسائل کو حل کرنے کے لیے ایک دوسرے کے تجربات سے فائدہ اٹھایا جاسکے گا۔ اس کے علاوہ کانفرنس سے خطاب کرتے ہوئے آسٹریلیا سے آنے والے زرعی سائنسدانوں نے کہا کہ آسٹریلیا میں موجود ٹیکنالوجی کو پاکستان میں متعارف کرانے کے لیے اقدامات کیے جا رہے ہیں تاکہ کنڈم کی فصل کو بہتر کیا جاسکے۔ جبکہ اس موقع پر ممبر صوبائی اسمبلی قاسم خان ڈی ڈی وینس ڈاکٹر برین سگھو Dr. Thisthothwala، ڈاکٹر کولیس (انگلینڈ)، ڈاکٹر عطا الرحمن (آسٹریلیا) ڈاکٹر جاوید امیر (نیپال) اور ڈاکٹر شفقت سید ڈاکٹر ذوالفقار علی، ڈاکٹر محمد نعیم، ڈاکٹر عرفان بیگ، ڈاکٹر اشفاق احمد و دیگر موجود تھے۔



ملتان: چیئرمین کشمیر کمیٹی سید فخر امام انٹرنیشنل کانفرنس کا افتتاح کر رہے ہیں

آسٹریلیا پاکستان انٹرنیشنل کانفرنس آن گندم نوڈ سکیورٹی شروع

نواز شریف یونیورسٹی میں کانفرنس کا افتتاح چیئرمین کشمیر کمیٹی سید فخر امام نے کیا

پاکستان گندم پیدا کر نیوالے بڑے 7 ممالک میں شامل ہے: تقریب سے خطاب

ملتان (خصوصی رپورٹر) ایم این ایس زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس ویک کا آغاز کر دیا گیا، زرعی رقبے پر گندم کاشت کی جاتی ہے۔ پاکستان بہت زیادہ ماحولیاتی تبدیلیوں کا شکار ہے اس حوالے سے پاکستان انٹرنیشنل کانفرنس ویک کے پہلے روز پہلی آسٹریلیا پاکستان انٹرنیشنل کانفرنس آن گندم اور نوڈ سکیورٹی کا انعقاد کیا گیا، صدارت ممبر قومی اسمبلی و چیئرمین کشمیر کمیٹی سید فخر امام نے کی جب کہ تقریب کے مہمان خصوصی صوبائی وزیر توانائی پنجاب ڈاکٹر اختر حسین ملک اور ریٹائرڈ آئی جی ریلوے پولیس سید اہن حسین تھے جبکہ آسٹریلیا سے آنے والے زرعی سائنسدانوں نے خصوصی طور پر شریکیت کی، کانفرنس کا افتتاح کرتے ہوئے سید فخر امام نے کہا کہ 1947 سے اب تک ہماری آبادی دگنا سے بھی زیادہ ہو گئی ہے جب کہ اس کے ساتھ ساتھ آبادی کی ضرورت اور پورا کرنے کے لئے ہماری گندم کی پیداوار بھی

زیادہ ہوئی ہے، انہوں نے کہا کہ پاکستان میں 37 فیصد زرعی رقبے پر گندم کاشت کی جاتی ہے۔ پاکستان بہت زیادہ ماحولیاتی تبدیلیوں کا شکار ہے اس حوالے سے پاکستان کا نام پہلے چھ سات ممالک میں آتا ہے زرعی سائنس دانوں کی ذمہ داری ہے کہ وہ یہاں بھی نئی فصلوں کی کاشت شروع کر سکیں، صوبائی وزیر ڈاکٹر اختر حسین ملک نے کانفرنس سے خطاب کرتے ہوئے کہا کہ زرعی یونیورسٹی نے گندم پر انٹرنیشنل کانفرنس کا انعقاد کروا کر اچھا قدم اٹھایا ہے، کانفرنس سے خطاب کرتے ہوئے ڈاکٹر چرڈ نے کہا کہ یہ پروجیکٹ دراصل انڈیا کے لئے شروع کیا گیا تھا لیکن انڈین سائنسدانوں اور انتظامیہ کی نااہلی کی وجہ سے یہ پروجیکٹ ناکام ہوا اور یہ پروجیکٹ پاکستان میں شروع ہو گیا جو کہ اب کامیابی سے جاری ہے۔



ملتان: نواز شریف زری یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس کا افتتاح ممبر قومی اسمبلی و چیئر مین کشمیر کینی فرامام، پروفیسر ڈاکٹر آصف علی کرہے ہیں۔

آبادی بڑھ گئی، نئی فصلیں کاشت کرنا ہوگی: فخر امام

آسٹریلیا کی ٹیکنالوجی سے فائدہ اٹھانے والے ڈاکٹر آصف علی، نواز شریف زری یونیورسٹی میں کانفرنس ٹیکنالوجی کو پاکستان میں متعارف، ایک دوسرے کے تجربات سے فائدہ اٹھائیں گے: آسٹریلیا میں سائنسدان، کانفرنس ویک ملتان (سٹاف رپورٹر) نواز شریف زری یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس ویک کا آغاز ہو گیا، پہلے روز پہلی آسٹریلیا پاکستان انٹرنیشنل کانفرنس گندم اور فوڈ سکیورٹی ہوئی جسکی صدارت رکن قومی اسمبلی و چیئر مین کشمیر کینی فرامام نے کی، مہمان خصوصی سوڈانی وزیر توانائی پنجاب ڈاکٹر اختر ملک اور رینائر ڈاکٹر بی ریلے سے پولیس این حسین تھے، فخر امام نے کہا کہ 1947ء سے اب تک ہماری آبادی دو گنا سے بھی زیادہ ہو گئی ہے جب کہ اس کے ساتھ ساتھ آبادی کی ضروریات کو پورا کرنے کیلئے ہماری گندم کی پیداوار بھی زیادہ ہوتی ہے، پاکستان میں 37 فیصد زری تھے پر گندم کاشت کی جاتی ہے، برازیل میں بہت زیادہ مقدار میں سویا بین اگایا جاتا ہے اب یہ ہمارے زری میں سائنسدانوں کی ذمہ داری ہے کہ وہ یہاں بھی نئی فصلوں کی کاشت شروع کروائیں، سوڈانی وزیر ڈاکٹر اختر ملک نے کہا کہ آسٹریلیا کی ٹیکنالوجی سے ہمارے کاشتکار فائدہ اٹھائیں گے، واٹس چائلر پروفیسر بیگ، ڈاکٹر اشفاق احمد و دیگر موجود تھے۔

39 کانفرنس ویک

پہلی سید ظہرا ام نے کی جب کہ تقریب کے مہمان خصوصی صوبائی وزیر توانائی پنجاب ڈاکٹر اختر حسین ملک اور ریٹائرڈ آئی بی ریٹائرڈ پولیس سید اہن حسین تھے جبکہ آسٹریلیا سے آنے والے زرعی سائنسدانوں نے خصوصی طور پر شرکت کی کانفرنس کا افتتاح کرتے ہوئے سید ظہرا ام نے کہا کہ 1947 سے اب تک ہا ری آبادی دو گنا سے بھی زیادہ ہو گئی ہے جب کہ اس کے ساتھ ساتھ آبادی کی ضروریات کو پورا کرنے کے لیے ہا ری گندم کی پیداوار بھی زیادہ ہو گئی ہے۔ انہوں نے کہا کہ پاکستان میں 37 فیصد زرعی رقبے پر گنم کاشت کی جاتی ہے۔ پاکستان بہت زیادہ ماحولیاتی تبدیلیوں کا شکار ہے۔ اس حوالے سے پاکستان کا نام پہلے ہیٹھ سے سات ممالک میں آتا ہے۔ اب یہ ہمارے زرعی سائنسدانوں کی ذمہ داری ہے کہ وہ نئی فصلیں کاشت شروع کر سکیں۔ مہمان خصوصی صوبائی وزیر ڈاکٹر اختر حسین ملک نے کہا کہ زرعی یونیورسٹی نے گندم پر انٹرنیشنل کانفرنس کا انعقاد کرنا اچھا قدم اٹھایا ہے۔ انہوں نے کہا کہ اس کانفرنس کے انعقاد سے ہمارے آسٹریلیا کے ساتھ تعلقات مزید بہتر ہوں گے اور آسٹریلیا کی ٹیکنالوجی سے ہمارے ملک کے کاشتکار روشناس ہو سکیں گے۔ انہوں نے مزید کہا کہ حکومت پاکستان اور خصوصاً حکومت پنجاب شعبہ زراعت کی اہمیت کو سمجھتے ہوئے عملی اقدام کریں۔ ڈاکٹر چائلر جامعہ پروفیسر ڈاکٹر آصف علی نے کہا کہ ہم کسانوں کے مسائل حل کرنے کے لیے اقدامات کر رہے ہیں تاکہ زرعی جامعہ محضوں میں اپنا کردار ادا کر سکیں۔ کانفرنس سے خطاب کرتے ہوئے ڈاکٹر چوڑے نے کہا کہ یہ پراجیکٹ دراصل انڈیا کے لیے شروع کیا گیا تھا لیکن انڈین سائنس دانوں اور انڈیا کی تا اہلی کی وجہ سے یہ پراجیکٹ ناکام ہوا اور یہ پاکستان میں شروع ہو گیا جو کہ اب کامیابی سے جاری ہے۔ انہوں نے مزید کہا کہ اس کانفرنس کے انعقاد کا مقصد گندم سمیت مختلف فصلوں کو درپیش مسائل حل کرنے کے لیے ایک دوسرے کے تجربات سے فائدہ اٹھانا ہے۔ کانفرنس میں ممبر صوبائی اسمبلی ہام خان لگا، پروفیسر ڈاکٹر ہرین سکھ، ڈاکٹر حفصہ وید، ڈاکٹر کونول (انگلینڈ)، ڈاکٹر عطا الرحمن (آسٹریلیا

زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس ویک کا آغاز

ماحولیاتی تبدیلیوں کی فصلیں کاشت کرنا، زرعی سائنس دانوں کی ذمہ داری

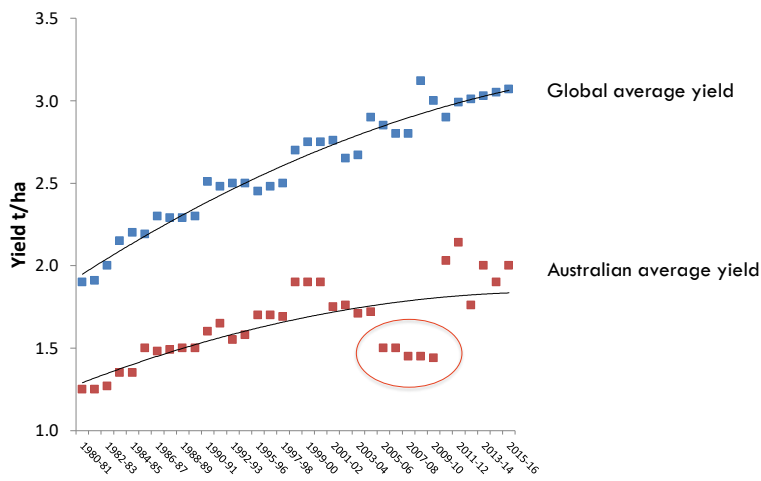
زراعت کی بہتری کیلئے اقدامات جاری: ڈاکٹر اختر ملک، آسٹریلیا پاکستان کانفرنس سے خطاب

ملتان (پبلک رپورٹر) ایم این ایس زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس ویک کا آغاز کر دیا گیا۔ پہلے روز آسٹریلیا پاکستان انٹرنیشنل کانفرنس آن گندم اور فروڈ سیکورٹی کا انعقاد کیا گیا۔ کانفرنس کی صدارت ممبر قومی اسمبلی و چیئرمین کشمیر (باقی صفحہ 4 چھپے نمبر 39)

The potential of hybrid wheat in Australia and beyond



Trends in global and Australian wheat yield



Wheat yield research at The University of Sydney



Research to maintain yield

- disease resistance
- weed research
- drought and heat research

Research to increase yield and sustainability

- Digital agriculture
- Better crop management

Research to improve yield potential

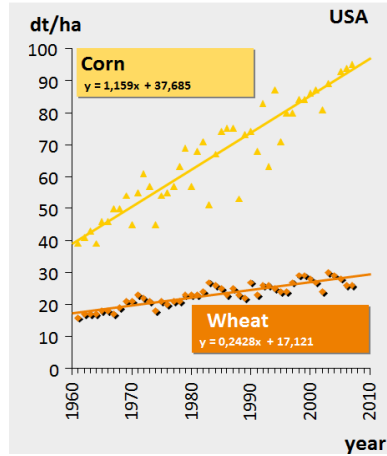
- More efficient photosynthesis
- High yielding wheat through empirical selection
- Hybrid vigour in wheat



Wheat yield versus maize in the United States

The rate of maize yield improvement has far exceeded that of wheat in the USA

- Environment/management
- Heterosis or “hybrid vigour”
- Investment



Source: FAOSTAT

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The limitations to producing hybrid wheat

- Wheat is self-pollinated
- An effective and low cost breeding system that produces and maintains male sterility is vital
- F1 commercial seed production constrained by poor pollen flow

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“Standing on the shoulders of a giant”

Dr Norman Darvey (1945 – 2017)
University of Sydney academic,
cytogeneticist and plant breeder

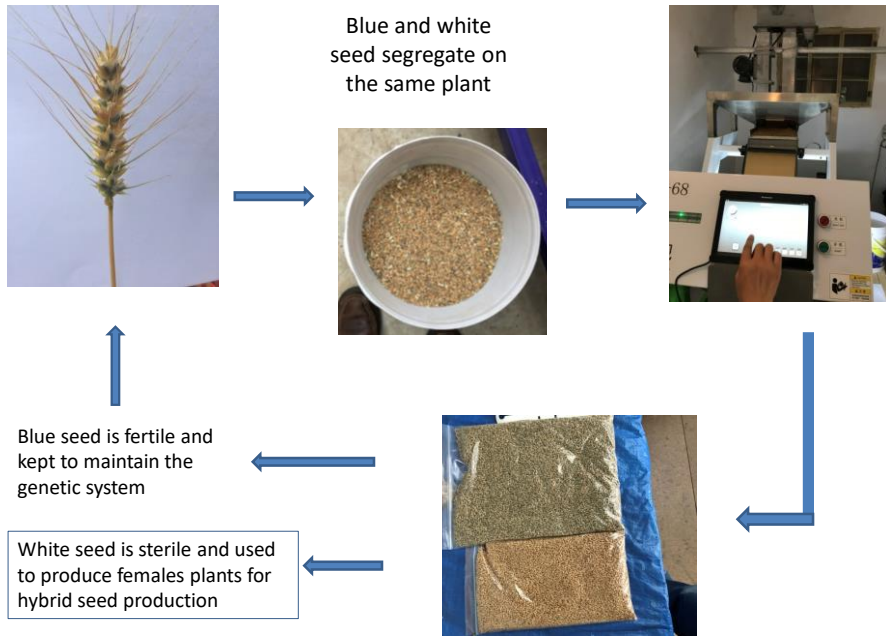


Perfecting the breeding system

Funding from the Department for International
Development **Innovate UK**
Technology Strategy Board

“Hybrid Wheat for Food Security”

Partnership with KWS (wheat breeding UK), Beverley
Darvey (GCI) and the University of Agriculture, Faisalabad,
and the Muhammad Nawaz Shareef University of
Agriculture, Multan

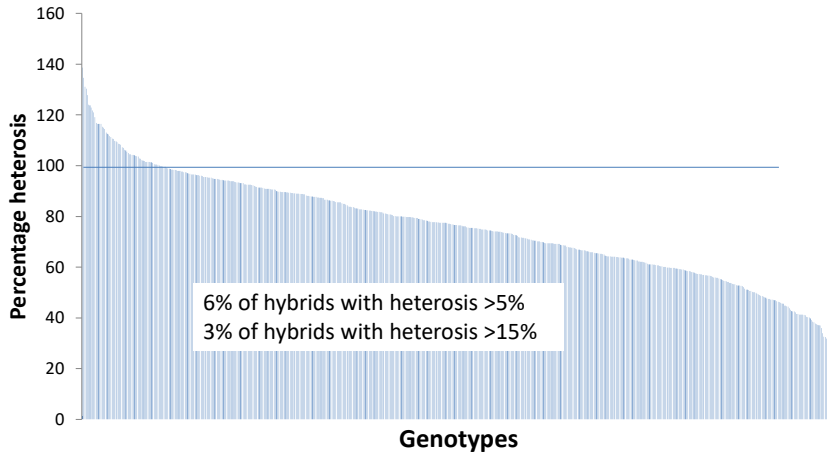


Challenges to realizing commercially viable hybrid wheat

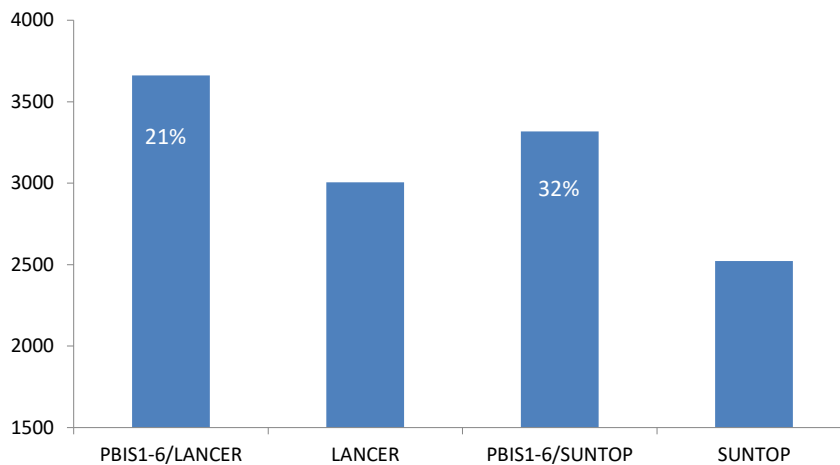
- Plant breeders have eliminated heterotic pools by crossing the 'best' with the 'best'
- Hybrid wheat breeding not dissimilar to breeding hybrid maize

A significant challenge: finding hybrid vigour

Percentage heterosis for yield compared to Suntop
(1,450 mean comparisons)

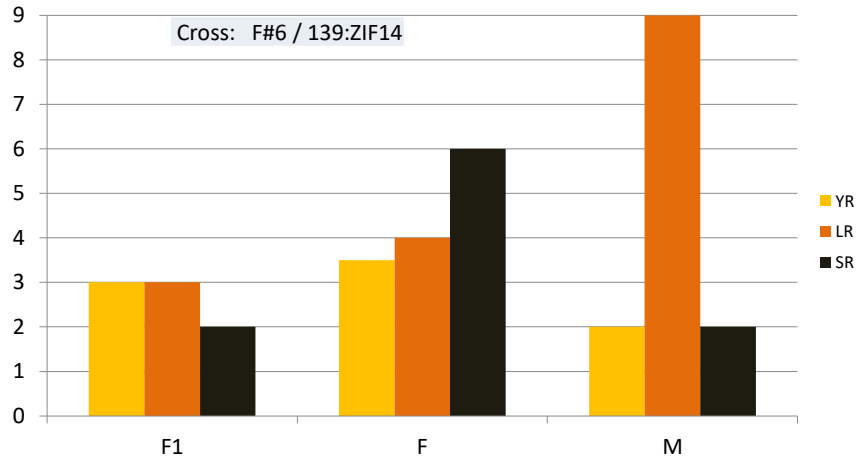


Yield under crown rot inoculation in the field



Rust resistant F1 hybrids are essential

Rust scored on a 1 - 9 scale



Challenges to realizing commercially viable hybrid wheat

- The cost of breeding F1 hybrids can be significantly reduced, however seed production limitations remain the same
- Male and female 'characteristics' need to be bred into wheat to promote F1 seed set







Integrated approaches for wheat breeding to mitigate production risk

Dr. Harpinder Singh Randhawa
Lethbridge Research and Development Centre

Canada in the World

- Canada produces about 4% of the global wheat supply
- Canada accounts for about 15% of global wheat trade
- Canada produces about 12% (4.5mmt) of the global durum wheat supply (37.1mmt)
- Canada accounts for about 52% of global durum wheat trade.
- Overall, it generates about \$7 billion annually, and about \$11 billion when value-added food processing is considered.



Climate in Western Canada

Av. July Temperatures: 23 C day / 9 C night (Calgary)
 27 C day / 12 C night (Medicine Hat)

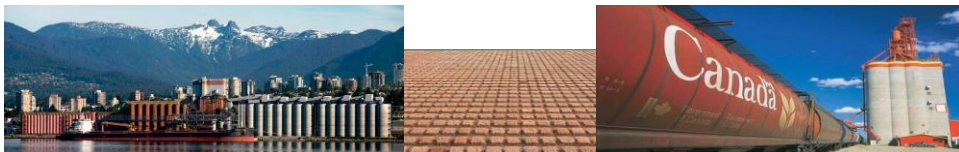
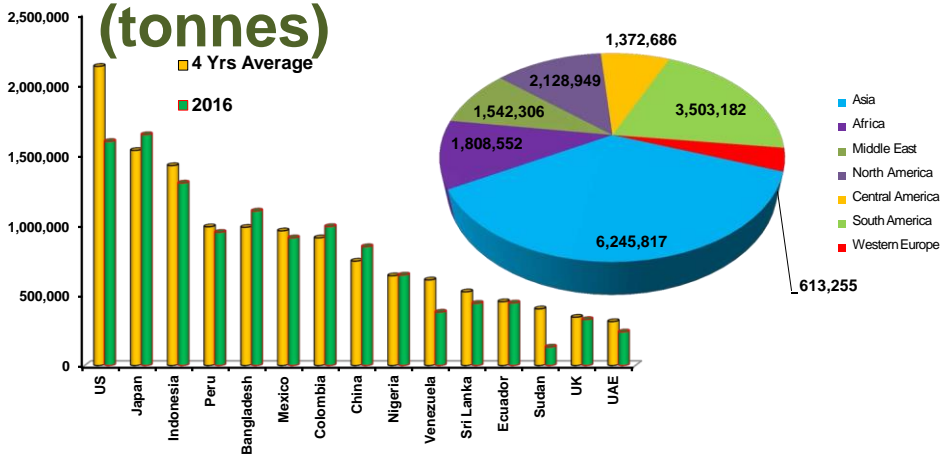
Av. January Temperatures: -2 C day / -14 C night (Lethbridge)
 -13 C day / -24 C night (Brandon)

Frost free days: approx. 95 to 120 days

Total precipitation: 300 to 380 mm in arid regions
 410 to 510 in moister regions



Canadian Wheat Export (tonnes)



Breeding objectives

To develop improved varieties of wheat for western Canada that combine superior **agronomic performance**, **Pest resistance**, and **end-use quality**



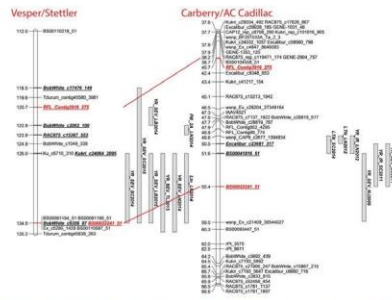
Stripe Rust in Western Canada

- ❖ First reported in the late 1920s in southern Alberta on SWS wheat
- ❖ Mild winter, cool wet spring & summer, close to PNW
- ❖ Green bridge with winter wheat
- ❖ Epidemics in 2005, 2006, 2012, 2014, 2016
- ❖ Overwintering in Alberta in recent years
- ❖ Occurring more frequently in SK and MB, and ON
- ❖ Now one of the five priority **ONE** diseases in W Canada



Pyramiding of QTL for stripe rust resistance using marker-

Chromosome 2A



TAG 2017 10.1007/s00122-017-2980-7

Genetics of Fusarium head blight

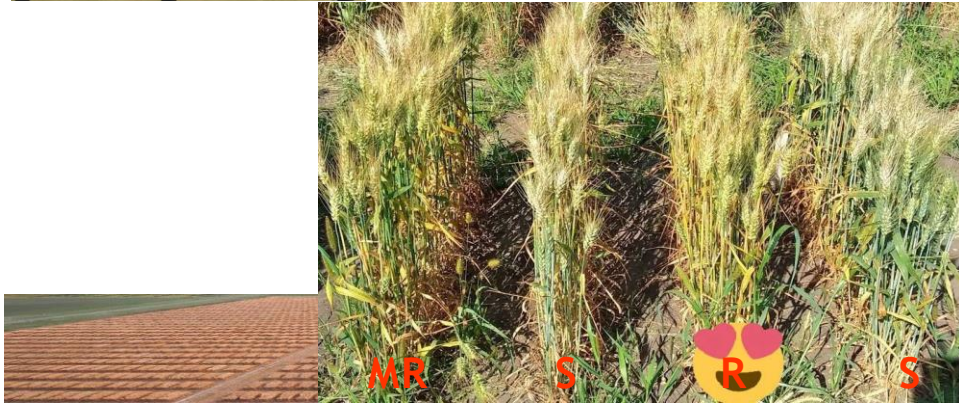
- ❖ Resistance is inherited in quantitative fashion
- ❖ Over 52 QTL studies (46 in bread wheat+ 4 in durum wheat+ 2 closely in related species)
- ❖ Only few sources of resistances: Sumai-3, Frontana, Praag8 and Novokrumka
- ❖ Pyramiding QTLs



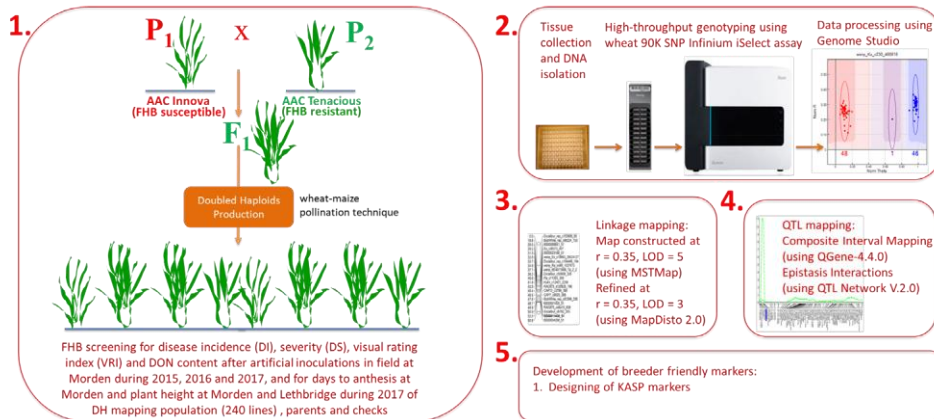
Fusarium head blight



Carman 2018



Understanding Genetics of Resistance



Doubled Haploid Production



Canada Prairie Spring: 2000-2500 lines per year



Acknowledgement

Funded through partnerships:



Introgression of heat-tolerant genes to broaden genetic variation in current wheat breeding populations

Rebecca Thistlethwaite & Richard Trethowan
IA Watson Grains Research Centre, Narrabri



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GRDC

Grains
Research &
Development
Corporation

Your GRDC working with you



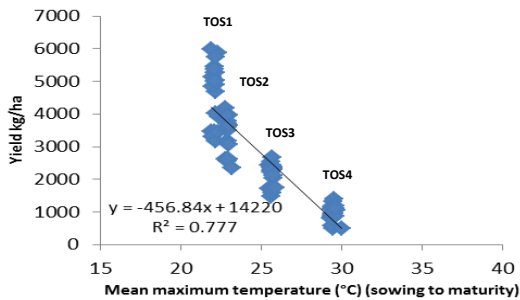
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Complex abiotic trait: heat tolerance in wheat

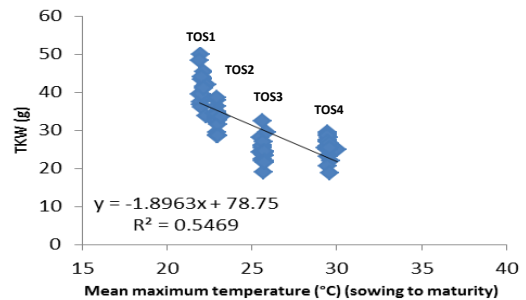
- \uparrow temperatures = \downarrow wheat yields
- Heat shock (3-5 days $> 35^{\circ}\text{C}$) **significantly reduces** yield
 - if experienced at meiosis/flowering (grain seed number)
- Temperatures $> 35^{\circ}\text{C}$ during grain filling reduces yield (reduced grain weight)
- The inheritance of heat tolerance is complex!

The impact of temperature on yield

Yield (kg/ha)



TKW (g)



❖ A decrease of 250 - 400 kg/ha for every 1°C rise in mean maximum temperature above the optimum depending on the year



Germplasm



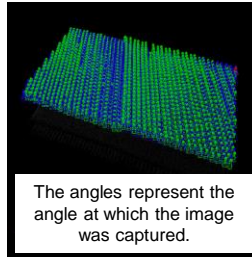
- Synthetic derivatives (USYD)
- Indian *T. dicoccum* introgressions in hexaploid backgrounds (USYD)
- Published sources of heat tolerance & Australian cultivars



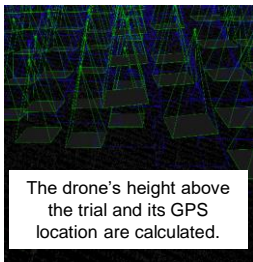
Scaling up phenotyping

RAY CLOUD Visualization within PIX4D Software

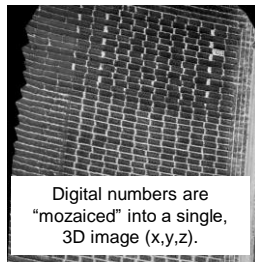
1000s of pixels per plot and are extracted (2cm x 2cm pixels) and averaged.



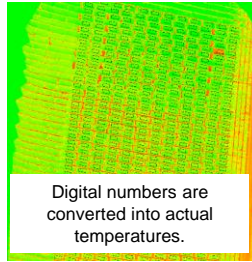
The angles represent the angle at which the image was captured.



The drone's height above the trial and its GPS location are calculated.



Digital numbers are "mozaiced" into a single, 3D image (x,y,z).

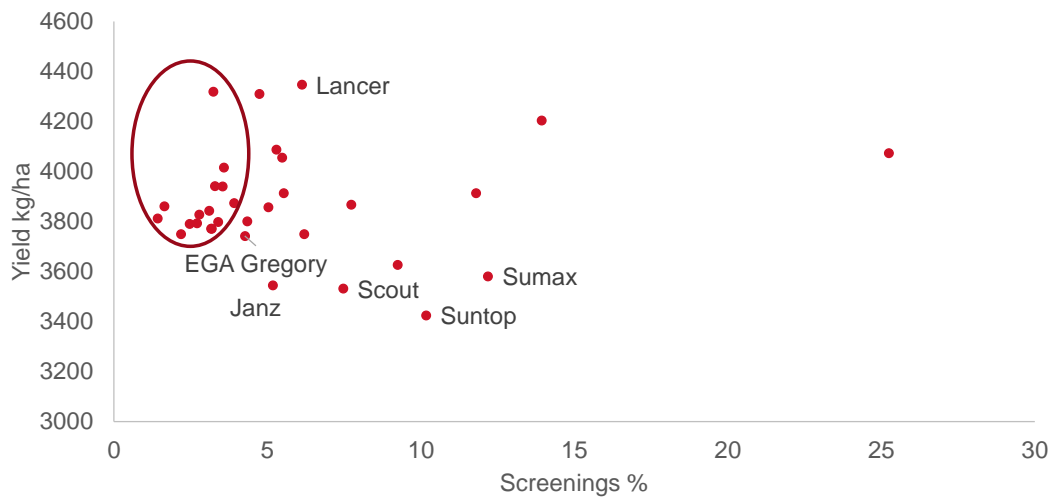


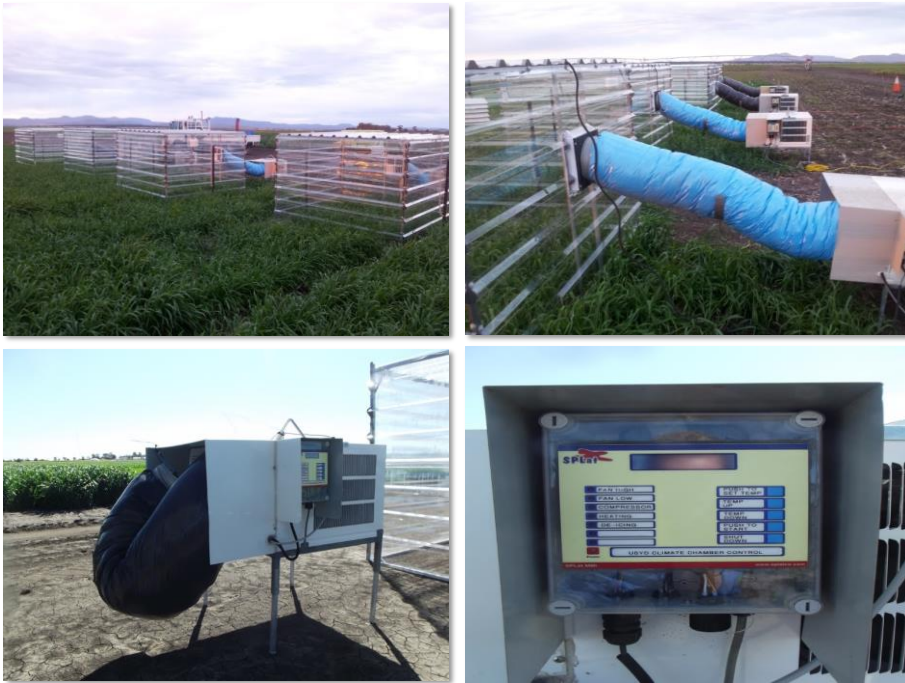
Digital numbers are converted into actual temperatures.

NDVI : Parrot Sequoia (multi-spectral camera)

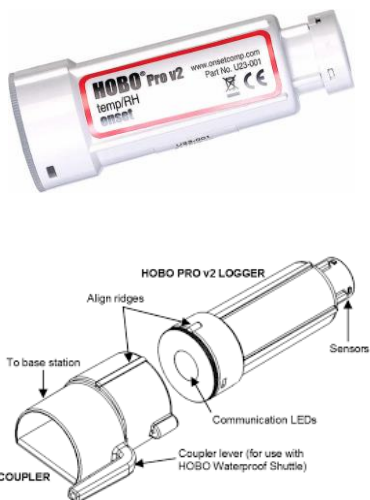
Canopy temperature: DJI XT (FLIR Radiometrically calibrated)

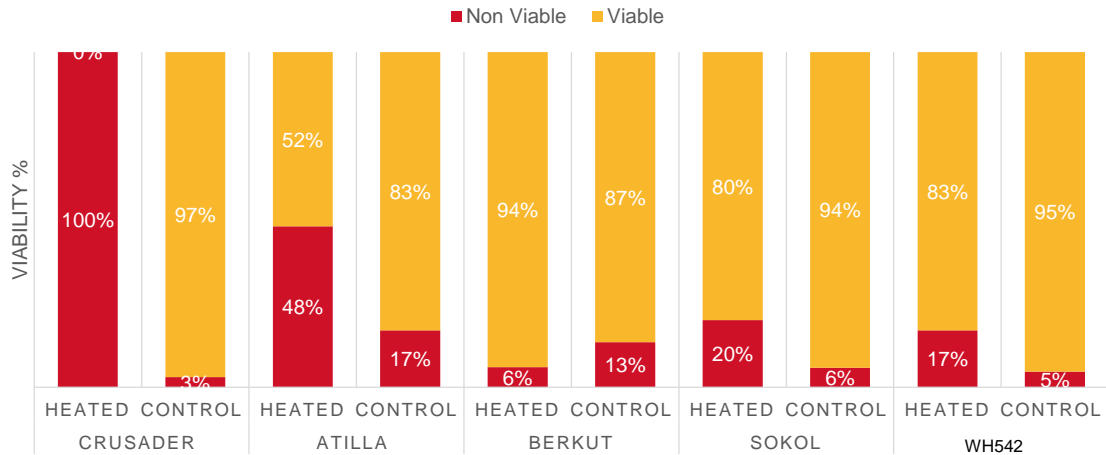
Grain yield and screenings (Optimal planting)



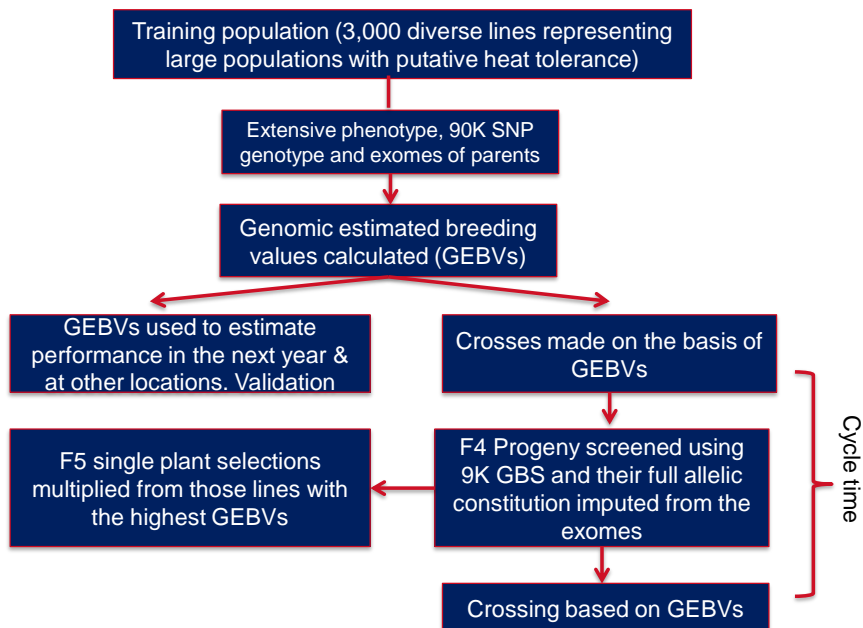


Data loggers and radiation shields





Genomic selection for heat tolerance





Why does this research matter?

- Genetic diversity for heat tolerance
 - Genotype performance over a wide range of seasonal conditions – multi year trials
 - Trait stability across multiple sowing dates
 - It is not just yield that needs to be considered!
 - Multiple mechanisms exist for heat tolerance and need to be phenotyped separately
-



Acknowledgements

The staff and students of the Plant Breeding Institute

Grains Research and Development Corporation

Hans Daetwyler, Sang He and Matthew Hayden (DEDJTR)

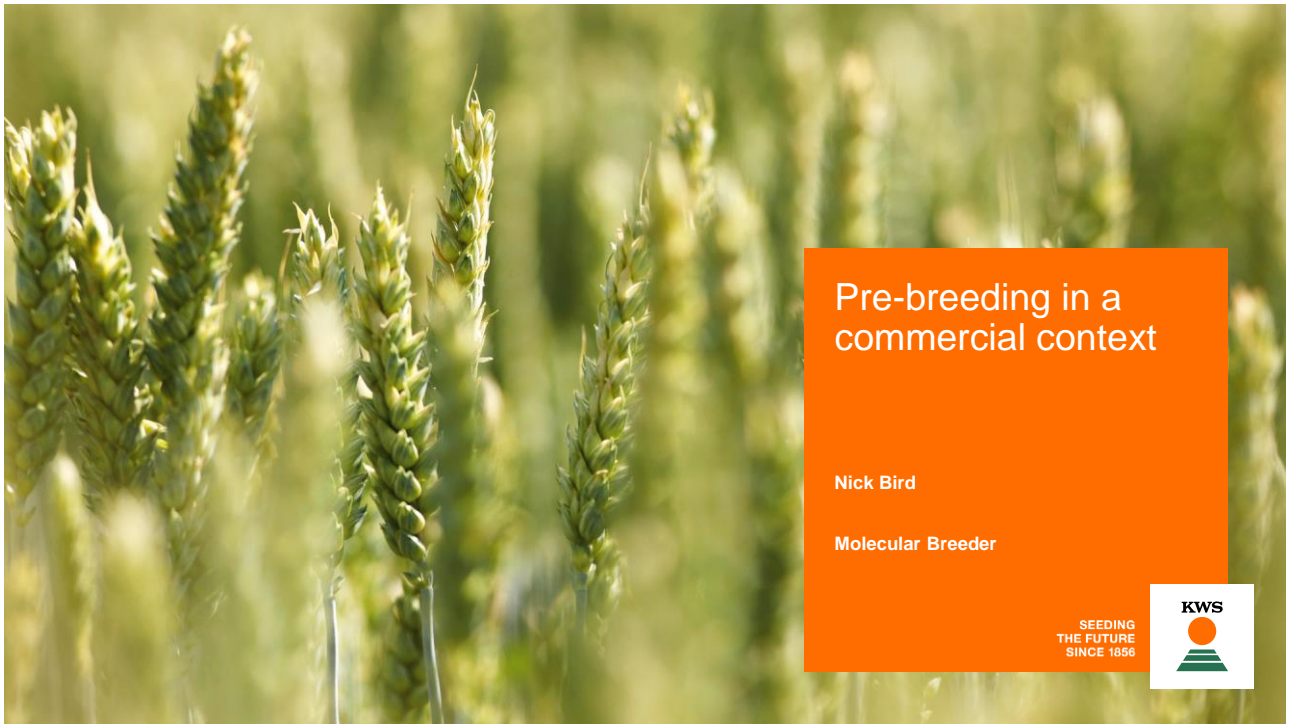
Daniel Tan and Anowarul Bokshi - USYD

James Strangoulis – Flinders University, SA

Michelle Murfit and team – MEF site Merredin, WA

Surya Kant and Giao Nguyen – AgVic Horsham, Vic





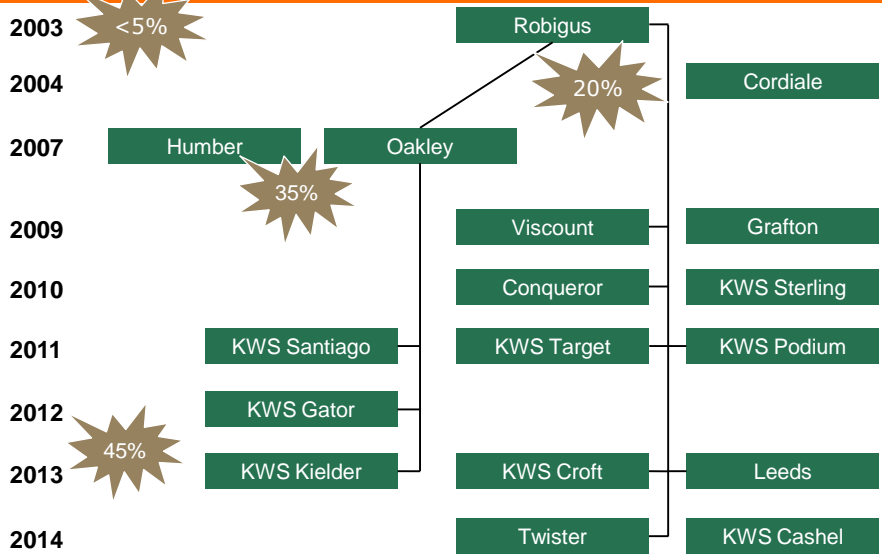
Why do we need pre-breeding in the commercial sector?



- *No one ever makes money from pre-breeding*
 - *Pre-breeders don't understand commercial breeding*
 - *Pre-breeding never delivers anything useful*
-
- Dwarfing genes
 - Rye translocations
 - Introgressions from related species
 - CMS hybrid system



10 years of commercial success at KWS with 'Robigus'



- *Triticum dicoccoides* introgression on 3B and 4A
- Originated from Dutch pre-breeding efforts

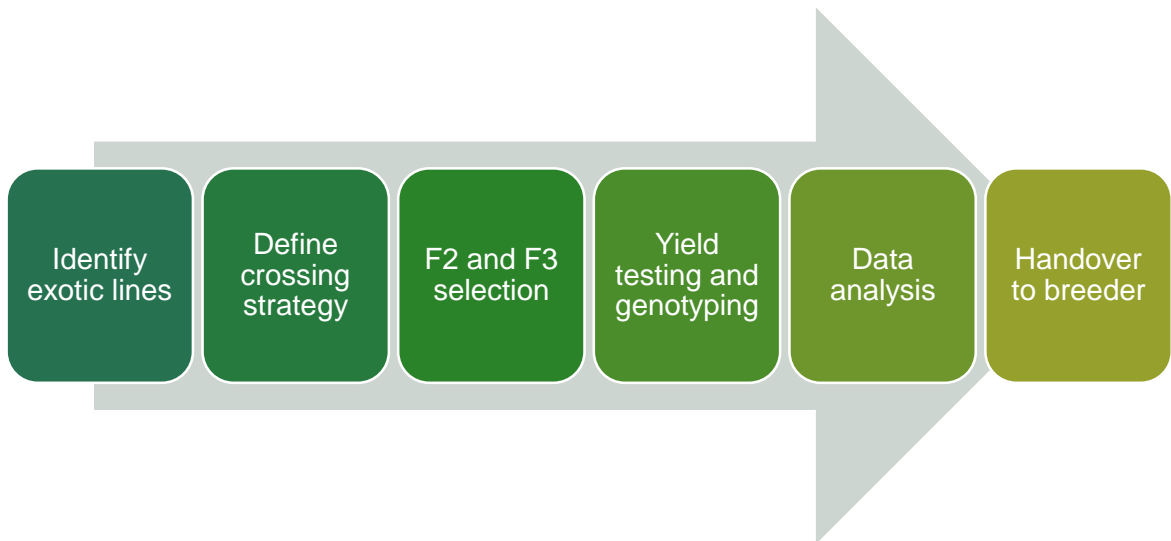


Wheat and barley Legacy for Breeding Improvement

WP6: Genome-assisted pre-breeding and breeding methods

FP7 European Project





Identify exotic lines

Sources of genetic diversity – where to look



- Genebanks are full of genetic diversity
- National and international pre-breeding programmes produces 1000s of line
- Germplasm exchange with breeders around the world

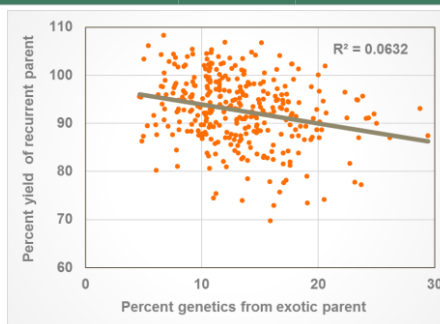
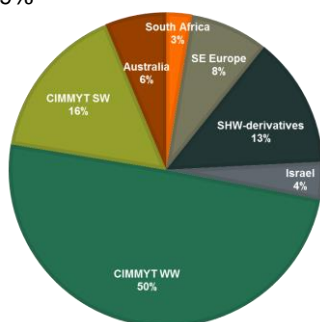


- Standard yield testing in unreplicated trials
- Recurrent parent repeated check



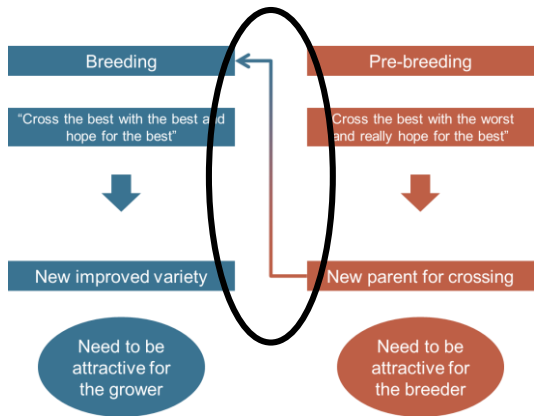
- 382 lines evaluated
- Yield compared to recurrent parent
 - Average: 93%
 - Range: 70-109%
- Level of exotic genetic diversity
 - Average: 13%
 - Range: 5-29%

Group	Avg Exotic	Avg Yield	Max yield	Exotic
South Africa	15.3	98.9	104.5	10.4
Southern Europe	12.1	97.7	108.3	6.7
SHW-derivatives	11.5	97.2	105.4	9.2
Israel	11.5	90.9	103.7	7.8
CIMMYT WW	13.1	91.4	106.8	15.1
CIMMYT SW	14.3	92.0	104.4	7.5
Australia	15.5	90.2	106.9	12



- 50 lines (13%) selected for replicated yield test and multi-location observation nurseries
 - Average yield: 101% of recurrent parent (93-108%)
 - Average exotic diversity: 12% (5-23%)
- In collaboration with breeder, evaluate:
 - Final yield performance
 - Introgressed exotic genetic diversity
 - Agronomic characteristics

3-5 lines selected for forward breeding



Thank you for listening

Rust diseases of wheat and Hybrids



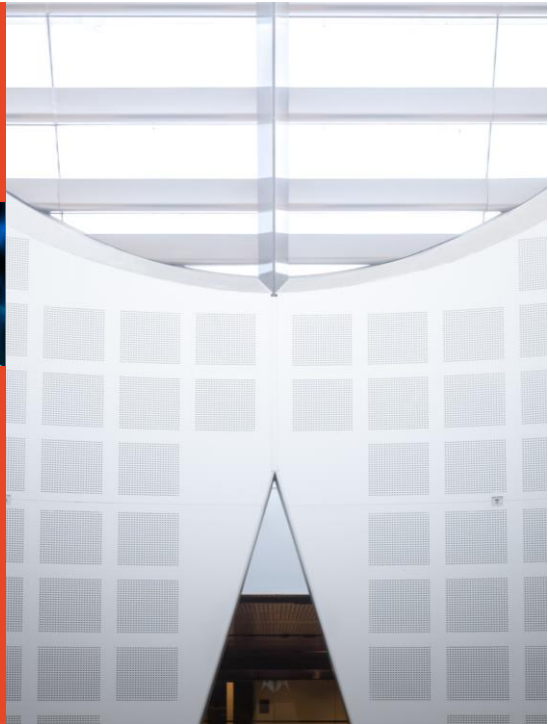
Harbans Bariana



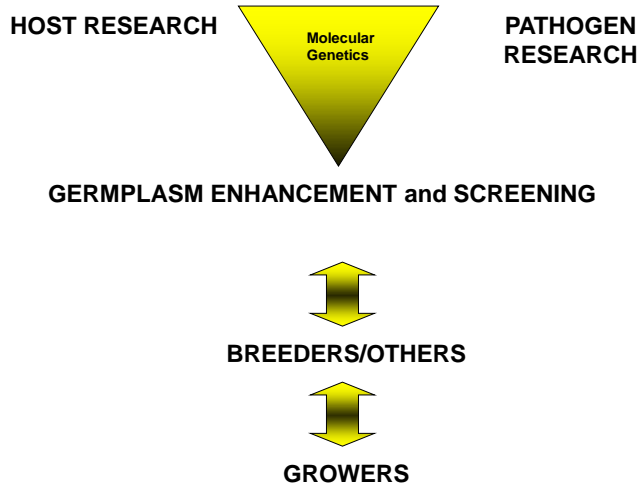
GRDC Grains Research & Development Corporation
Your GRDC working with you



THE UNIVERSITY OF SYDNEY



Australian Cereal Rust Control Program



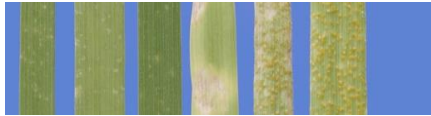
Rust diseases of wheat

- Stem rust (up to 100% losses)
- Leaf rust (up to 50% losses)
- Stripe rust (up to 70% losses)



Types of resistance

- Seedling/major/all stage/vertical resistance

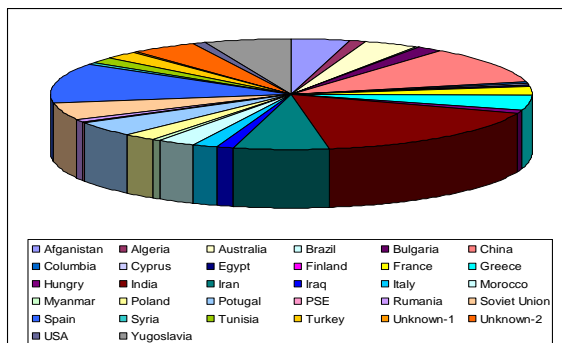


- Adult plant/mature plant/field/horizontal resistance



Target Germplasm for Discovery

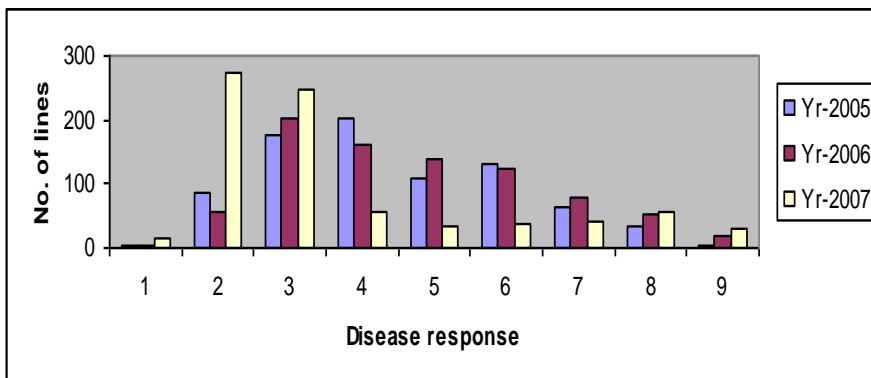
- Watkins collection
- Winter wheats and Spring wheats
- National and international Nurseries



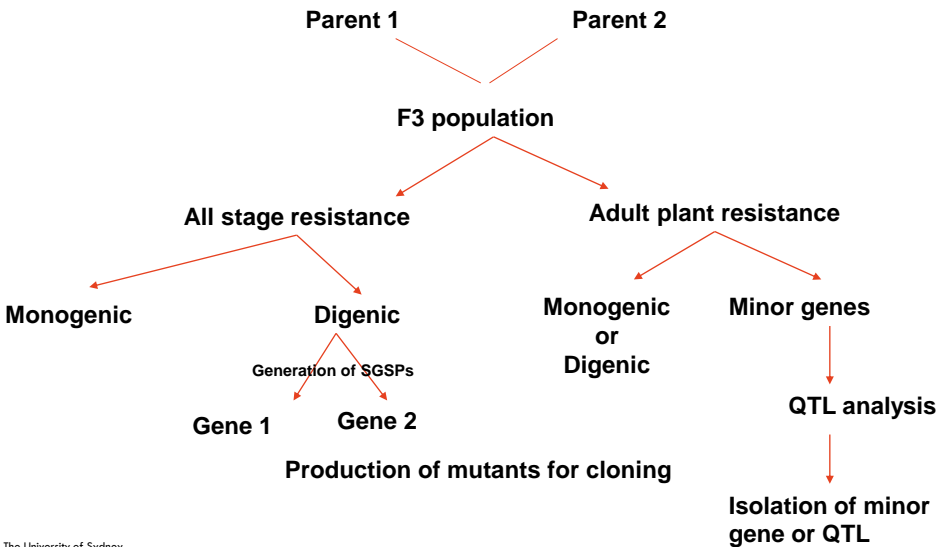
Rust research pipeline

- Discovery of potentially new sources of resistance
- Development of mapping populations
- Genetic analysis and molecular mapping
- Identification of closely linked markers
- Validation of resistance gene linked markers in diverse genetic backgrounds
- Cloning of resistance genes

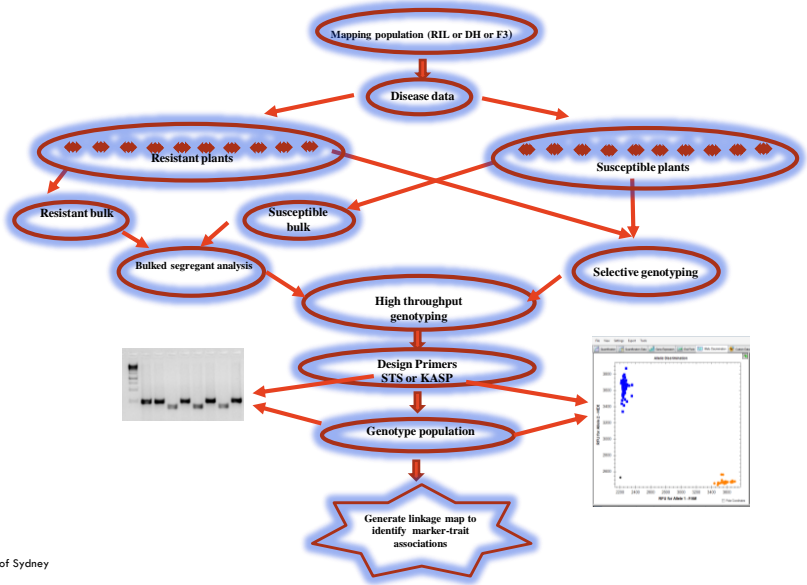
Stripe rust response variation



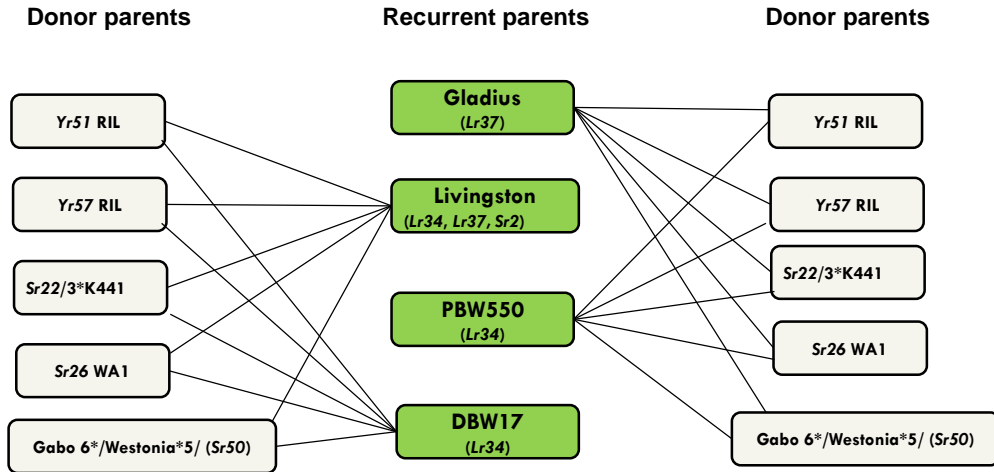
Population development and genetic analysis



Mapping flow chart



Deployment of resistance genes



Thanks

