


**Brassica Genomics Initiatives Update**

Canadian Brassica Genomics Network Session

**Faouzi Bekkaoui 10 Dec 09**



**Brassica genomics initiatives  
update outline**

1. Why Brassica genomics?
2. Genome sequencing technology
3. CanSeq project update
4. Update on other initiatives
5. Future initiatives

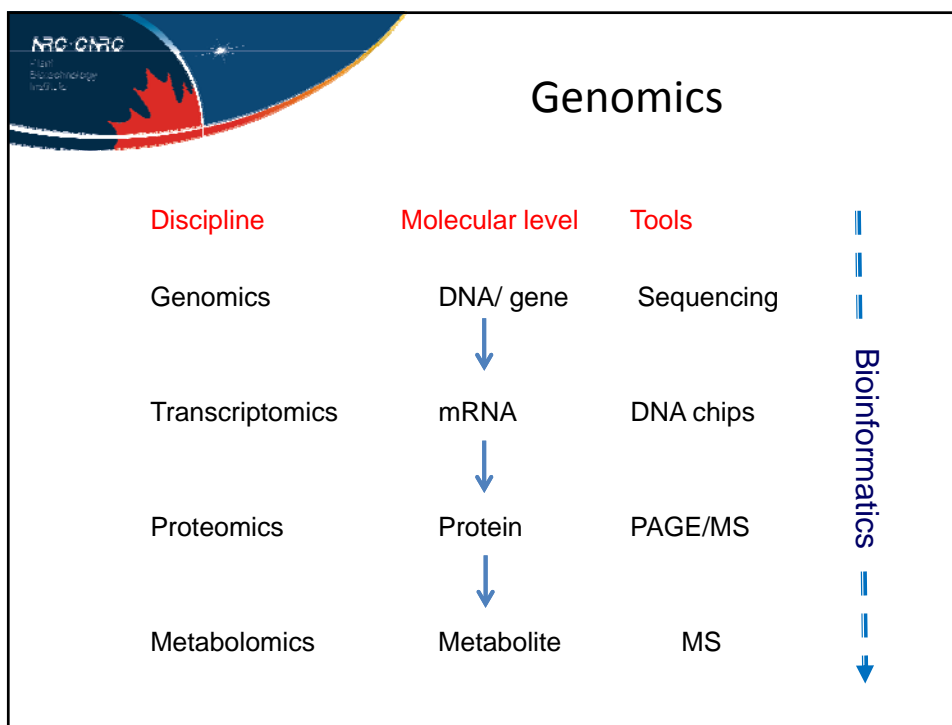
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## Why Brassica genome sequencing?

A foundational resource for Brassica crop species:

- Identify 'novel' genes
- Understand complex agronomic traits
- High value transgenic lines
- Development of DNA markers for accelerated breeding and enhanced trait development
- Establish a basis for novel mutation (TILLING)








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## Canadian Canola Sequencing Initiative - CanSeq -

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## *B. rapa* sequencing project – NRC-AAFC collaboration

Multinational Brassica Genome Project (MBGP)  
The Brassica 'A' genome : Multinational *B. rapa* Sequencing Project (MBrSP)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
									
									

## Brassica Genome Sequencing International Initiatives

- B. rapa Genome Sequencing Project (BrGSP)
- China Initiative
- France Initiative
- Bayer Initiative

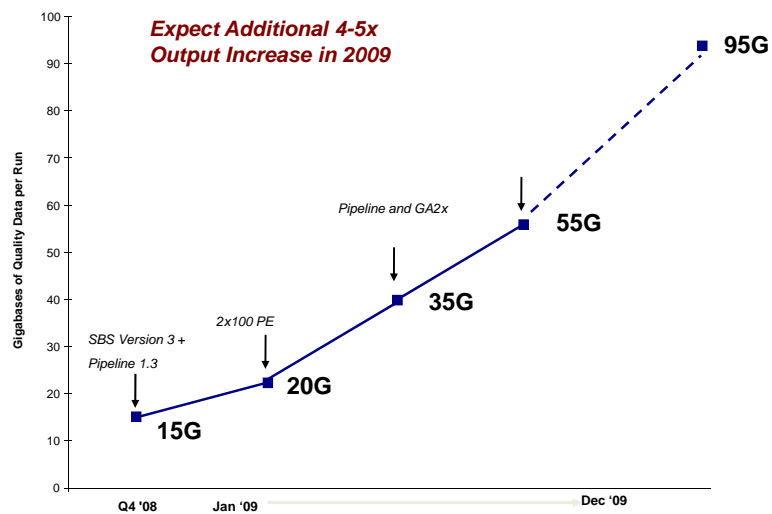
## DNA Sequencing Technologies

- **Sanger / Capillary**
  - gold standard, long reads (1kb), ABI3730xl
- **Next Generation Sequencing (NGS)**
  - Sequencing by Synthesis / Ligation
- **Third Generation Sequencing**
  - Single molecule sequencing

## Costs of genome sequencing

- 2000 1<sup>st</sup> draft human genome \$3B
- 2003 finished draft \$3M
- 2007 C Venter / J Watson \$350,000
- 2008 Illumina / ABI \$50,000
- 2009 Complete Genomics \$5,000
- 2010-11? \$1,000

## Performance changes





## Progress in DNA sequencing

- Miniaturization
- Improvement in chemistry
- Computation/Bioinformatics
- Significant research resources
- Competition/Race

## De novo vs. re-sequencing

- De novo
  - Size
  - Complexity of genome (repeats)
- Re-sequencing





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### CanSeq revised objectives

- Complete the genome of *B. rapa* in collaboration with the International community (China, UK, Korea, Australia, US and France).
- Re-sequence an oilseed *B. rapa* genome using the Illumina platform.
- Develop a whole genome shot-gun of the *B. oleracea* genome in collaboration with the US, France and the UK.
- Generate a draft sequence of *B. napus* – using *B. rapa* and *B. oleracea* as reference sequences.
- Re-sequencing of 16 *B. napus* lines selected by the project partners.
- Initiate sequencing of additional B genome Brassica species.

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### CanSeq Accomplishments (1)

- 166 *B. rapa* BAC clones sequenced, 59 submitted to GenBank
- BAC sequencing to validate *B. rapa* (vegetable type Chiifu) sequencing as part of the international effort
- Approximately 16X DNA sequencing coverage has been completed for the *B. rapa* oilseed line

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## CanSeq Accomplishments (2)

- Approximately 7X DNA sequencing coverage of *B. oleracea* has been accomplished in collaboration with other institutions (USA, UK and France)
- Sequencing in Canadian spring *B. napus* line has begun
- Sequencing in *B. nigra* (B genome) has begun

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## Project Data Release


- ***B. rapa*, *B. oleracea*, *B. nigra* data**  
- released to public domain
- ***B. napus* data**  
- project partners discretion to release
- **Project Website**  
- [canseq.ca](http://canseq.ca)

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## Example Brassica genomics project accomplishment

**Genome Canada, Genome Prairie/Alberta  
Federal Genomics Initiatives (GHI/NRC, CGI/AAFC)**  
=> Development of ESTs, 450K in GenBank

- Microarrays: study of gene expression
- Genome Sequencing: Genome assembly
- Gene Discovery

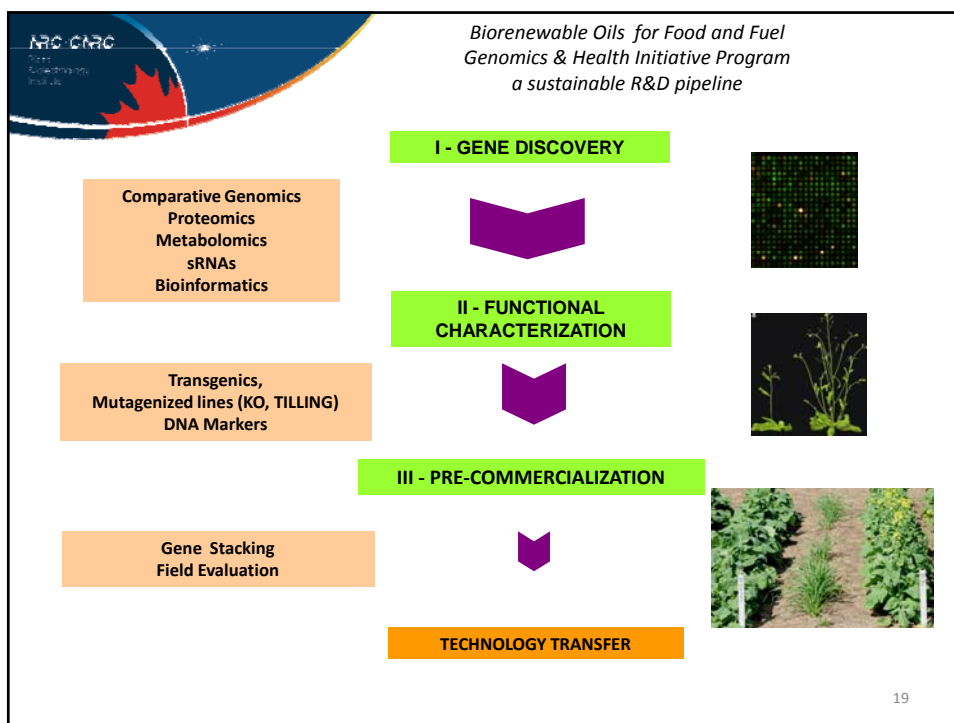


*Bio-renewable Oils for Food  
and Fuel*

Goal: Applications of genomics-based approaches to enhance the productivity of canola by increasing oil content, seed yield and seedling vigour.


4 Institutes (PBI, IIT, BRI and AAFC)  
17 PIs, 42 FTEs

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NRC GRAC  
Genomics  
Research  
Initiative

**Performance associated genes  
conferring higher seed size**



WT                      35S::SF                      WT    35S::SF

*Datla et al*                      21

Genomics R&D Initiative

**Proposed Model**

Current GRDI

NRC
AAFC
HC
NRCan
EC
DFO

Renewed GRDI\*

1	2	3	NRC
			AAFC
			HC
			NRCan
			EC
			DFO
			PHAC
CFIA			

shared Canadian research priorities

common functions

\* the illustrated size of the three components may not reflect final funding proportions

Canada

## Conclusions

- Genomics research long term,
  - investment has to be continuous
  - Impact is gradual
- Progress in the technology tremendous
- Collaborations are key to success



## *Acknowledgments*

- CanSeq NRC-AAFC, Genome Alberta and 8 Industrial partners
- Genomics and Health Initiative program
- National and International collaborators
- Genome Canada / Alberta / Prairie
- Saskatchewan Province