

Name Aida Kebede
Subject Title Applying genomics resources to oat genetic improvement
Theme number III - transformational technologies and innovation under advanced breeding tools/genetic and genomic technologies
Host institution IBERS, Aberystwyth University, Aberystwyth, UK
Host Collaborator Tim Langdon
Fellowship dates May 1st – Aug. 21st, 2019

I consent for my report to be posted on the Co-operative Research Program's website.

1. What were the objectives of the research project? Why is the research project important?

The main objective of the research project was to utilize the recently available oat genome assembly and exome capture for cataloguing genes involved in trait expression and develop gene-based markers.

Specific objectives were to (i) anchor SNP markers linked to economically important genes to the oat reference genome assembly, (ii) identify candidate genes for high beta glucan content and (iii) identify candidate genes for oat crown and stem rust resistance genes. This research project is important because it is one of the first attempts to use the oat genome assembly to fill the gene space associated with economically important traits.

2. Were the objectives of the fellowship achieved?

The objectives of the fellowship were >90% achieved. We are currently validating the candidate gene-based markers identified during the fellowship on the mapping population for confirmation.

3. What were the major achievements of the fellowship? (up to three)

The major achievements were:

- The SNP markers that were linked with high beta glucan content, oat crown rust resistance (*Pc45*, *Pc68*, *Pc91*, and *Pc94*) and stem rust resistance (*Pg2*, *Pg12*, and *Pg13*) were successfully anchored on the oat reference genome assembly (scaffolds) of *Avena byzantina*.
- The scaffolds identified based on the trait-associated-SNPs were further characterized using NCBI blast to predict their protein domains and gene functions. Three candidate genes for high beta glucan content, cellulose synthase like F6 (*CslF6*), were discovered. Candidate genes for oat crown and stem rust resistance (clusters of genes related with NBS-LRR domain protein) were identified.
- KASP assay for the SNP markers identified within candidate genes were developed and being tested on the original mapping populations where the QTLs were discovered.

4. Will there be any follow-up work?

There will be follow-up work on testing the newly discovered candidate gene-based SNPs. The SNPs will be tested on diverse oat lines for their effectiveness as diagnostic markers in marker assisted breeding work. There is interest to further study the resistance genes. A collaborative research among IBERS, MRDC and a few other research institutions is underway to use resistance gene enrichment sequencing (RenSeq) to annotate the NB-LRR gene family from sequenced oat genomes which will speedup the identification of candidate resistance genes.

- Is a publication envisaged? Will this be in a journal or a publication? When will it appear?

There is one paper under preparation for journal publication. The paper will be on mapping QTLs for high beta glucan content and will include results obtained during the fellowship. There will also be a second paper to be written about the candidate crown and stem resistance genes.

- Is your fellowship likely to be the start of collaboration between your home institution and your host?

My fellowship was key to start more collaborative research work between my home institution (MRDC) and my host (IBERS).

- Is your research likely to result in protected intellectual property, novel products or processes?

There will not be any protected intellectual property developed from my research. All new findings of the results will be available through journal paper publications, newsletters and oat news website (<https://oatnews.org/>).

5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

The results of the research project will improve efficiency in oat breeding programs, resulting in increased and more stable production of higher quality oat grain. It will reduce agricultural productivity constraints such as issues related with food security, nutrition and health. There will be reduced stresses on natural capital including soil and water through less fungicide use. It supports green growth and better economic returns to farmers by increasing productivity and reducing production losses from disease.

6. How was this research relevant to:

- The objectives of the CRP?

Sustainable use of natural resources in agriculture and policies that support them could be enabled by scientific advances. Facilitating these scientific advances is one of the main objectives of the CRP. The current research undertaken utilized the most advanced genomic resources available for oat (*Avena byzantina* genome assembly, RNAseq and exome capture) to discover genes that are responsible for economically important traits.

- The CRP research theme?

The research falls under the CRP theme III - transformational technologies and innovation under advanced breeding tools/genetic and genomic technologies. One of the first oat genome assembly was used to predict candidate genes for high beta glucan content (water soluble fiber with health benefits) and resistance to crown and stem rust diseases.

7. Satisfaction

- Did your fellowship conform to your expectations?

Yes, the fellowship conformed to my expectations and I am really satisfied with the research that I have undertaken in the host institution. My mission was accomplished successfully.

- Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.

The OECD Co-operative Research Programme fellowship would give me an advantage when applying for a permanent position within the same institution I am currently working. I am a term research scientist at MRDC, AAFC. The scientific experience and opportunity for continued international collaborative research I bring with this fellowship would significantly impact my job prospect.

- Did you encounter any practical problems?

No, I did not encounter any practical problems during my fellowship.

- Please suggest any improvements in the Fellowship Programme.

The fellowship programme is excellent. Please keep up the good work.

8. Advertising the Co-operative Research Programme

- How did you learn about the Co-operative Research Programme?

I learned about the Co-operative Research Programme through a call for application sent to all staff by my institution.

- What would you suggest to make it more “visible”?

The host and fellowship recipient institutions could advertise this program and past fellow recipients’ achievements in their social media websites such as institutions local newsletters, twitter, facebook, linkedin, etc.

- Are there any issues you would like to record?

I have no issues to record. Thanks very much for giving me the opportunity.