

# TREE TIPS

Partenariat pour  
la recherche  
forestière FORESTRY  
Research  
Partnership



## Technical Notes

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### Realized Gain Trials Forestry Research Partnership Project No. 130-406

#### The Aim

##### Background Information for Realized Gain Trials

Tree breeders use the term 'genetic gain' to refer to the average improvement in the reforestation stock resulting from parents selected for superior performance. These gain estimates are based on individual tree performance under experimental conditions.

However, the value of a tree improvement program is ultimately determined by the financial return on the investment. So, some evaluation of genetic gains under operational conditions is important for maintaining a corporate commitment to continuing breeding programs.

Realized gain trials are test plantings that are designed to provide qualitative and/or quantitative evidence of operational. While such tests are conceptually straight forward, most breeding programs around the world have not implemented a robust suite of realized gain trials for a number of reasons, including:

- A large number of environmental factors influence stand development.
- The addition of alternative silvicultural treatments adds to the complexity of the trails.
- Large plots (gain vs. controls) are required for precise estimates of operational gains.
- Relatively small levels of genetic gain require a large number of plots to detect statistically significant differences.
- Final results are not available until stands are harvested and data retrieval can be expensive. Such retrospective results are at least one generation behind the breeding program and do not support cost-benefit analysis for predicting benefits from continued investments.
- Even a small number of plots can deplete limited financial resources that would otherwise be used for the breeding program

The challenge for Ontario's tree improvement program is to design and implement an approach to realized gain trials that is both cost effective and provides sufficient empirical evidence of improved early plantation performance to validate the effectiveness of tree breeding programs. Realized gain trials must also support the evaluation silvicultural treatments and stand development at ages typically monitored by the growth and yield program.

Such empirical evidence should include:

- A simple demonstration showing that improved reforestation stock grows more quickly than unimproved stock. Such visual validation is essential to build and maintain corporate support for continuing breeding programs.
- Small-scale yield plots that support quantitative estimates of realized gain in younger operational stands (< 20 years).
- Large-scale yield trials to test both genetic gain and silvicultural effectiveness, and that can be converted into permanent sample plots at later ages.

With the above thoughts in mind, the Forestry Research Partnership undertook the following set of trials.

## The Approach

In October 2005, a site was selected on Tembec's Martel Forest in Chapleau District. The area was site prepared and the trials were planted in May, 2006.



Figure 1.0: Seed orchard stock from kapuskasing

This project used three levels of genetic gain (high – control-pollinated “elite” families, medium – open-pollinated seed orchard stock, and low – bulked- stand wild seed) in four trials – outlined below.

The four trials are as follows:

### **Trial #1: Black Spruce Family Demonstration Planting**

Row plots planted along the edge of the road to demonstrate visual differences height growth among three genetic levels of stock a) multiple controlled-cross “elite” families, b) open-pollinated seed orchard stock, and c) bulked stand seed lots. The demonstration also supports visual comparisons among a number “elite” families.

### **Trial # 2: Clonal Evaluation Trial**

The operational use of rooted cutting of “elite” black spruce families offers immense potential for capturing high levels of genetic gain. However, some demonstration of the superior performance of rooted cuttings under operational conditions is required to build corporate support. The clonal evaluation trial is evaluating variation in performance at three levels; a) among “elite” families; b) among clones within families, and c) between first and second cycle rooted cuttings.

### **Trial #3: Pure Family vs. Mixed Family Deployment**

There is some reason to expect that the use of single families in block planting can lead to more uniform stands. The pure vs. mixed family realized gain trial is evaluating the relative performance of “elite” families under alternative block plantings. The use of root cuttings improves the ability of the planting to evaluate the significance of differences in performance.

### **Trial #4: Estimating Area-Based Genetic Gain**

The balance of the area was planted with the three stock types in identified blocks large enough to contain a minimum of three 20 m. permanent sample plots.

### **Future Follow-up**

The entire area was herbicide released in August 2007, and is scheduled for another release in August 2009.

Measurements of the trials will be taken after the growing season of 2010, and the required permanent sample plots will be installed.