BREEDING

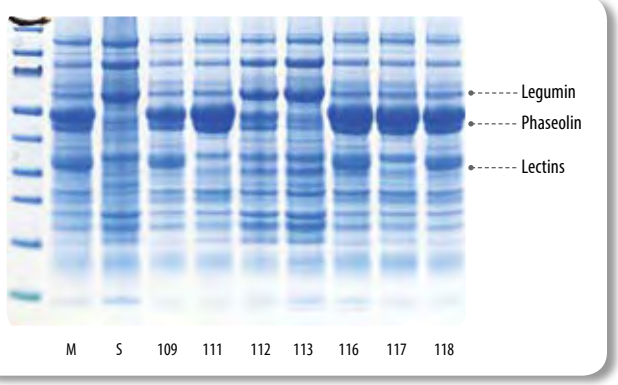
Genetic Improvement of Protein Quality in Manitoba-Adapted Dry Beans

Crossing a locally adapted cultivar with a germplasm line high in sulphur-containing amino acids increased protein quality.

DRY BEANS HAVE a high protein content; however, their protein quality is often considered poor compared to other plant sources, such as soybean. The key factor limiting the protein quality in dry beans is the sub-optimal content of sulphur-containing amino acids, particularly methionine. Using breeding methods to improve bean protein quality could lead new value-added food applications and identity preserved marketing opportunities. This study developed dry bean germplasm (breeding materials) with improved protein quality while maintaining important agronomic traits such as yield and anthracnose resistance.

Dry bean germplasm line SMARC1N-PN1 lacks the major seed storage proteins, which leads to increased cysteine and methionine. SMARC1N-PN1 was crossed with the locally-adapted navy bean cultivar Morden003 to develop a recombinant inbred line population. In 2013, a population of 182 lines were grown at Morden for seed increase and in 2014, the population was grown in field trials at Morden, MB and London, ON. After screening with protein electrophoresis (see below) and amino acid profiles, it was discovered that there were significant variations in polypeptide composition and amino acid content. Protein electrophoresis revealed that 61 of the 182 lines had Morden003 type phaseolin and lectin; 59 lines had Morden003 type phaseolin and SMARC1N-PN1 type lectin; 38 lines had SMARC1N-PN1 type phaseolin and Morden003 type lectin; and 16 lines had SMARC1N-PN1 type phaseolin and lectin. Amino acid analysis revealed significant increase of sulphur-containing amino acid (cysteine and methionine) concentration in 16 lines that exhibited protein patterns of SMARC1N-PN1.

Lines with desirable agronomic traits and anthracnose resistance were also identified. Morden003 is resistant to races 73 and 105 and SMARC1N-PN1 is resistant to race 73, but susceptible to race 105. Forty lines were resistant to both races, with the rest of the lines being susceptible to either one or both races. Lines with increased sulphur-containing amino acid content, acceptable yield, maturity and anthracnose resistant traits with be further tested in field trials as well as used for crossing for cultivar development.



Representative samples and electrophoresis results showing protein profiles of Morden003 (M), SMARC1N-PN1 (S), and selected lines with protein patterns same as Morden003 (Lines 109, 116, 118), and SMARC1N-PN1 (Line 113); lacking of phaseolin in SMARC1N-PN1 and similar lines leads to increased sulphur-containing amino acid content.

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MPSG INVESTMENT $36,000

DURATION 3 years