

**Project #: 126593**

**Progress Report Year:** 2 of 3 years (maximum of 3 year funding cycle)

**Title: Intelligent Prediction and Association Tool to Facilitate Wheat Breeding**

**PI:** Dr. Zhiwu Zhang

**Cooperators:** Dr. Michael Pumphrey, Dr. Arron H. Carter, and Dr. Kimberly Campbell

**Executive summary:** *We had two major accomplishments each corresponding a publication in this year. One was that we developed a golden standard to evaluate accuracy of genomic selection without bias. The results were published in 2016 by Briefings of Bioinformatics. The other was that we developed a software for breeders, iPat (integrated Prediction and Association Tool). iPat has a friendly Graphic User Interface (GUI). The GUI allows breeders to perform data analyses without any programming requirements. The software was written in Java to adapt any third-party software packages in R, including our newly developed packages of FarmCPU and GAPIT for genome-wide association studies and genomic selection. GAPIT serves as one of the iPat engines with two new statistical methods implemented. The new version of GAPIT was also published in 2016 by academic journal, Plant Genome.*

**Impact:** *Implementation of our research findings creates the opportunity to efficiently develop varieties with high yield, high quality, and resistance to biotic and abiotic stress. In short term, breeders have more confidence to eliminate lines with low genetic potentials to reduce the cost of field trials. In long term, breeders have more chances to retain the genetic lines with desirable genes, and recombine them to create superior varieties. In our previous funding cycle, we established pipeline to conduct genomic selection and evaluate prediction accuracy by cross validation. In recent funding cycle, we developed the golden standard for cross validation that allow the evaluation of prediction accuracy without bias. In recent funding cycle, we also developed software with friendly graphic user interface that allow breeders to conduct data analyses without any programming requirements. With this computing tool, breeders are able to access data and variety of statistical models and visualized analytical results and make decisions for molecular breeding.*

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WGC Project title: **Intelligent Prediction and Association Tool to Facilitate Wheat Breeding**

Project PI(s): *Zhiwu Zhang, Michael Pumphrey, Arron H. Carter, and Kimberly Campbell*

Project initiation date: 1-Jul-15

Project year: 2 of 3

<b>Objective</b>	<b>Deliverable</b>	<b>Progress</b>	<b>Timeline</b>	<b>Communication</b>
2) Enhance statistical software usability with a user-friendly graphic interface	IPAT with graphic user interface for wheat breeders	<p>a) We developed a golden standard to evaluate accuracy of genomic selection without bias.</p> <p>b) We developed the new version of GAPIT that implemented two new statistical methods for genomic selection with improved accuracy of prediction. Real data have been analyzed the improvements have been demonstrated through cross validation.</p> <p>c) We developed a new software, iPat, that was written in JAVA with friendly graphic user interface for breeders without any programming requirements.</p>	<p>We have met the timeline of June 30, 2016 to Complete GAPIT package that can be used by researchers for wheat breeding. We developed two new statistical methods for genomic section and integrated them into our existing software (GAPIT). We have also met the timeline of December 31, 2016 for the development of source code on elementary functions in iPat, an integrated Prediction and Association Tool with friendly Graphic User Interface (GUI) for breeders.</p>	<p>a) We published two articles on academic journals. One is Briefings in Bioinformatics and the other is Plant Genome;</p> <p>b) We have one article on Wheat Life to introduce the lead PI;</p> <p>c) We instructed one course and three workshops for training next generation breeders.</p>