NIHLGÅRD, MARIA[1]*, MATS LEVALL[1], RICKARD JONSSON[1], BRITT-LOUISE LENNEFORS[1], REBECCA LARSON[2] and GERHARD STEINRUCKEN[1], [1]Syngenta Seeds, P. O. Box 302, 261 23 Landskrona, Sweden and [2]Syngenta Seeds, Inc., 1020 Sugarmill Road, Longmont, CO USA 80501. **Storage diseases – assessment and implications for breeding.**

ABSTRACT

For farmers and the sugar industry it is essential to store sugar beets for various periods of time. An extended storage time can secure the beet supply, stretch the campaign and allow for flexibility. It is critical that the sugar beets retain sugar yield during storage. Sugar losses can depend on different factors including the health status of the beets when put into storage, the degree of injury, the amount of soil attached to roots and on the pathogenic microorganisms present in the pile. It is known that different diseases such as *Aphanomyces cochlioides*, *Fusarium* spp., *Rhizoctonia solani*, rhizomania, and Curly top can influence storage capacity. Consequently, it is important to use varieties with the appropriate disease resistance packages to combat different diseases in the production areas to not only maintain optimal yield in field, but also prevent sugar losses during storage. During storage trials performed by Syngenta Seeds, different factors influencing the storability have been investigated. It has been clearly shown in the storage trials that mechanical and frost damage in beets leads to increased fungal attack. The major fungal microorganisms colonizing the roots in storage are *Fusarium* spp., *Penicillium claviforme* Bainier and *Botrytis cinerea* Pers. Beet health in storage also depends on the degree of dirt attached to the beet. Less soil reduces the amount of pathogens and humidity, both of which cause damage, so root architecture, specifically root groove depth, has a significant impact on storability. In trials performed by Syngenta Seeds, sugar beet materials with good storability have been identified.

Objectives:

The main objective was to identify sugar beet materials maintaining a good health status, good processing properties and high sugar yield during and after storage. It was also of interest to get more knowledge about the impact of mechanical damage and frost on stored beets and to study the microbial community.

Procedures:

Syngenta Seeds has an extensive breeding program against all major sugar beet pathogens which includes Rhizomania, Curly top, *Rhizoctonia solani*, *Aphanomyces cochlioides*, *Fusarium* spp, pathogens that both cause yield reduction in field and reduce the storability of beets. Syngenta Seeds also breeds and selects for materials with low soil tare.

During several years a number of storage trials were performed by Syngenta to evaluate the storability of different types of material in the gene pool. The beets have been grown in normal sugar beet fields and healthy sugar beets were directly after harvest placed during maximum 12 weeks in a store room with different temperatures. The root weight, content of sucrose and inverted sugars were measured before and after storage. The fungal attack on the stored beets was scored in a scale 1-9 (1= a completely rotted beet and 9 = a healthy beet). Fungi were isolated from a number of stored beets for identification.

An additional study was set up to investigate the effect of either mechanical damage or frost on stored beets. The beets were damaged by cutting off the tip of the tap roots. In the frost experiment the beets were frozen and thawed. The vigour and fungal attack were scored before and after storage.

Conclusions:

The results showed that mechanically or frost damaged beets had a significant negative impact on the storability with an increased colonisation of fungi. This shows that it is valuable with a root shape that is easy to harvest to avoid mechanical damage on the beets.

Significant differences in storability between materials within the sugar beet germplasm of Syngenta Seeds were demonstrated. The fungal score was 7.5 for the best materials and 1 for the worst. *Fusarium* spp., *Penicillium claviforme* Bainier and *Botrytis cinerea* Pers were isolated from the beets.

It was estimated that already after 6 weeks of storage, up to 25% yield difference at harvest could be compensated by a good storing material. Among the materials with the best storability, lines with good root disease resistances were identified.

In conclusion, a number of breeding lines and hybrids were identified to have good storability, with maintained high sugar yield, low level of invert sugar, and low attack of fungi. With this knowledge, the breeding activities will aim to produce sugar beet varieties with maintained quality and high yield even after storage.

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