Storage Comparison for Beets On and In a Building Pile

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TASCO 80,000 ton storage building

ON pile samples in storage building

Surface rot % assessment

Introduction

- Sugar losses from beets stored long term is a perennial concern for sugar companies, especially in piles stored at temperatures above freezing
- Seed companies are constantly trying to find varieties that have improved characteristics including improved storability
- The challenge has been to test varieties under environmental conditions from which meaningful storage results can be extrapolated to the conditions of the majority of the beets in company piles

Objective

- To compare the surface rot and sugar reduction in sugar beets stored on and in a storage building beet pile

Methods

- A farmer cooperator yield trial site near Paul, Idaho that tested positive for rhizomania infection was used
- 18 varieties were selected for testing with 3 reps per variety
- On September 25, 2009, during yield trial harvest with a Hesston 3 row digger, 16 beets for storage were taken from each plot and placed in a rubberized tare bag
- Initial sugar per cent was determined on two other 20 lb tare samples per plot, taken during harvest, in the TASCO tare lab using an Autopol 880 Polarimeter (Strausbaugh et al., 2009)
- Bagged storage beets were transported to an 80,000 ton Amalgamated Sugar Company (TASCO) storage building at Paul, Idaho
- Samples of 16 beets were split into onion bags (8 beets per bag), weighed and placed on plastic tarps in wooden onion crates sitting on the storage building aerated cement floor until October 9 and the split samples were placed either ON top of or hung IN the pile from the top of the pile by ropes to a depth of 10 to 15 feet in groups of 4
- Temperatures in the storage building are kept within a degree or two of 35F with relative humidity ranging from 95 to 100 % for most of the storage period
- Beets ON top of the pile were stored 150 days (until February 22, 2010) and beets IN the pile stored 181 days (until March 25, 2010)
- Samples were weighed, surface rot assessment made and brei samples packaged and frozen immediately after removal
- Amalgamated Research, Inc. did after storage sugar percent analysis using gas chromatography (Strausbaugh et al., 2009) in May 2010
- % sugar reduction at end of storage period was calculated as : 1-[(%sugar of storage sample X weight of storage sample) / (%sugar at harvest X weight of sample when put in onion bag after harvest)] X 100
- The estimated recoverable sugar (ERS lbs/ac) after storage was calculated as: [(1-(%sugar reduction/100)) X (ERS of plot at harvest)]
- ANOVA (ACB) and LSD analysis was done with AGROBASE® (Version 18.15.2; Agromix Software, Inc. 171 Waterloo St. Winnipeg, Manitoba, Canada) at the 5% level of significance

Table 1. IN Pile Summary

Variety	%Sugar Harvest	ERS Harvest lbs/ac	%Surface Rot March 18	%Sugar March 18	% ERS Sugar Reduction	ERS March 18 lbs/ac
18	17.26a	11186ab	17ef	14.20ab	23.14f	8598a
8	15.66cdefg	11511a	21def	11.90bc	31.69cdef	7863ab
11	16.17bc	11556a	23cdef	12.20abc	32.97cdef	7746abc
5	14.95hi	10512bcd	20def	12.00abc	28.44def	7522abc
10	15.37efgh	11270ab	21def	11.10c	35.33cdef	7288abc
17	15.83cdef	10957abc	20def	11.70bc	33.76cdef	7258abc
2	16.07bcd	10684abcd	14f	12.20abc	32.91cdef	7168abc
12	17.11a	9300e	5f	14.80a	23.89ef	7078abc
1	15.22fgh	10171cde	18ef	11.80bc	31.73cdef	6944abc
14	15.11gh	11430ab	41abcde	10.00cd	39.95bcdef	6864abc
4	14.88hi	10793abcd	21def	10.50cd	36.82bcdef	6819abc
6	15.4defgh	11303ab	43abcde	10.10cd	43.22abcd	6418bcd
13	15.92bcde	11203ab	29bcdef	10.20cd	43.11abcd	6373bcd
15	16.59ab	10692abcd	48abc	11.00c	40.75abcde	6335bcd
16	16.01bcde	10898abc	53ab	9.57cde	46.77abc	5801cd
7	15.54cdefgh	10775abcd	58ab	9.56cde	46.73abc	5740cd
9	14.36i	11054abc	63ab	7.02e	57.39a	4710d
3	14.97hi	9858.9de	45abcd	8.11de	53.59ab	4576d
Pr>F	<0.0001	0.0027	0.0008	0.0005	0.013	0.0312
LSD 5%	0.68	973	26	2.81	17.27	2056

Table 2. ON Pile Summary

Variety	%Sugar Harvest	ERS Harvest lbs/ac	%Surface Rot Feb. 22	%Sugar Feb. 22	% ERS Sugar Reduction	ERS Feb. 22 lbs/ac
14	15.11gh	11430ab	14	12.40	23.99	8688
11	16.17bc	11556a	23	12.70	27.04	8431
18	17.26a	11186ab	14	13.80	24.73	8420
8	15.66cdefg	11511a	18	11.80	29.39	8128
4	14.88hi	10793abcd	11	11.60	25.31	8061
17	15.83cdef	10957abc	14	12.10	27.51	7943
6	15.4defgh	11303ab	20	11.50	30.1	7901
7	15.54cdefgh	10775abcd	22	11.70	29.34	7614
10	15.37efgh	11270ab	26	11.20	33.06	7544
1	15.22fgh	10171cde	33	11.90	26.35	7491
5	14.95hi	10512bcd	18	11.50	29.43	7418
12	17.11a	9300e	4	14.30	20.97	7350
9	14.36i	11054abc	39	9.60	39.02	6741
13	15.92bcde	11203ab	33	10.40	40.2	6699
15	16.59ab	10692abcd	39	11.10	37.79	6651
2	16.07bcd	10684abcd	31	10.70	38.63	6557
3	14.97hi	9858.9de	25	10.60	36.03	6307
16	16.01bcde	10898abc	50	9.70	43.49	6158
Pr>F	<0.0001	0.0027	0.0621	0.0557	0.2353	0.1929
LSD 5%	0.68	973	ns	ns	ns	ns

Results

IN Pile

- Table 1 shows the results of the IN pile samples after 181 days of storage
- All data analysis were significant at the 5% level
- The ERS (estimated recoverable sugar) after storage for the 18 varieties ranged from 4576 (53.59% sugar reduction) to 8598 (23.14% sugar reduction) lbs/ac for the 18 varieties
- Surface rot assessment ranged from 5 to 63%

ON Pile

- Table 2 shows the results of the ON pile samples after 150 days of storage
- The February 22 data was insignificant at the 5% level although the surface rot assessment and sugar % would be significant at the 10% cutoff
- The ERS after storage for the 18 varieties ranged from 6158 (43.49% sugar reduction) to 8688 (23.99% sugar reduction) lbs/ac but the lowest sugar reduction was 20.97%
- Surface rot assessment ranged from 4 to 50%

Table 3. ERS Rank Comparison for IN and ON

IN ERS March 18 lbs/ac	IN Pile Variety	Rank	ON Pile Variety	ON ERS Feb. 22 lbs/ac
8598	18	1	14	8688
7863	8	2	11	8431
7746	11	3	18	8420
7522	5	4	8	8128
7288	10	5	4	8061
7258	17	6	17	7943
7168	2	7	6	7901
7078	12	8	10	7614
6944	1	9	7	7544
6864	14	10	5	7491
6819	4	11	1	7418
6418	6	12	12	7350
6373	13	13	9	6741
6335	15	14	15	6699
5801	16	15	13	6651
5740	7	16	2	6557
4710	9	17	3	6307
4576	3	18	16	6158

Results cont.

IN Pile and ON Pile Rank Comparison

- Table 3 shows the results of the rank comparisons according to after storage ERS between the IN pile and ON pile samples
- The IN pile ERS overall is lower compared to the ON pile ERS mostly due to the longer storage period (181 vs. 150 days) for the IN pile samples
- Only varieties 17 and 15 were ranked in the same position for both the ON and IN lists although the IN samples as expected had lower ERS values
- However, varieties 18, 5, and 2 stored IN the pile for a longer period than the ON pile counterparts actually had higher after storage ERS values

Conclusions

- For this study, IN pile storage statistics were all significant at the 5% level whereas ON pile statistics were not significant at that level
- At the end of this study, the IN pile samples had a larger % sugar reduction and lower ERS (estimated recoverable sugar) overall compared to the samples stored ON pile
- The overall lower after storage ERS for the IN pile samples is assumed due to a 31 day longer storage period
- Ranking of the 18 varieties according to after storage ERS was not consistent for after storage ERS of split samples stored IN and ON the pile except for varieties 11, 17 and 15
- Varieties 18, 5 and 2 stored IN pile had higher ERS values than their ON pile counterparts even though they were stored 31 days longer
- The variety specific sugar reduction inconsistency between the on and in pile locations is assumed due to the different environmental boundary conditions for each of the storage locations

Reference

Strausbaugh, Carl A., Imad Eujayl, Eugene Rearick, Paul Foote and Dave Elison. 2009. Sugar Beet Cultivar Evaluation for Storability and Rhizomania Resistance. Plant Disease 93(6):632-638.

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Splitting samples into onion bags, labeling and weighing

Samples prepared for storage

ON pile samples with fungal growth (basidiomyte)

Retrieving IN Pile Samples March 18