North Central Region Canola Research, FY 2011-2012

Development of new canola germplasm for increased oil per acre adapted in the North Central Region

Annual Report 2011-2012

The major objective of the NDSU Canola Breeding Program is to develop high oil per acre germplasm adapted to North Central Region especially in North Dakota. A breeding program was taken to develop spring type canola lines with high seed yield and high oil content i.e. high oil per acre for food and/or biodiesel production.

Greenhouse activities (2011-2012):

Roundup Ready germplasm development: A total of 10 high seed yield and high oil content roundup ready canola lines were selected from 2011 summer canola testing program conducted at Prosper, Carrington, Langdon, Minot, Drake, Williston, and Hettinger. The selected lines were crossed with each other in the greenhouse to get genetic recombination to pyramid the desired genes for high seed yield and higher oil content. Eight F_1 plants per cross were self-pollinated using micro-perforated selfing bags to produce sufficient F_2 seeds for 2012 summer nursery testing program.

Conventional line development:

Crossing between winter and spring parents: Publicly available spring type and winter type germplasm were collected from USDA-ARS National Center for Genetic Resources Preservation, Kansas State University, and University of Alberta. Crosses and reciprocal crosses were made among the spring type parents selected from 2011 summer testing program, and winter types lines screened in the greenhouse. Vernalization in the vernalization chamber was required for the winter type plants to get flowering in the greenhouse. The winter type plants were grown in the greenhouse for four weeks followed by five weeks vernalization in the vernalization chamber. The winter type parents flowered 3-4 weeks later after taking out the plants from the vernalization chamber. Therefore, 12-13 weeks were required to get flowering from the winter type parent, whereas about 6 weeks were required for the spring type parents. Flowering time was synchronized at the similar time by planting in different time in the greenhouse. Crosses and reciprocal crosses were made among the six winter type parents and six spring type parents. The F_1 and the reciprocal F_1 did not require vernalization for flowering in the greenhouse. Eight F_1 plants per cross were self-pollinated using micro-perforated selfing bags to produce sufficient F_2 seeds for 2012 summer nursery testing program.

Crossing among spring parents: The selected six spring type parents were used for diallel crossing. Eight F_1 plants per cross were self-pollinated using micro-perforated selfing bags to produce sufficient F_2 seeds for 2012 summer nursery testing program.

Field activities (2012):

Roundup Ready germplasm: A total of 100 F_2 RR families were planted in Canola Breeding Nursery at Prosper to advance into F_3 families. 150-200 plants per family were grown in single row basis. Individual plants per family were evaluated for early vigor, plant height, days to flowering, pod setting, lodging, disease scoring, days to maturity, seed yield/plant, and seed oil content. A total 100 F_3 families were selected from the best families and have sent to winter nursery facilities in Chile for 2013 summer canola breeding program at multiple locations.

Conventional line: A total of 650 F_2 families from winter x spring crosses, and spring x spring crosses were planted in Canola Breeding Nursery at Prosper to advance into F_3 families. 150-200 plants per family were grown in single row basis. Individual plants per family were evaluated for early vigor, plant height, days to flowering, pod setting, lodging, disease scoring, days to maturity, seed yield/plant, and seed oil content. A total of 350 F_3 families were selected from the best families and have sent to winter nursery facilities in Chile for 2013 summer canola breeding program at multiple locations.

Two conventional crossing populations between winter x spring type crosses were used for molecular analysis. DNA was extracted from winter parent, spring parent, the F_1 and the F_2 segregating populations. Development of molecular markers for seed oil and seed yield is in progress.

Published articles (in peer-reviewed journal):

Rahman, M., and McClean P.E. (2012) Genetic analysis on flowering time and root system in *Brassica napus* L. Crop Sci. 53:141–147 (doi: 10.2135/cropsci2012.02.0095).

Abstract/proceeding publications (international)

Mukhlesur Rahman (2012). Understanding the Root System in *Brassica napus*. An abstract for 6th International Symposium on Brassica and 18th Crucifer Genetics Workshop during November 12-16, 2012 at Catania, Italy.

Mukhlesur Rahman (2012). Independent Assortment of Seed Color and Leaf Hairiness Genes in *Brassica rapa* L. Proceedings of 2012 International Annual Meetings organized by ASA-CSSA-SSSA at Cincinnati, Ohio, USA from Oct 20-Oct 25, 2012.

Mukhlesur Rahman (2011). Winter Canola Is the Potential Source of the Development of High Seed Yield Spring Canola. Proceedings of 2011 International Annual Meetings organized by ASA-CSSA-SSSA at San Antonio, TX, USA from Oct 16-19, 2011.

Mukhlesur Rahman (2011). Winter canola is a potential source to develop high performance spring canola germplasm. An abstract for Association for the Advancement of Industrial Crops 23 Annual Meetings, September 11-14, 2011, Fargo, ND, USA.