American Crystal Sugar Company

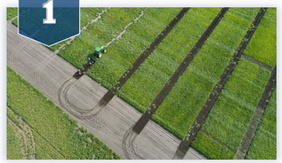
Official Variety Trial Program

The official trials operated by American Crystal Sugar Company (ACSC) were initiated in 1973 to supply information to growers that assisted their selection of varieties for planting.

Starting in 1982, an approval system was implemented which utilized data from the official trials to select varieties which met specific requirements.

The growers continue to receive data from these official trials to assist in selecting the best sugarbeet varieties.

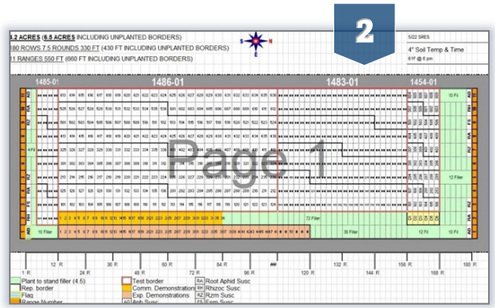
How the Official Variety Trial Program Works



Varieties Entered into Official Trials

Seed companies are invited to enter varieties into the Official Trials each year. The trials consist of commercial trials (commercial seed evaluated), experimental trials (new varieties seeking approval), specialty yield trials (tested in Aphanomyces-infested fields), and numerous disease nurseries. Yield trials are planted at 13 sites throughout the Red River Valley. Disease nurseries are planted in the in the valley by ACSC and in other locations by cooperating companies or the USDA for Aphanomyces root rot, Cercospora leaf spot, Rhizoctonia crown and root rot, and Fusarium yellows. Additionally, susceptibility to sugarbeet root aphid is tested at multiple locations.

Field Map



Each yield trial site (an individual grower's field containing the official trials) has all of the plots (50 feet by 2 or 4 rows) diagramed onto a field map. Each grid on the map represents an individual plot. Each map is used to facilitate planting, note taking and harvest operations. Each location is typically 5 to 15 acres in size.

Coding Varieties to Assure Non-Biased Results

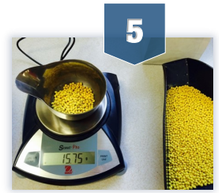
3

A coding agent (independent representative) assigns code numbers randomly to each trial entry and places seed of each variety into a bag labeled with the code number for planting into yield trials and disease nurseries. ACSC does not know the names of the varieties associated with the seed in each bag labeled with a number only. A separate sample is placed into a bag with the variety name for use in demonstration plots which are identified with variety names for viewing by seed companies and growers.

Seed Preparation

While most seed received for testing is treated with multiple fungicides and an insecticide, sometimes small samples of seed to be used for disease checks and indicators needs to be treated. A small Hege treater is used for this work.

Preparing Seed for Each Plot



After creating a randomization (varieties are assigned to plots at random), seed for each plot is placed into a packet. A uniform number of seeds is placed in each packet. Seed for one variety is placed into all corresponding packets for all replications and locations. The process then continues with the next variety. Demonstration packets are also prepared for the official trial sites.

Sorting Packets by Plot Order

After all varieties are packeted, the packets are placed into plot planting order.

Rodding of Packets for Planting

All packets for a specific location are placed into planting order (including demonstration and filler material) onto tables. The packets are then placed on metal rods to keep the packets in proper order during transport and planting in the field.

Planting

A specialized research 12-row vacuum planter (Seed Research Equipment Solutions) is used to plant the official trials. The planter uses GPS to control seed placement. Three technicians handle two seed dispersing units each (one unit plants 2 rows). Each seed packet plants two 50 feet long rows. The field map is referenced during the planting process to ensure all plots are planted in the correct order.

Emergence Counts

About 20 days following emergence, emergence counts are taken on the trials.

Official Variety Trial Program

American Crystal Sugar Company

Demonstration Plots

Demonstration plots (from seed samples prepared by the seed coder) are available for viewing at most sites. These plots are labeled with a sign identifying the variety name.

Alley Widening and Measuring Row Length

Prior to harvest, alleys are widened to remove end-beet effect. Each row is measured for total length and gaps over 60 inches are measured. Footage is adjusted for gaps exceeding 60 inches.

Defoliation

Plots are defoliated using a six-row defoliator with trailing scalpers. Following defoliation, the area is walked and any dislodged beets are returned to their position.

Harvest

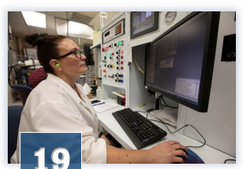
A custom six-row research plot harvester manufactured in 2019 (Ike's Welding and Manufacturing, Munger, Michigan) is used to harvest plots. The harvester is capable of harvesting, cleaning, and weighing each of the six rows independently. The harvester and other machinery are equipped with safety shielding to minimize exposure to moving parts.

Sample Bags

One 25 lb. quality sample (10 to 20 beets) is taken from each plot and placed into a sample bag for processing at the Moorhead Technical Services Quality Lab facility. The remaining beets from each plot are weighed and dropped on the ground to be picked up by a "bulk beet harvester" (without lifter wheels) and then hauled to the sugar factory to be processed into sugar.

Quality Lab

Each sample is analyzed for sugar and impurity components.



Unloading Harvester

The sample bags are transferred from a hopper on the back of the harvester to a live bottom truck to be transported to ACSC Technical Services Center for sugar and quality analysis. Bulk beets are transferred to a truck for transport to the nearest open piling station or sugar factory.

Quality Lab Unloading Area

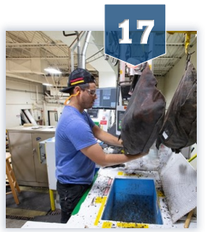
Sample bags are unloaded and placed on a conveyor to initiate quality analysis.

In Scale

Beets are weighed (prior to washing) and the sample ID bar code is scanned into the Quality Lab data collection system.

Topping and Transfer Station

Soil and green leaf material are removed prior to sample collection. The out scale records the clean weight for each sample to allow calculation of tare percent.



20 Disease Nurseries

Aphanomyces, Cercospora, Fusarium and Rhizoctonia nurseries in the RRV are part of the Official Trial program. Additional sites of disease nurseries are planted by cooperating companies at sites in Glyndon, MN (Magno Seed Aphanomyces nursery), Shakopee and Randolph, MN (Betaseed/KWS Aphanomyces and Cercospora nurseries) and in Michigan (USDA Cercospora and Rhizoctonia nurseries). Root aphid evaluation is performed in greenhouse and field sites outside of the RRV and in growth chambers at the ACSC Technical Services Center. Aphanomyces and Fusarium nurseries are grown in fields with naturally occurring levels of disease inoculum. Cercospora and Rhizoctonia nurseries are inoculated to enhance uniform infection.

Rhizoctonia Inoculum

Rhizoctonia solani AG 2-2 is grown on sterilized barley kernels under high humidity at 80°F for about 3 weeks, dried, and ground into a coarse powder immediately prior to use in the field.

Rhizoctonia inoculum evaluation

The inoculum is evaluated by treating seedlings in a growth chamber under conditions favorable for disease (warm temperatures and high soil moisture). After three weeks, plants are checked for Rhizoctonia symptoms to verify the inoculum will be effective in field trials.

For Rhizoctonia nursery inoculations, the finely ground barley is sprinkled on the leaves and crowns of the beets around the 8-leaf stage, followed by irrigation to promote fungal growth and plant infection.

23 Approval Calculations

Following yield trial and disease nursery data collection, statistical analysis, identification of varieties and combining of data across multiple years, calculations for determining approval status of currently approved and experimental varieties are performed.

The list of approved varieties is provided to all growers and cooperating seed companies. Disease ratings and agronomic performance for varieties are also provided to growers and seed companies.