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High Energy Forages and Soil Building Cover Crops

SUNSTRA® Hybrid Alfalfa Technology "The Next Level of Forage Yield Performance"



Brought to alfalfa growers using **SINSTRA** Hybrid Alfalfa Technology

The New Science of Alfalfa.

Hybrid Alfalfa is the most notable advance in plant breeding since the introduction of hybrid corn. In 2001, Dairyland Seed introduced the patented msSunstra Hybrid Alfalfa Technology marking the beginning of a new era in alfalfa production and is the key to unlocking alfalfa's yield potential.



The next generations of hybrid alfalfas were introduced in 2009. These new hybrids mark the next level of forage yielding capacity. They deliver:

- **1.** *Highest forage yield potential* in both well and poorly drained soils. Delivering consistent performance across weather patterns and cutting programs.
- 2. *Reliability* from first to last cut and from seedling year into older stands.
- 3. *Fine stem quality forage* increases palatability and dry matter.
- 4. *Drought tolerance* indicated by the plants not going into reproductive stage during dry conditions.



Hybrid Parents

Hybrid alfalfa consists of three parents:



1. Female parent

Cytoplasmic male sterile Female fertile, male sterile

Note the lack of pollen shed on the black knife.

Female seed production

2. Maintainer parent

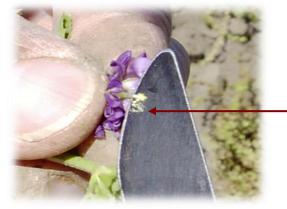
When the maintainer parent is crossed to a female parent, the seed from the female parent is male sterile.

Female x Maintainer



Female seed





3. Restorer parent

Fertile parent used to pollinate the female parent that restores fertility to the hybrid.

Note the pollen shed on the black knife

4. Hybrid seed production

Female x Maintainer

Restorer Line Selection





Disease, Insect and Nematode Resistance Selection

Each parent is selected for resistance to a broad spectrum of diseases, insects and nematodes. The initial selection begins in a greenhouse which continues to field selection searching for resistance to multiple pests.



Verticillium Susceptibility



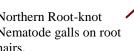
The center plant is resistant to both Aphanomyces and Phytophthora root rot.

Diseases selected for resistance:

- **Phytophthora* Root Rot *Aphanomyces Root Rot *∗Fusarium* Wilt *∗Verticillium* Wilt *Anthracnose ✤Leaf diseases ✤Crown Rots ✤Brown Root Rot
- Insects evaluated for resistance: ✤Pea Aphid
- ℁Spotted Alfalfa Aphid *****Potato leaf hopper

Nematodes are included in the selection procedure:

- **[∗]**Stem Nematode *Northern Root-knot Nematode ✤Southern Root-knot Nematode Columbia Root-knot Nematode
- ✤Lesion Nematode







Northern Root-knot Nematode galls on root hairs.

Winter Survival and Persistence Selection

All of the resistant plants that survive the greenhouse disease and pest selection are transplanted to a disease infested field that has high levels of *Phytophthora* and *Aphanomyces* Root Rot, Bacterial Wilt and *Fusarium* Wilt. Prior to planting, plants are inoculated with *Verticillium* Wilt and Anthracnose to kill any remaining susceptible plants. The field is over-watered in the fall to promote winter survival susceptibility and heaving pressure.



Irrigation simulates disease and winter stress

The following spring, plants that are heaved out of the ground or susceptible to disease and winter stress are eliminated. Only the most vigorous plants are saved and advance in the breeding program.



Under stress conditions, some plants are extremely vigorous, while others are weak.



Alfalfa plant heaved out of the ground.



The majority of disease resistant plants cannot survive in this high-stress environment.



Plant Trait Evaluation

Branch Root Trait



Right: **Deep Set Crown Trait:** The crown's deep placement protects it from wheel and animal traffic. With the lower set crown, there is additional insulation from the soil during cold soil temperatures.

Saline Soil Tolerance *Right:* **Saline Soil Tolerance** is

becoming more of an issue in stand establishment and production in the Great Plains and Western United States. Selections and evaluations are being conducted in these saline soils.

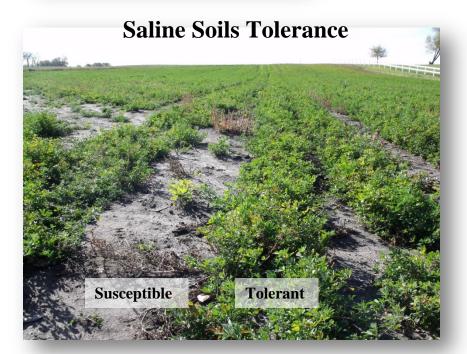


Parent plants regarding any distinctive characteristics are identified. These features may be:

Left: **Branch Rooted Trait**: Helps to anchor the alfalfa plants in the ground when freezing and thawing occur during the winter and spring. This trait also keeps more of the root system above the water table, allowing oxygen to exchange and the plants to be productive.

Deep Set Crown Trait





Forage Yield and Persistence Evaluations

A few parents can be combined in many ways to produce a multitude of hybrid combinations. All hybrid combinations are forage yield tested and compared against the newest hybrids and the best competitor varieties. At the Clinton, Wisconsin research farm, thousands of plots are

planted and harvested each year. Forage yield trials are conducted on 3^{rd} , 4^{th} and 5^{th} cuts during the growing season.

Right: Alfalfa hybrids are planted in 5 x 20 foot plots and harvested for 3 or more years. Only high yielding persistent hybrids are considered a hybrid alfalfa variety.





Competitor

Left: Up to 3,000 forage yield plots can be harvested in a single day. More than 10,000 plots are harvested on an average of 4 times a year.



Left: The excellent persistence of hybrid alfalfas keep weeds out of the stand.



Fine Stems of msSunstra Hybrid Alfalfa



Competitor