POPLAR COUNCIL OF CANADA/CONSEIL DU PEUPLIER DU CANADA

GENOMICS TO PRODUCTION (G2P) WORKSHOP
Edmonton, Alberta, April 7-8, 2005

EXECUTIVE SUMMARY

Concern about the need to build bridges between players in poplar genomics and poplar breeders and growers in order to realize the full potential of recent developments in poplar genomics led to the Genomics to Production (G2P) workshop being convened by the Poplar Council of Canada (PCC) in early April 2005. Participation in the Edmonton workshop was by invitation and included 30 people from industry, government and academia. The event was organized by Brian Ellis of UBC, Barb Thomas of Genstat Consulting and John Doornbos, Chair of PCC. The objectives were to understand the potential deliverables and limitations of having the poplar genome sequence available; to understand the commercial needs and challenges in poplar utilization today; to develop a strategy for bringing these genome-associated products and tools into operational use; to develop a list of contacts across disciplines and sectors; and to develop a glossary of terminology for poplar genomics, genetics and utilization.

The first day of the workshop was intended to present a sample of broad-ranging information, from poplar genomics to poplar production, and in so doing lay the foundation for the more in-depth discussion of the second day. Presentations dealt with the Canadian poplar resource, in terms of what is out there in the wild, what breeders are presently working with, and how we use poplar today and might use it in the future. Possible future constraints, related to both policy and operations, were considered. The tools of genomics were elaborated, including resources needed by genomics scientists to address operational needs, an outline of what a genome is and how the poplar genome sequence was built, as well as explanations of related tools such as microarrays and molecular markers. Utilization of genomics tools in tree improvement was also addressed. A draft glossary of genomics and tree breeding terminology was presented.

The second day started with a discussion of how to make use of the poplar genomic resources to better understand poplar biology and whole-tree studies. The general conclusion was that communications and resources were the basic problems. In relation to communications, perhaps the greatest need was for the genomics community to understand production issues. Related to that, allocation of funds to different aspects of poplar biology needs to be reviewed. There was debate as to whether there was a shortage of breeders (since no-one was training them any more) or whether there were indeed sufficient breeders globally but they had insufficient funds. If the latter is the case, it points to the need for genomics workers who had lots of funds to join up with breeders. We need to look ahead 20 years to see the results of silviculture. Information available on the PCC website on poplar research needs was seen as useful.

Potential solutions to some of these problems were identified and debated, including a case-study approach, development of a Canadian poplar consortium in which PCC might be involved, an industry survey of needs and problems, better communications – another area in which PCC could take a lead role – and more effective lobbying for a positive policy and incentive environment. Long-term commitment and a long-term relationship were felt to be critical.

The question of how to make use of the poplar genomic resources to build or breed a better poplar led to the identification of a list of desired traits in a better poplar. The list included resistance to insects and diseases, cold tolerance, drought tolerance, phenological traits such as bud-set, volume production, density, fibre properties, rootability and control of flowering. It was suggested that fast growth is essential and for growers is perhaps the first priority. The genetic toolbox available to work on these traits included markers (EST, AFLP, microarrays, SNP, association mapping, etc.), TILLING, activation tagging and genetic modifications. Transgenic poplars could be a powerful tool to test models and validate assumptions. New tools were needed for breeding future stock, as well as for improving and selecting current standing stock.

Development of a proof of concept that genomics can help was felt to be a useful approach. The ability to make early selection was critical.

The simplest problem – assessing hybrid status in poplar material – would require finding unique DNA sequences for species and hybrids and developing probes to identify those sequences. This would be quite easy to do in perhaps one year. When the biological outcome forms a continuum, e.g. *Septoria* resistance, analogous genomic approaches could be used. Genetic resources might need to be increased, with lots of lines with similar genetic backgrounds, to permit comparisons enabling genomic tools to identify differences. Genomics workers would need to work with field people as a team to develop and screen material. Genomics resources could also be useful to work on issues like the rootability problem, but could be of most help in understanding the basic functions underlying root induction.

The GENADAP (GENomics of ADAPtation in Poplar) proposal, aimed at identifying genes responsible for a wide variety of traits, including *Septoria*- and *Melampsora* resistance, pest resistance, water use efficiency, cold and drought resistance, and nutrient use efficiency, involved bringing genetic resources together under a common umbrella, and providing a pipeline to analytical resources and 'recipes' for analysis of individual traits. It was correlated with useful programs and tools for deploying well-adapted genes and included a socio-economic component. There would be a scientific advisory board for the project, as well as an end-user advisory board to keep the project on track with regard to operational goals. [The proposal was not selected for funding in the competition results announced in July 2005.]

Capacity building and understanding the 'other culture' were discussed as primary challenges to government, industry and academia working effectively together to extract maximum value from the new genomics resources. Useful solutions were seen to include co-op programs which brought students into industry, 'shadowing' programs providing reciprocal exchanges between genomics labs and field operations, and networks such as 'Réseau Ligniculture Québec'. Some kind of 'dating board', perhaps hosted by the PCC, could help establish networks. At the operational end, nurseries needed to know what would be expected of them. In terms of practical steps, early communication was important to provide lead-time on projects and allow development of the necessary prior knowledge. One basic problem is that the university research culture is very different from the industrial research culture.

In consideration of next steps, it was noted that a 'Plant Canada' meeting would be held in Edmonton June 15-18, 2005. Brian Ellis agreed to take the PCC-developed poplar research priority list to that meeting and encourage involvement from that community.

There was general agreement that there should be a follow-up gathering, perhaps in conjunction with the PCC annual meeting August 22-27 in Prince Albert, Saskatchewan. A summary report of the present workshop was to be prepared, and presentations made during the workshop were to be circulated on CD or via FTP. It was suggested that the Genetics and Breeding Working Group of PCC might be the logical body to foster cooperation between genomics people, breeders and operational people, and this might be supported by remaining Genome Canada funds. The same Working Group might have an added genomics dimension as a means of providing a continuing identity for the present G2P workshop group. This could form the nucleus of a Canadian poplar consortium. Other PCC roles could include implementing a 'dating service' on the website on a trial basis to post priority topics for research and invite researchers to sign up with expressions of interest. PCC could become a clearing house for information.

Malcolm Campbell offered to set up a 'dating service' (though under a different name), possibly funded by Genome Canada and with PCC as the possible communications vehicle. Plans were made to match a revised research priorities list against the GENADAP list. It was felt that there would be plenty of work whether GENADAP was funded or not. Some items on the research list could be tackled immediately, but others such as disease resistance and drought- and cold-tolerance might take longer and so not be amenable to funding via the NSERC Strategic Grant route.

[With the subsequent lack of funding for GENADAP, some of the momentum for follow-up activities was lost and not all of the next steps have been taken to date.]

ACKNOWLEDGEMENTS

Sincere appreciation must be expressed to the ad-hoc organizing group of John Doornbos, Brian Ellis and Barb Thomas who worked long and hard to create a workshop format that would maximize the opportunities for exchange and interaction between the sectors involved, and to bring together a group of individuals who truly represented the full spectrum from poplar genomics to poplar production, and who were willing to listen, learn, interact and try to move forward. The same trio, along with Annie DesRochers and Shawn Mansfield, also provided leadership and facilitation at different times during the discussions. Thanks are due to Sandra Williams, Executive Secretary of PCC, for administrative support for the workshop and for transcribing 'in real time' flipchart notes created during discussion. Finally, the organizers and participants and the Canadian poplar community in general are indebted to Genome Canada and to the Forest 2020 Program of the Canadian Forest Service, Natural Resources Canada for their generous financial support and encouragement which made the workshop possible.

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