2014 Large-Scale Applied Research Project Competition
Genomics and Feeding the Future

Summary of Review

Project Leader(s): Riesebeg, Loren and Burke, John
Project Title: Genomics of Abiotic Stress Resistance in Wild and Cultivated Sunflowers

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A.   RESEARCH PROPOSAL, INCLUDING RESEARCH ON (GE³LS)

Strengths:
The aims of this proposal, to identify and characterize the basis of stress resistance traits in sunflower and to develop new stress resistant varieties exploiting wild germplasm, were enthusiastically received. Sunflower was accepted as an excellent model, especially based on the variation of phenotypes with respect to abiotic stresses that were presented. It was seen as a proposal that exploits genomic technologies well in an applied project with clear deliverables and a reasonable path to realization. While some issues remained insufficiently clear in the written proposal, the panel discussion was pleasantly open and helped in clarification.
The panel of reviewers particularly liked the proposed WGS of wild germplasm and the long-term investment of creating a MAGIC population, which was well designed and supported by breeders.
The modeling approach in activity 5 was seen as valuable with the opportunity to generate interactions with other activities through gathering important input data for the models.

Weaknesses:
Activity 4, functional analyses of candidate genes, was not presented strongly in the written proposal or the discussion. However, since this is an important activity that begins in the later stage of the grant, the panel assumes that appropriate approaches will be selected based on the best available methods at that time. Today, it is not clear that allele replacement using the CRISPR system will work well.
Main deliverable 2, a central data mining and analysis resource for sunflower, was seen as a necessary component, and the investigators have not made it sufficiently clear how this will be accomplished, especially as the role of SAP for a long-term publicly accessible portal does not seem to be secured. However, the team convinced the panel in the discussion that alternatives can be put into place. Since the team sees this as a necessary deliverable, it is assumed that delivery of a product, possibly at a reduced level of functionality, can be guaranteed.
The integration of the GE3LS activities 5 and 6 with the rest of the project was seen as weak. It was not clear how any of the GE3LS activities would actually feed into, or be

informed by the research activities. Especially the relevance of activity 6 when dealing with SMTAs was not acknowledged by the other team members, although the reviewers assume that many of the lines, especially extremophiles, utilized in this project will be under an SMTA.

Summary Statement:
This is a strong proposal with a mostly excellent research plan. Several weaknesses were identified but can be addressed during the project, e.g. the reviewers do see opportunities for interactions with the GE3LS activities. The project is very well aligned with the Genome Canada call and makes excellent use of genomics technologies integrated with the generation of important long-term breeding resources.

B.   SOCIAL AND/OR ECONOMIC BENEFITS

Strengths:
The reviewers were satisfied that this project will most likely meet its deliverables. These will include important resources for sunflower breeding, and through excellent networking with end users, the plan for realization of these benefits is highly promising. The germplasm that will be generated by this project is noteworthy.

Weaknesses:
As there is not a clear plan for the deliverable "central data mining and analysis resource", the impact of this deliverable could range from minimal compared to existing resources, to translational, setting an example for other crops.
There is not a strong case for the impact the GE3LS research will have, both on the project and for realization of the benefits. However, the reviewers found the GE3LS activities worthwhile, and expect that efforts will be made so that results can be applied both within the project and for realization of its benefits. Here, guidance on working with SMTAs could make quite a difference to the acceptance of germplasm resources created in the project, an opportunity which could have been stated more clearly, whereas the possibility of influencing treaties was not seen as promising by the reviewers.

Summary Statement:
This project clearly has important outcomes for sunflower breeding, and given the relevance of sunflower to the Canadian economy and the broader importance of addressing abiotic stresses (food safety and climate change), the reviewers were convinced that important advances can be made by this project that will benefit society as well as the Canadian economy. The excellent integration of end users convince the reviewers that benefits will be realized.

C. MANAGEMENT AND FINANCE

Strengths:
The management plan and budget are adequate and clear. The team gives the impression of working well together. Especially the openness in which risky or unclear parts of the research plan were discussed convinced the reviewers that critical review of plans, risk mitigation and joint resolution of problems will be tackled well by this team.

Weaknesses:
The cooperation with SAP for important parts of the work including the deliverable 2 "central data mining and analysis resource" is risky, especially as the work is not clearly laid out. The amount of cofunding specified is appropriate but not well justified, as compute power alone would not justify these costs. It is assumed that know-how, licenses and engineer time, or whatever is required for the task, are covered as well. This said, the cooperation with SAP also promises important gains in computability for the complex datasets in this project. Additionally, in the discussion the team gave the impression that they would still be able to perform the project even if SAP dropped out, though maybe with reduced functionality. The limitation to one year is acceptable for a company contribution, and an extension seems probable.

Summary Statement:
Overall this is a solid plan, and the risks of cooperating with SAP are well balanced with the enhanced functionality provided.

D. BUDGET - DUE DILIGENCE

No issues requiring follow-up by Genome Canada were raised.

SUMMARY STATEMENT:
This is a creative and well-considered project that was discussed intensely and openly. Sunflower is an excellent model for studying abiotic stresses, and this project applies both genomic tools and long-term breeding strategies to provide important inputs to breeding programs. It combines large-scale phenotyping and genotyping with population genomics analyses that expand the state of the art. There is a high potential of agronomic benefits and, given the expertise and experience of the investigators, a high probability of achieving deliverables. Weaknesses in the project plan include a lack of integration of the GE3LS activities. The reviewers expect that shortcomings of the work plan will easily be overcome by the strong team.