PROCESSING OF FROST DAMAGED BEETS IN THE MAGIC VALLEY 1991-92 CAMPAIGN

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SWENSON, ALAN *1, JARO, VIC *2, LARRY VELASQUEZ 2, GARY POOL 2, ALAN HIEB 1, MIKE STROEBEL 2, AND JIM HARTWELL 1. 1 - The Amalgamated Sugar Company, P.O. Box 700, Paul, Idaho 83347 and 2 - The Amalgamated Sugar Company, P.O. Box 127, Twin Falls, Idaho 83301. Processing of Frost Damaged Beets in the Magic Valley - 1991-92 Campaign.

The area known as the Magic Valley is included in the area about 10 to 20 miles on either side of the Snake River in Southern Idaho from Aberdeen/American Falls on the east to Bell Rapids/Gooding on the west. This growing area supplies sugar beets to the Mini-Cassia and Twin Falls factories and the Nampa factory.

During the 1991-92 harvest, abnormally low temperatures were experienced in the Magic Valley during the last week in October and the first week of November. During the period from 25 October until the last of November recordable precipitation was received almost each day. The last week of October saw night time temperatures in the 20's for several consecutive nights and on November 2, 3, and 4 the lows dropped to the single digits. In some of the higher growing areas the temperature dropped to -10 F. This cold spell caught approximately 10% of the Mini-Cassia and 15% of the Twin Falls crop still in the ground. The decision was made to harvest these beets and process them before those already harvested. The following will describe some of the problems experienced and the methods used to process the crop.

The impact from the freeze on beet quality was devastating both from a harvest quality perspective and freeze damage to the beet itself.

The crop was harvested as fast as field conditions would allow and the beets were either delivered to the factory for immediate processing or were piled. The first beets delivered to the factory had been topped using normal methods. Because of the damage the beets had experienced due to the cold weather a lot of the tops were still attached to the beet or were delivered as "balls of tops". These tops had the characteristics of rope and plugged the beet handling and cleaning equipment. At times the plugging became so severe that the equipment would become overloaded and shut down. The following are some of the specific problems:

1. The weed catchers would become plugged with tops and beets and the flume would overflow. At times the load would be great enough to overload the drive and shut the machine down.
2. Beet lift wheels would plug with tops and start to act as a pump. No water would/ could drain from them.
3. Beet washer screens would plug and overflow.
4. The dewatering rolls into the beet elevators would become plugged and fill the elevator buckets with water.
5. The elevator buckets would also plug and carry water up to the picking tables.

All of these conditions presented opportunity to injure people and damage equipment. Additional people were stationed at the various locations mentioned above to wash tops off the equipment or to periodically shut it down and clean it out. During this time the Agriculture Department was working with the growers to solve the harvest problems. Because of the muddy field conditions harvesting was difficult. Some beets had the tops beaten off three or four times, and straw choppers (metal flails) were often required to remove the tops. In some cases the soil was so wet that the beets were pushed out of the ground ahead of the equipment and because the beets were not in the proper harvest position, toppers were ineffective. During the period 5 November through 14 November, the quality of the harvested beets remained good. The problem was getting them to the slicers. On 14 November the slice had fallen from 9,269 tpd to 9,086 tpd at Mini-Cassia.

By 14 November the "top" problem appeared to be solved but the frost damaged beets in the piles were starting to deteriorate. Large volumes of vapor was observed coming from the tops of the affected piles, the center of the piles had started to sink and juice was starting to run out from under them. An attempt was made to salvage these beets by digging out the "hot spots" and processing them. This was unsuccessful because the decomposition products made the juice unfilterable. The "hot spots" were dug out and abandoned. Methods were developed to salvage and process as many of the damaged beets as possible. These included:

1. Stripping the damaged pile sides utilizing excavators with extendable booms.
2. Hand sorting damaged beets from "good" beets using potato sorting conveyors.
3. Segregating remaining "hot spots" to minimize further deterioration. Some abandoned beets were sold for animal feed.

Just a few days following the freeze, temperatures moderated, and on November 8 reached 60 F. There was also significant rainfall during the period. Beets that had been frozen then thawed, creating a perfect environment for bacterial infection and the consequent production of dextrans and levans, and the release of other polysaccharides such as pectin. Dextran levels in beets increased from a normal of 40-50 ppm or less to more than 1000 ppm. Dissolved during the extraction process, dextrans caused viscosity increases, a drastic reduction in calcite particle size of 2nd carbonation precipitates, and prevented the natural agglomeration of particles. The high dextran levels caused operating difficulties that plagued the operation to some degree throughout the remainder of the campaign. At its worst, the operation saw widely fluctuating slice rates, lime kilns that suffered from the resultant spur and jerk draw rates, a tower and dryer operation that was influenced by coarser and generally poorer quality cossettes, higher bacteria infection rates and consequent losses, reduced settling rates in juice purification and 1st carbonation, sometimes impossible 2nd carbonation filtration, high limesalts, low purities, higher color, reduced granulated production rates, and separator feed molasses that was difficult to filter. A summary of actions taken and observations made during the "Z" beet campaign follows:

1. TOWER DIFFUSER: With the poor consistency of the frozen beets, rather than using a normal knife setting of 4 1/4 or 4 1/2 mm up, had to use 4 3/4 to 5 or higher settings which produced considerably coarser cossettes. The coarse cossettes kept tower diffuser operating differentials and torques at acceptable levels, but unfortunately reduced operating efficiencies in both the tower and pulp dryer operations. Lower tower temperatures were also required to maintain cossette quality within the tower and reduce the extraction of impurities that would hurt juice quality down stream.

   Nitrite and lactic acid tests were regularly run by the lab to monitor bacteria infection and the potential for sugar losses. Using a combination of methods as an indicator, biocide was added to various process points to at least attempt some sort of control.

2. PRELIMER: (Part of a DDS Juice Purification System) Adjusted the backmixing baffles to get a lower pH in the first compartments to get better floc stabilization and more effective dextran removal. The sludge recycle return point was moved from the No. 4 to the No. 2 (towards the juice inlet end) compartment to improve floc quality. Sludge recycle rates were maintained at the 60-65 percent level to improve settling of 1st carbonation muds.

3. FIRST CARB AND DORR CLARIFIER: There was very close attention to the settling rate and clarity of dorr underflow and effluent, respectively, through the adjustment of alkalinity and flocculant addition rate. Set up very precise mixing instructions for the settling aid to produce consistency between shifts and calculated ppm addition rates hourly or on noticeable changes in the processing rate. Tried to hold addition rates at between 1 - 1.5 ppm. Felt that potential filtration difficulties could occur at rates over 2 ppm.

4. SECOND CARB: Dextran inhibited the growth of calcium carbonate crystals in the 2nd carb causing blinding of filter cloths and short cycle times of kelly filters. (There were times when a kelly filter was being pulled and cleaned every 6-7 minutes).

   a. Milk of Lime - Initially added M.O.L. to 2nd Carb at the rate of 0.5% on juice. Increased rate to 1.5% on juice before improvement was noticed. M.O.L. acted mainly as a filter aid with no noticeable improvement in N.S.

removal or sugar quality.

b. 1st Carb Recycle - This was tested only in the lab and the tests showed that the mud redissolved in the alkalinity of 2nd carb. Did not use in the full scale process.

c. Aragonite (Mississippi Mud) - Aragonite is the orthorhombic crystal (needle shaped) versus the hexagonal calcite form of precipitated calcium carbonate. It is used not as an additive to hydrolyze the dextran , but as a crystal modifier and to provide surface area to form agglomerated grain. Aragonite was used as a means to produce larger crystals that would filter more easily, and was found to be most effective at 300 ppm dextrans or greater with an addition rate of 500-1000 ppm.

d. Filteraid FW-12 - When the alligators were nipping on an especially bad day, we started adding FW-12 at a 500-1000 ppm addition rate. There was a significant improvement in filtering rate. At high dextran levels (300 +), it worked well in combination with Mississippi Mud. Below 300 ppm, most times the FW-12 was effective on its own.

e. Relocation of Returns - Moved kelly excess, and excess sweetwater and filtrate from kelly supply to 2nd carb. This prevented short circuiting of dextrans back to kelly filtration.

A mixing tank, mixer, pump and two (2) accu-rate feeders were set up to add the aragonite and/or filteraid to the 2nd carb supply line.

5. SOFTENER: Higher limesalts caused the need for higher soda ash addition rates to keep softener feed at 0.060 limesalts. Saw tremendous expansion and contraction of the resin. At the end of campaign, rejuvenated the resin with magnesium chloride with no significant improvement in resin capacity. Close inspection of the resin revealed physical damage. The resin appeared soft and porous, not firm like new resin. Further study suggested an oxidizing of the resin as a prime suspect in resin deterioration. With extreme filtration difficulties, could not adequately maintain level in softener supply/degassing tank. Inadequate retention time and/or actually pulling air into the supply pump likely caused air to enter cells and cause resin deterioration. New resin was required for the next campaign.

6. SUGAR END: Reduced production rates. Dextran acts very much like raffinose in that it produces a needle like crystal and also increases the viscosity of sugar end streams. Produces raw fillmass that is very difficult to handle and exhaust. This was compounded by the high soda ash addition causing high rates of molasses production and high purity.

7. SEPARATOR: Molasses filter service times were reduced because of high pressure drop across the filters caused by the viscosity effects of the dextrans. Stored molasses had a filtration coefficient of 0.95 - production molasses 1024 (approx).

Dextrans in molasses:

9-30-91	105
11-25-91	6190
1-13-91	3470

Dextrans did separate to the raffinate, so extract did not cause a recycle of dextrans to the sugar end.

OBSERVATIONS:

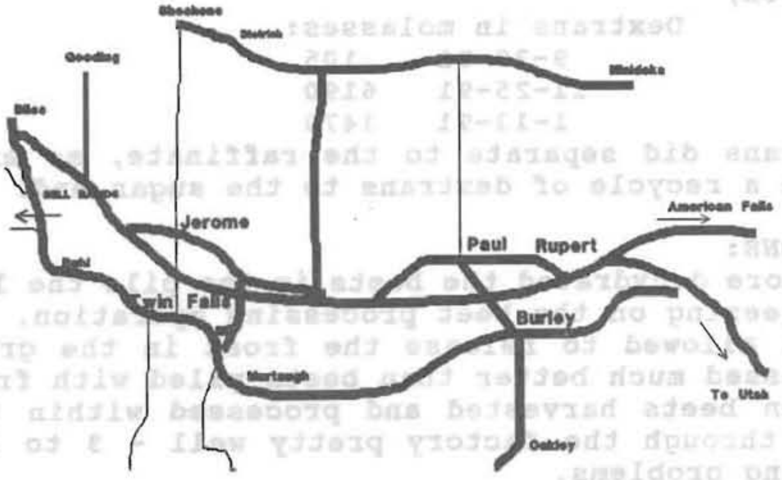
1. The more dehydrated the beets in the pile the less the effect of freezing on the beet processing operation.
2. Beets allowed to release the frost in the ground naturally processed much better than beets piled with frost damage.
3. Frozen beets harvested and processed within three (3) days went through the factory pretty well - 3 to 5 days started showing problems.
4. The importance of good communications between the Operating and Agricultural Departments was clearly demonstrated.
5. The use of new materials (to our process) such as aragonite and the use of standard materials such as Diatomaceous Earth Filter Aid in a non-traditional application proved to be effective in allowing the majority of the crop to be processed.

The efforts of the Agricultural Department in their areas of responsibility must be recognized and commended in helping the Magic Valley Factories address the "Z" beet problem. Ag people were stationed at piling grounds around the clock to personally monitor beets loaded and help assure the least possible negative impact to the factory process. If beets had been allowed to be loaded and delivered as "pile-run", there would have been many more days the factory would have been brought to its knees.

The 1991-92 campaign will be noted in the Amalgamated history book for the worst processing conditions encountered during an operating campaign. Things were tough and will not be soon forgotten. What is really noteworthy is how well the factory operated in spite of the sometimes impossible conditions. It demonstrates the adaptability, perseverance, and innovative abilities of our operating and mechanical employees. Their efforts are appreciated and are to be commended...there are none better!

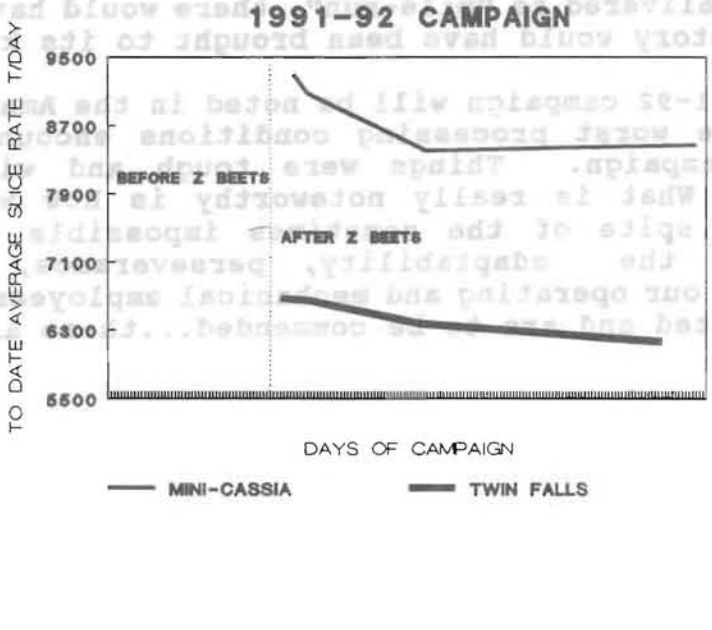
MAGIC VALLEY

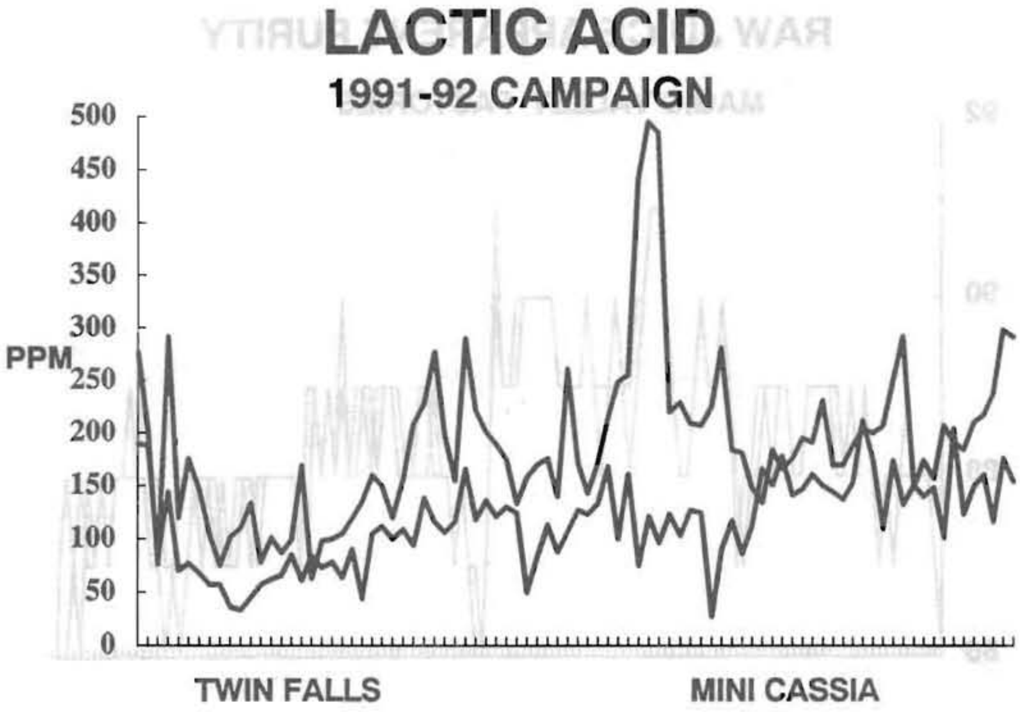
REGION OF SOUTHERN IDAHO



MAGIC VALLEY FACTORIES

1991-92 CAMPAIGN




LACTIC ACID
1991-92 CAMPAIGN
PPM
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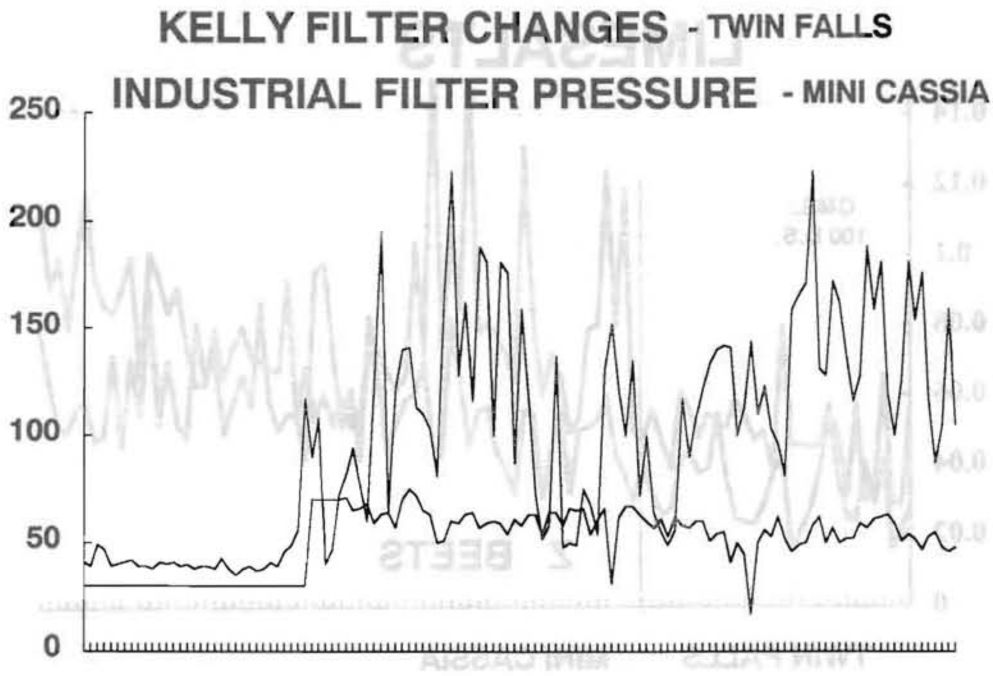
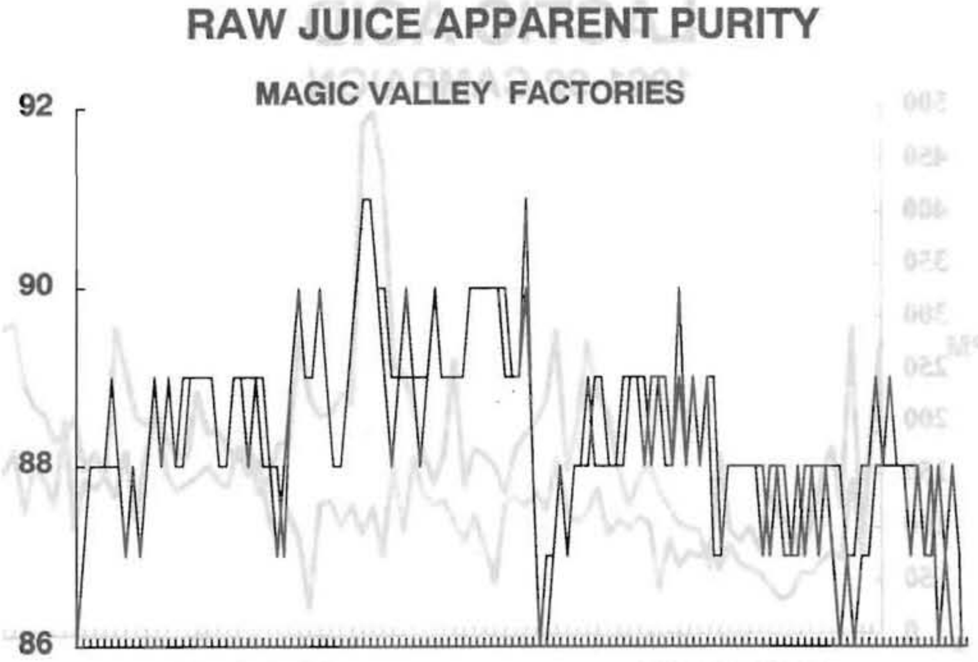
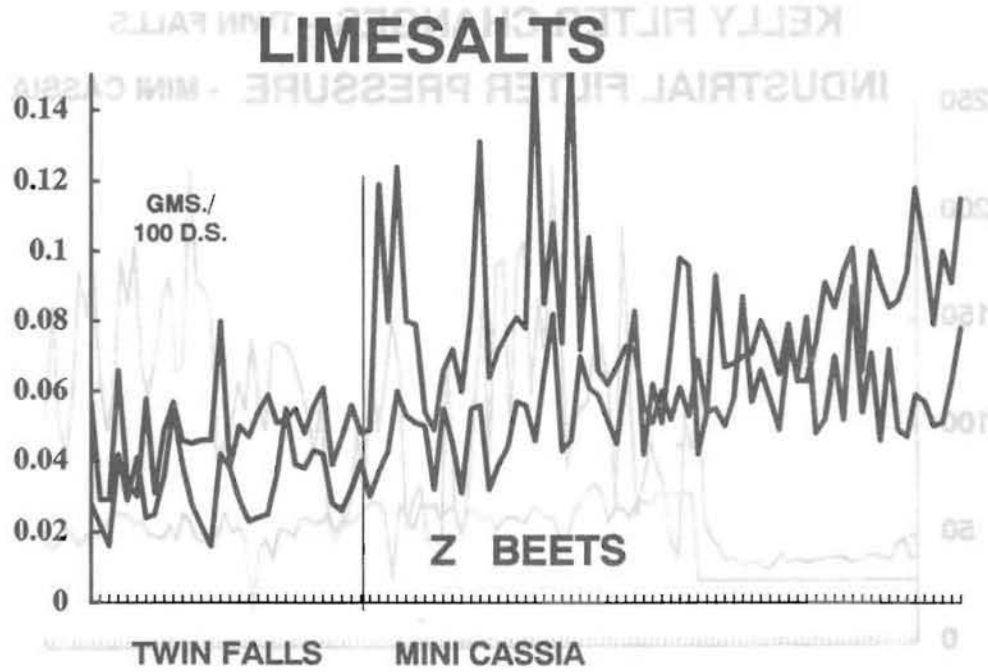
450
400
350
300
250
200
150
100
50
0
TWIN FALLS
MINI CASSIA


KELLY FILTER CHANGES - TWIN FALLS
INDUSTRIAL FILTER PRESSURE - MINI CASSIA
250
200
150
100
50
0


RAW JUICE APPARENT PURITY
MAGIC VALLEY FACTORIES
92
90
88
86


LIMESALTS
0.14
0.12
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0
GMS./
100 D.S.
Z BEETS
TWIN FALLS
MINI CASSIA

CWT GRAN SUGAR PRODUCED