BMS Developer Community: The IBP works closely with the Lawrence Lab (Iowa State University) and the iPlant Collaborative under the Genomes to Fields project to improve breeding data management

Mexico, 5 August 2015 – The Genomes to Fields (G2F) Initiative is a collaborative effort to develop advanced maize improvement strategies based on combining phenotypic trait data, environmental observations, and genetic information. G2F seeks to correlate environment, genes, and traits to provide researchers with more predictive power in plant selection than ever before.

Integrated Breeding Platform (IBP) developers have been working closely with the Lawrence Lab at Iowa State University (ISU) for the G2F Initiative since October of 2014 to adapt the IBP Breeding Management System (BMS) to store and make accessible phenotypic and environmental data to support data management needs for the project. The iPlant Collaborative is a third partner, providing virtual machines, image storage, and file sharing so the researchers can compare and correlate data. It is expected that key components of the iPlant Cyberinfrastructure (CI) will be deployed to scores of users in up to 20 locations within the next 2 years. This powerful three-member partnership shows how working together can get a whole team farther, faster.

“What started as a general enquiry in the search for an information management system for maize breeding turned out to be a much more fruitful partnership. IBP engineers have been so responsive and collaborative in customizing features to adapt to our needs. This doesn’t usually happen with service providers, and was incredibly important to us,” says Darwin Campbell, Program Coordinator for the Lawrence Lab at Iowa State University.

From the start, it was also important for G2F to find a solution that could easily be deployed in the iPlant Discovery Environment, since iPlant’s CI would enable their geographically scattered team to work together on the same data. iPlant’s ability to handle visual data for phenotyping was a crucial complement to the strengths of the BMS software suite. The longstanding relationship between iPlant and the IBP therefore made the BMS an even more attractive option, as Associate Professor Carolyn Lawrence-Dill at ISU explains.

“Many researchers on the Genomes to Fields team who were not working on breeding – but on high throughput images, or any number of other aspects of how you measure a phenotype – were using the the iPlant infrastructure already, so we liked the idea of having a breeding management system that was sitting on the same infrastructure,” said Lawrence-Dill. “It would simplify making all the different components interoperable. It turned out the IBP folks were already interacting with iPlant, and people at iPlant were willing to help us to develop and deploy all of this. It’s kind of like the story of stone soup, where everybody had a little something to bring to the table.”

“Genomes to Fields is a natural fit to iPlant infrastructure, because their goal of linking genotypes, phenotypes, and environments is one of the original and ongoing scientific challenges our infrastructure is designed to address,” confirms Ramona Walls, Scientific Analyst at iPlant. “Genomes2Fields can take advantage of existing components like the iPlant Data Store -- with its fine-grained sharing permissions -- and our many analysis platforms. The fact that iPlant was already providing infrastructure for IBP services and software made it easy to incorporate elements of the BMS into Genomes to Fields via iPlant.”

Carolyn’s excitement is palpable as she talks about the future, predicting a revolution in accurate, consistent, high-throughput phenotyping, in which the coupled data-crunching powers of iPlant and the BMS will be key. “We would like for phenotyping to be something that is as cheap and doable and straightforward as genotyping,” she says. “This stage is like the beginning of sequencing – initially it was expensive, and we had to figure out how to do it better and more efficiently. It’s through developing initial systems that we’re going to figure out how best to analyze and manipulate the data. Then we can determine how best to scale up.”

At the IBP, the team has many reasons to be thrilled with the experience as part of this powerful triangle. It provides the IBP with real life scenarios and user cases that test the limits of the BMS, and valuable feedback and direction as the team strives for improved functionality and constant innovation. Collaborations within initiatives like G2F are crucial pilots as the IBP grows its development community, where greater reach and impact can be achieved through partner networks. For the IBP team, it is a great satisfaction to troubleshoot real issues and make real improvements to BMS functionality for users.

Rebecca Berrigan at Leafnode, the IBP’s longstanding partner in development, has spearheaded this effort with ISU and iPlant for the IBP and believes the relationship has already brought about some major positive impacts: “The BMS was originally envisaged to be a single computer application, but has now grown to be a multi-user, web-driven system, capable of data sharing and API integration. The BMS will naturally deploy onto any Web Server, but the installation of the BMS on iPlant’s CI allows us to run on high-powered systems, integrating with large data stores. It also stretches the BMS into the world of high-throughput phenotyping and image processing. We are keen to see the BMS fully utilise all its capabilities in data storage, retrieval and multi-system integration – and the chance to contribute to high quality research at the same time is exciting.”

Although the BMS will continue to be available as a stand-alone application, with the next version (v4.0) it will also be possible to deploy the BMS as a true web application on a local intranet or through a cloud service provider. A number of other important new features are being incorporated in view of this next release, among which:

- a much more powerful and flexible mechanism for managing controlled vocabularies such as trait dictionaries, locations, and trial conditions;
- significant improvements to the seed inventory management system;
- expanded support for popular hand-held data capture applications;
- the ability to import and work with custom nursery and trial designs;
- additional statistical analysis capabilities such as the reporting of summary statistics across environments and the processing of outliers.

Jack Gardiner, a data curator for the Lawrence Lab, is new to using the BMS, but he is happy working with the solution chosen to support G2F. “It looks like the IBP has anticipated a lot of our needs as a group in terms of what traits we want to enter into the BMS and what other kinds of metadata we want to record. So I would say overall my experience has been good, he says. “Within a couple hours of poking around I figured out where almost everything was, so I think that’s pretty good for something as detailed as the BMS. I haven’t seen solutions as comprehensive as this one.”

“This is a true collaboration where everybody gets a win,” concludes Carolyn. “My own group wanted to be able to give our stakeholders in Genomes to Fields a place to put their data and share it; people working at IBP want an example of people that are using their BMS solution so they can show others how to use it; and people at iPlant need something of this ilk to be able to demonstrate that the cyber-infrastructure that they’ve developed is useful to scientists. So we all need each other.”

“Together we will do great things,” agrees Jeremy DeBarry, a Scientific Analyst at iPlant. “Integrating genomics and environmental science to understand crop biology will directly benefit humanity's ability to feed itself. This is the 'sweet spot' where the cyber-infrastructure is being used to facilitate research that will benefit mankind.”

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About the Integrated Breeding Platform

Plant breeders are at the forefront of the next food revolution. The Integrated Breeding Platform (IBP) provides the tools and knowledge they need to rise to a new level of breeding innovation, primarily in developing countries. It offers a suite of integrated software solutions (the IBP Breeding Management System); several breeding services such as genotyping; and breeding materials and related information for a broad range of crops, including germplasm, trait dictionaries and predictive markers. Furthermore, the IBP empowers plant breeders through training, funding opportunities, dedicated support and community spaces, making it the most comprehensive source for best practices in plant breeding. Register today: www.integratedbreeding.net.

About Genomes to Fields

G2F is an umbrella initiative to support translation of maize genomic information for the benefit of growers, consumers and society. This public-private partnership is building on publicly funded corn genome sequencing projects to develop approaches to understand the functions of corn genes and specific alleles across environments. Ultimately this information will be used to enable to accurate prediction of the phenotypes of corn plants in diverse environments.

About iPlant Collaborative

The iPlant Collaborative designs, develops, deploys and maintains a national Cyberinfrastructure to enable basic and applied Life Sciences research and to train the next generation of scientists in its use. iPlant democratises access to world-class compute resources, encouraging innovation through collaboration and federation, and fostering growth of the scientific community's computational abilities.

For more information

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