Introduction

- Canada is the world’s largest producer of flaxseed (average >700,000 tonnes/annum 2000-2010), most of it is produced in Saskatchewan (SK).
- Flaxseed is rich in oil and alpha-linolenic acid (ALA), a polyunsaturated n=3 (omega-3) fatty acid.
- In Canada, oilseed flax (Linum usitatissimum L.) takes 90-125 days to reach maturity.
- SK has a short growing season, 105-135 frost-free days annually. Frost and freezing that occurs during the early fall will reduce crop quality and yield.
- Earlier crop maturity can prevent damage from early fall frost to the flax crop.
- 5-azacytidine (5-azaC) is a chemical that hypomethylates DNA. It induced early flowering and reduced plant height in flax cultivar “Royal”. Three 5-azaC treated epi-mutant lines RE1, RE2 and RE3 were derived. They flowered 7-13 days earlier than the original material “Royal”.

Objectives

- Study the effect of 5-azaC on oilseed flax flowering time and height.
- Develop early flowering lines suited for short growing season in the Canadian prairies.

Methods

Original Germplasm

<table>
<thead>
<tr>
<th>CDC line</th>
<th>CDC Sorrel</th>
</tr>
</thead>
</table>

| Mutant Royal lines | Royal (M0), RE1, RE2, RE3 |

Population I: Mutant Population

- M0, CDC Sorrel treated with 5-azaC (2011)
- M1 derived from 5-azaC treatment grown in growth chamber (2011)
- M2 rows grown at high latitude field conditions in a MAD design (2012), 100 earliest individuals selected to be M3 (2013)
- M3 lines grown at high latitude in the field in a MAD design (2013), 100 earliest individuals selected to be M4 (2014)

Population II: Crossing Population

- Reciprocal crosses between: CDC Sorrel and Royal; CDC Sorrel and 5-azaC treated mutant Royal M2 lines (RE1, RE2 and RE3) (2011)
- F1 plants grown in the growth chamber (2011)
- F2 rows grown at high latitude in the field in a MAD design, 25 earliest individuals from each row selected to be F3 (2012)
- F3 lines grown at high latitude in the field in a MAD design (2013), 3 earliest individuals from each line selected to be F4 (2014)

Results

Population I: Mutant Population

Population II: Crossing Population

Conclusions & Future Work

- Variations in DTF and plant height were observed under field conditions in both populations. F2 rows presented intermediate phenotypes while selected F3 lines showed intermediate or transgressive phenotypes compared to parental lines (CDC Sorrel and Royal mutant lines).
- 5-azaC increased variability in DTF and plant height which indicates that 5-azaC treatment could induce early flowering in flax.
- Earliest lines were selected from both populations to be advanced in the next year’s field tests.
- Future work includes advancement and selection of M4 and F4 and mutagenesis of other CDC oilseed flax varieties.
- Other investigations underway include: characterization of the Royal epimutants under controlled short and long day environments; flowering time gene expression studies comparing early flowering 5-azaC treated with untreated flax lines.

Acknowledgements

References