BREEDING

# Soybean Breeding Lines Evaluated for Iron Deficiency Chlorosis Resistance

Sixteen germplasm lines were consistently tolerant to iron deficiency chlorosis (IDC) under field conditions. Further screening under controlled conditions confirmed six varieties to have high IDC resistance.

**IRON IS ESSENTIAL** for photosynthesis. Not surprisingly, crops deficient in iron frequently show chlorosis (yellowing). Legumes such as soybeans also suffer due to reduced nodulation. The malaise of IDC is common, especially in Manitoba's high carbonate soils. Soil is generally rich in iron; however, iron may be unavailable for plant uptake. Saline, wet and cool soils exacerbate the effects of IDC. Previous research has shown that development of resistant cultivars and breeding lines are the most efficient way to overcome IDC in soybeans. They must, however, also mature early and possess high yield potential. To bring these characteristics together, soybean breeders start by screening large populations of genetically diverse plants in hopes of finding the few that display IDC tolerance. These tolerant breeding lines are crossed with varieties that have established yield and pest resistance characteristics.

Screening of soybean breeding lines for resistance to IDC was done in the field and in the greenhouse.

## FIELD EVALUATION

This project evaluated 62 advanced soybean breeding lines developed at Agriculture and Agri-Food Canada (AAFC) Ottawa along with 160 early-maturing germplasm materials selected at AAFC Morden. Field trials were conducted at Emerson, MB in 2012–2015. The site offered optimal conditions for IDC to occur. Each line was rated at the third to eighth trifoliate growth stage on a scale of 1–5: 1 = no chlorosis and 5 = very severe chlorosis or dead plants.

Many lines showed early IDC symptoms, but were able to recover to some degree at later growth stages. Some lines had stunted plant growth, which led to severe yield loss. The advanced breeding lines from Ottawa were generally tolerant to IDC, suggesting genetic improvement through breeding had occurred. In total, 16 germplasm materials were consistently tolerant to IDC.

Due to the heterogeneous field conditions, inconsistency was observed in the soybean materials evaluated at Emerson. Thus, screening of soybean IDC under controlled conditions was initiated.

## GREENHOUSE SCREENING

Further screening took place in the greenhouse using hydroponic nutrient solutions. This system enabled researchers to control environmental factors that influence IDC, resulting in more precise resistance ratings. Among other efficiencies, greenhouse trials allowed severe IDC to be induced in order to test the limits of observed resistance. This method has several advantages over field evaluations since a high severity of chlorosis can be induced and confounding effects of environment may be avoided. Additionally, this method of screening may be done year round.

From 2015–2016, 71 selected soybean materials classified as early-, medium- and late-maturing were tested for IDC resistance. Six lines were confirmed to have high levels of IDC tolerance making them suitable donors to variety development programs. Some lines that appeared to be resistant in the field were determined to be false positives and rated as IDC-susceptible in the greenhouse.

From these studies, 10 resistant and susceptible materials are being crossed to generate genetic populations for further genetic analysis of IDC resistance.

*IDC susceptible (L) and resistant (R) lines at Emerson, MB in 2013.*

*Hydroponic system in Morden showing susceptible (L) and resistant (R) lines.*

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MPSG INVESTMENT $76,000

DURATION 3 years