

## **INTRODUCTION**

The purpose of the Northern Regional Soybean Cyst Nematode (SCN) Tests is to evaluate the best experimental SCN resistant soybean lines developed by public researchers in the U. S. and Canada and to provide soybean breeders with a source of genetically diverse germplasm for continued progress in the release of well adapted, SCN resistant breeding lines and varieties. Participants are encouraged to exchange germplasm within the legal guidelines pertaining to transgenic strains.

Tests are established for each maturity group 00 to IV. Transgenic (ie. Roundup Ready) entries are established in separate tests from conventional strains. Experimental strains are evaluated in Preliminary Tests grown at a limited number of locations for one year before they are entered in Uniform Tests. Uniform Tests are grown at more locations with more replications than Preliminary Tests.

## **POLICY ON EVALUATION AND RELEASE OF STRAINS**

### **Qualifications for inclusion in the Northern Regional SCN Tests**

- 1) Participants must be willing and able to conduct separate tests for conventional strains and strains containing proprietary and/or transgenic traits. However, all participants are not required to evaluate both; and, placement of entries in tests depends on whether the entries are transgenic or non-transgenic.
- 2) Participants are individually responsible to ensure that any proprietary and/or transgenic strains that they submit are approved for human consumption and are cleared for sale as commodity seed.
- 3) Participants must disclose pedigrees to the Uniform Test Coordinator for publication with performance data in Uniform Soybean Test Report unless contract arrangements prohibit disclosure of information.
- 4) It is recommended that breeders obtain written permission for the use of privately developed varieties or strains as parents in the development of lines included in the Uniform Tests.

### **Use of Northern Regional SCN Test Entries in Soybean Breeding and Research**

- 1) Seed of Uniform test entries is for evaluation in the Uniform tests only and may not be distributed to non-participants of these tests without prior approval by the originator of the entry.
- 2) Uniform Test participants must obtain written approval before using any entry, other than their own, in any breeding or genetic studies, or for any other research.
- 3) Experimental strains entered in the Uniform Tests should be labeled "Experimental Strain" and should not be identified by strain designation when grown in demonstration plots or when the Uniform Tests are shown on field days or farm tours.
- 4) Seed of any transgenic entry must not be used for further evaluation without written permission from the originator of the entry, and must be discarded at the end of the season, except for crossing purposes, subject to the restrictions outlined in the preceding section two.

### **Release of Northern Regional SCN Test Entries**

- 1) Entries in the Northern Regional SCN Tests are released according to the policies and procedures of the originating institution.
- 2) Restricted or contractual releases cannot impose any restriction on the prior use of an entry as a parent by SCN Test Participants.

## METHODS

Regional SCN Uniform Tests and Preliminary Tests are planted in multiple-row plots with the center rows used for data collection and harvested for yield. Plots in the Uniform Tests are generally replicated three times while plots in the Preliminary Tests are generally replicated twice. The coefficient of variability (CV) is reported for replicated data at each location. Yield data with a CV value of greater than 15 is generally not included in the test means.

**Descriptive Code** is abbreviated as underlined below.

Flower color: Purple, White, M indicates mixed flower color

Pubescence color: Tawny, Gray, Light tawny, M indicates mixed pubescence color

Hilum color: black, imp~~er~~fect black, brown, buff, gray, yellow

**Previous testing** is the number of previous years in the same SCN Uniform Test or a reference to the previous year's test, abbreviated to SCN PIII for SCN Preliminary Test III, for example.

**Yield** is measured after the seeds have been dried to a uniform moisture content and is recorded in bushels (60 pounds) per acre.

**Maturity** is the date when 95% of the pods have ripened. Delayed leaf drop and green stems are not considered in assigning maturity. Maturity is expressed as days earlier (-) or later (+) than the reference variety.

**Height** is the average length in inches from the ground to the tip of the main stem at maturity.

**Lodging** is rated at maturity according to the following scores:

1 = Almost all plants erect.

2 = All plants leaning slightly or a few plants down.

3 = All plants leaning moderately (45 degrees), or 25 to 0% of the plants down.

4 = All plants leaning considerably, or 50 to 80% of the plants down.

5 = Almost all plants down.

**Seed quality** is rated according to the following scores considering the amount and degree of wrinkling, defective seed coat (growth cracks), greenishness, and moldy or rotten seeds. Threshing or handling damage is not included, nor is mottling or other pigment.

1 = Very good    2 = Good    3 = Fair    4 = Poor    5 = Very poor

**Seed size** is recorded in grams per 100 seeds based on a 100 or 200 seed sample.

**Seed Composition** is measured on samples submitted to the USDA-ARS National Center for Agricultural Utilization Research, Peoria, Illinois. A 25-gram sample of clean seed is prepared by taking an equal volume or weight of seed from each replication. Protein and oil content is measured on these samples using infrared reflectance and is reported as dry-weight percentage values. The values listed in this report have been converted to a 13% moisture basis.

**Shattering** is scored at a specified time after maturity and is based on estimates of the percent of open pods as follows:

- 1 no shattering
- 2 1 to 10% shattered
- 3 10 to 25% shattered
- 4 25 to 50% shattered
- 5 over 50% shattered

**Minnesota Iron Chlorosis scores (IDC)** Scores are the mean of 2 reps and 2 observation and are based on the amount and severity of chlorosis (leaf yellowing). Scale; 1 = no chlorosis to 5 = severe chlorosis, leaf necrosis and possibly plant death. Data was collected from Lake Lillian and Wilkin Co. Minnesota.

**ISU Iron Chlorosis scores (IDC)** Each variety was planted in a hill plot consisting of five seeds per hill, with two replications per variety, at two high pH field locations in central Iowa. Locations were chosen by identifying IDC symptoms on soybeans growing in each field at the end of June. Prior to planting the experiments, the soybeans growing at each location were removed. Notes were taken for IDC symptoms at each location approximately four weeks after planting and again at five weeks after planting. Varieties were rated on a scale of "1" to "5" with a "1" indicating no symptoms of IDC present and a "5" indicating plant death due to IDC. Ratings from the two scores were averaged for each plot. The scores from each location then were averaged. Eight or more entries of a variety highly resistant to IDC (A11) and 8 or more entries of a variety highly susceptible to IDC (Dwight) also were included in each rep of the experiment as checks. The average score of all resistant plots and susceptible plots are listed on the tables under R= and S=, respectively.

**Green Stem** is a rating of delayed green stem at time of plant maturity (R8 = 95% of the pods have reached mature pod color). The condition is rated according to the following scores.

- 1 = almost all plant stems yellowing or have ripened, as indicated by their mature stem color.
- 2 = 1 - 10% plants with green stems
- 3 = 11 - 25% plants with green stems
- 4 = 26 - 50% plants with green stems
- 5 = > 50% plants with green stems.

**ISU Emergence Scores** – Emergence was assessed by counting all plants in 1 random meter of the inner two rows of each plot 35-40 days after planting. Plots were planted at a rate of 10 seeds per foot. Emergence scores are listed as percent stand.

**Missouri Frogeye Leaf Spot (FELS)** was rated by Dr. Allen Wrather at Portageville, MO on a 0 to 9 scale with 0=no frogeye and 9=severe.

**Missouri Rootknot Nematode (RKNT)** was rated on 2 reps on a 1 to 5 scale with 1=no galls and 5=severe galls at 2 locations in plantings behind potatoes near Bertrand, MO.

## SCN/DISEASE SCREENING

**Purdue SCN greenhouse test:** Soil from each field location is brought to the laboratory and used to test each SCN soybean line for resistance to the SCN population found in that field. Seeds of each soybean line are germinated in sand. When seedlings are several inches tall, sand is washed from the roots. Each seedling is placed in a 1-inch cell of a seedling tray partially filled with a soil:sand (1:3) mixture, 1 ml of inoculum is pipetted over the roots and additional soil/sand mixture is added to the cell. Three replicates of each entry are set up in this fashion. Inoculum is prepared by extracting cysts from field soil. Eggs and juveniles are released by dissolving the cuticle with sodium hypochlorite and mechanical crushing. Inoculum is adjusted to a concentration of 2000-3000 eggs per ml. Plants are grown for a period of 8-10 weeks at a temperature of about 75° F. When it is judged that development of second generation SCN females has taken place, roots are gently dipped in water to remove soil and sand. Entries are then rated as resistant (R), moderately resistant (MR), moderately susceptible (MS) or susceptible (S) based on the following scheme of a visual inspection of the roots. The entry is considered resistant if the total number of females on the root is judged to be less than 10, moderately resistant if number of females is 11-20, moderately susceptible if 21-50 and susceptible if higher than 50.

**Illinois SCN greenhouse test:** Seed of each entry is germinated in germination paper placed in an incubator at 27° C for three days. One healthy seedling of each entry is then placed in an individual container of sterilized sandy soil and inoculated with 1,000 eggs. Each entry is replicated three times. Infected seedlings are grown in a greenhouse in a water bath system that maintains a constant 27° C soil temperature. After 30 days, female cysts are washed from the roots of each seedling and counted. A female index (FI) is calculated for each entry by dividing the mean number of cysts on the entry by the mean number of cysts on the susceptible check Lee 74 and multiplying by 100. Entries are then rated as highly resistant (HR), resistant (R), moderately resistant (MR), low resistance (LR) or no effective resistance (NR) based on the FI number as follows:

HR = FI of < 10

R = FI of 10 to 24

MR = FI of 25 to 39

LR = FI of 40 to 59

NR = FI of > 60

nd = not determined FI>10, CV>35

**Illinois Sudden Death Syndrome rating:** Plots were scored in the field by Southern Illinois University. All disease scores were interpolated to the R 6.2 growth stage.

DX = SDS Disease Index (DI\*DS/9)

DI = SDS Disease Incidence (% of plants with visible symptoms).

DS = SDS Disease Severity (1 = mild chlorosis, 5 = severe leaf scorch, 9=premature plant death).

