Utah's Pioneer Beet Sugar Plant:
THE LEHI FACTORY of the UTAH SUGAR COMPANY

BY LEONARD J. ARRINGTON

The Lehi factory of the Utah Sugar Company occupies a pre-eminent place among the early sugarbeet factories of America. Commencing operations in 1891, it was the first sugarbeet factory in the Mountain West, the first to utilize beets grown by irrigation, the first to have a systematic program for the production of its own beet seed, the first to use American-made machinery, the first to use the "osmose process" of reprocessing molasses, the first to build auxiliary cutting stations, and the first to have been established as part of a great social and religious movement. This factory also served as a training base for a high proportion of the technical leaders of the sugarbeet industry of the United States. After 75 years it is well to remind ourselves of the truly pioneering character of this first successful sugar enterprise in Utah.

The story of the construction of the Lehi plant begins with the efforts of Arthur Stayner, a Mormon horticulturist from England, to make sugar

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from sugar cane, sorghum cane, and sugarbeets in the 1880's. In 1887 Stayner received a $5,000 bounty from the territorial legislature for the first 7,000 pounds of marketable sugar produced in Utah. This brown sugar was made from grain sorghum at a small plant erected at Spanish Fork in 1886. Continuing in his efforts to found an industry, Stayner visited the experimental sorghum cane plant of the federal government at Fort Scott, Kansas, and also the pilot beet sugar plant of E. H. Dyer at Alvarado, California, which was the first successful sugarbeet plant in the nation. With passionate earnestness Stayner solicited the support of church and business leaders until they finally agreed to participate in the formation of a company to finance further investigations.

On September 4, 1889, the Utah Sugar Company filed incorporation papers in Salt Lake City. Total subscribed capital stock was $15,000, consisting of 1,500 shares with a par value of $10.00 each. Only 10 per cent of the capital ($1,500) was paid up. The president was Elias Morris, a Salt Lake City builder who, as a Welsh immigrant, had been in charge of sugarbeet machinery transported from England to Utah in the 1850's in an earlier Mormon attempt to produce sugar from beets. The other officers were Vice President Francis Armstrong, a Salt Lake City utilities executive; Secretary Arthur Stayner, who also assumed the role of general manager until the spring of 1891; Treasurer James Jack, financial secretary of the Church of Jesus Christ of Latter-day Saints; and the officers already listed plus Henry Dinwoodey, Charles H. Hardy, Leonard G. Hardy, Amos Howe, Charles W. Stayner, Samuel P. Teasdel, George W. Thatcher, R. K. Thomas, and Henry Wallace as directors. Other important stockholders (there was a total of 28) were Wilford Woodruff and George Q. Cannon, of the L.D.S. Church First Presidency; Daniel

Unless otherwise indicated this paper is based primarily upon Fred G. Taylor, A Saga of Sugar (Salt Lake City, 1944), and manuscript materials in the archives of the Utah-Idaho Sugar Company, 47 West South Temple Street, Salt Lake City. The latter include: Minute Books of the Utah Sugar Company, The Utah Sugar Company, and the Utah-Idaho Sugar Company; papers and memoirs written and collected by Walter L. Webb, a retired executive of U & I (hereafter referred to as the Webb MSS); and verifax copies of clippings and excerpts from clippings collected by Dan Gutleben (hereafter referred to as Gutleben MSS). The Gutleben MSS on Lehi consist essentially of excerpts from articles in the Lehi Banner, 1891–1901, of which Walter Webb was editor; Deseret Evening News (Salt Lake City); Salt Lake Herald; and Salt Lake Tribune. There is also a collection of Webb MSS, including a long "oral history interview" with Walter L. Webb, in the archives of the Brigham Young University Library.

Nine letters from Arthur Stayner to members of the First Presidency of the Church of Jesus Christ of Latter-day Saints, written in 1888 and urging church promotion of a sugar manufacturing enterprise, are in the Arthur Stayner file, Manuscripts Division, L.D.S. Church Historian's Library, Salt Lake City.

The first action of the company after incorporation was to appropriate $300.00 for a “first class” polarscope to be used in testing the sugar in the beets being grown on an experimental basis in Utah. The second action was the appointment of a committee of five persons (Morris, Armstrong, A. Stayner, Howe, and Thatcher) to visit the two beet factories in operation in California and the sorghum plant in Kansas. According to the committee’s report, as presented to the board of directors on October 23, 1889, the factory of the Pacific Sugar Company at Alvarado was earning profits at the rate of $500.00 per day for a run of 90 days. This was a 25 per cent return on invested capital of $190,000. The works of the Western Sugar Company at Watsonville, California, was earning profits of almost $1,000 per day on a 90-day run, which was 19 per cent on the invested capital of $475,000. On the other hand, because of adverse weather and other factors, the $72,000 sorghum sugar works near Fort Scott, Kansas, was found to be in a failing condition. Stayner remained convinced that the alkali in Utah soils would increase the refractoriness of beet juice and render its crystallization uncertain and costly, and continued to argue for a dual plant which could work up both cane and beets. But the remainder of the committee began to be more and more impressed with the possibilities of a single-purpose beet plant.

The next step was to determine the practicability of beet sugar production in Utah. Seed was acquired and distributed widely, and local newspapers carried articles on the culture of the beet. Tests of beets grown in widely scattered areas of the territory showed a satisfactory sugar content. The committee calculated that the cost of growing and manufacturing beets in Utah would be no greater than in California. The committee also ascertained that there was a good choice of sites for a factory, with suitable land for growing beets, ample supply of water, and close proximity to other manufacturing materials and markets. A factory, according to committee calculations, would cost $300,000. With a working
capital of $50,000, this would mean a total capital requirement of $350,000. Such a factory would cut 30,000 tons of beets per season and produce 6 million pounds of sugar. By paying farmers $5.00 per ton for the beets, and selling the sugar for seven cents per pound, profits would amount to $120,000 per season, yielding a return of about 33 per cent on investment.

Spurred on by the profit incentive, the board, on November 20, 1889, made a definite decision to build a factory. Officers and directors prepared a prospectus setting forth the objects and prospects of the company and the amount of capital needed. At the same time they investigated suitable sites from the standpoint of their technical feasibility and the financial inducements that might be offered by the communities in which they were located. Arthur Stayner and others also persuaded the territorial legislature, meeting in the spring of 1890, to vote a bounty of one cent per pound on all sugar manufactured in Utah during the succeeding two years. (This bounty was renewed for a second biennium in 1892.)

**The Lehi Factory**

Upon solicitation from the board, the Oxnards, who had begun three factories in Nebraska, bid $450,000 for a 300-ton factory imported from Europe. E. H. Dyer and Company, who had made arrangements with the Kilby Manufacturing Company of Cleveland to make machinery according to their design, bid $400,000. A contract was let to the latter on November 5, 1890. This provided that the factory be completed by October 1, 1891, and that two of the Dyers remain to manage the factory during the first two campaigns. The Utah people agreed to procure railroad communication with the plant in time for the reception of machinery and building material.

Because the cost of the factory and other expenses were much in excess of original estimates, the capital stock of the company was increased to $1 million on October 9, 1890, and an issue of $400,000 was placed on sale immediately thereafter. The only substantial subscriptions came from a group of persons from Lehi, including John Beck, the mining magnate; Thomas R. and John C. Cutler, merchants; and John Austin and sons, farmers and stockmen. The Lehi group provided a particu-

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6 A printed circular entitled “Extracts from the Report of the Committee of the Utah Sugar Company on the Practicability of the Sugar Industry in Utah,” dated May 13, 1890, is in the Utah Sugar Company file of the Manuscripts Division, L.D.S. Church Historian’s Library.

7 A printed “Prospectus” of The Utah Sugar Company, dated November 14, 1890, is in the Utah Sugar Company file of the Manuscripts Division, L.D.S. Church Historian’s Library. Attached thereto is a printed letter from the church First Presidency, same date, asking local church officials to cooperate in the subscription drive.
The Lehi Sugar Factory shown on the title page was constructed in 1891. This photograph was made after the capacity was expanded four-fold in 1900. In 1924 the factory was retired, and finally dismantled in the 1930’s.

Peculiarly attractive financial inducement. Through Mayor Samuel Taylor, Lehi offered as a building site 40 acres of the old Mulliner Flour Mill property (including building rock), together with a perpetual water right to the millpond sufficient to run the factory. Lehi also offered to donate $1,000 to apply on the purchase of additional ground, $1,000 in labor to make a good road to the site, 1,500 acres of land (at $30.00 per acre) for a company beet farm, 80 acres of good limestone quarry eight miles from Lehi, and subscriptions for $88,000 in company stock.

After several visits to the chief contending locations in Cache, Weber, Salt Lake, and Utah counties, the directors finally approved a motion, on November 18, 1890, to begin immediately the work of building at Lehi. The site was admirable from a transportation standpoint since the Rio

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8 The first gristmill in Lehi was erected by Samuel Mulliner, with the assistance of villagers, in 1854. A millpond was created by diverting the stream from a spring which ran down into Utah Lake. Walter L. Webb, “History of the Old Lehi Grist Mill,” Lehi Free Press, May 26, 1960.

9 See also Hamilton Gardner, History of Lehi (Salt Lake City, 1913), 261–62.
Grande Western Railway passed on one side and the Union Pacific Railway on the other.

A formal cornerstone-laying ceremony was held on December 26, 1890, at which were present more than 2,000 persons, including the First Presidency of the Mormon Church, leading business and political figures in the territory, and farmers and mechanics from several nearby communities. President Wilford Woodruff said:

I want to say to all Israel that we believe it right to dedicate everything we engage in to the Lord. We have assembled today to lay this cornerstone, as is our custom in establishing all our temples. I will call on President George Q. Cannon to offer the dedicatory prayer. . . . I want you all to unite on the subject of sugar. There is not a question of public improvement which is of more value or has better prospects than sugar. God bless you.

After placing a tin box with contemporary relics in position and laying the stone in place with cement mortar, President Cannon said, “I take pleasure in announcing that the cornerstone of the Utah Sugar Factory has been laid. God bless it.” A newspaperman then reported that he mounted the stone and offered prayer, at the close of which there were “three cheers for the enterprise, which were followed with great spirit and two additional tigers.”

As designed by the Dyers the main factory was 172 feet long, 86 feet wide, and three stories high. The factory annex was 176 feet long and 38 feet wide — 76 feet of it, containing bone black filters and lime kiln, was three stories high, while the other 100 feet where the steam plant was located was but one story. One hundred carloads of machinery, valued at $260,000, were shipped from Cleveland to equip the plant. Back of the main buildings were six beet sheds, 500 feet long and 24 feet wide, with a capacity of 14,000 tons of beets. There were four pulp silos 180 by 24 feet and 10 feet deep, and coal bins 250 feet long and 48 feet wide. The millpond which furnished most of the water was fed by natural springs with a capacity of 4 million gallons in 24 hours. The facilities also included a boardinghouse with accommodations for 50 people.

While the Dyers were engaged in the construction, committees were appointed to visit the farmers and “labor with them” to raise the beets required by the enterprise. But the principal concern of the company was

10 Salt Lake Herald, December 27, 1890; Deseret Evening News, December 27, 1890.
11 Contemporary descriptions of the factory and its construction are found in Deseret Evening News, May 23, 29, October 8, 1891; Salt Lake Tribune, October 8, 1891; Scientific American, LXV (December 5, 1891), 360; and Herbert Myrick, The American Sugar Industry (New York, 1902), 54–60.
financial. Even before the cornerstone was laid the company owed the Dyers $50,000 in cash as first payment, but the company was unable to raise even this sum. The church assisted the drive for funds by appointing committees of general church authorities to visit the various congregations in northern Utah to solicit subscriptions. Not much was raised. A committee was appointed to visit the Dyers to see if an extension of time could be arranged on the first payment, but the Dyers reported that they had already placed orders with the machinery manufacturers in Cleveland and that they could not grant the extension. Serious consideration was given to forfeiting the $50,000 deposit and abandoning the whole project. But President Woodruff declared that "the inspiration of the Lord to me is to build this factory." 12 Finally, at the December 9 meeting of the board, President Cannon moved "that we pay the first $50,000, that the treasurer raise all he can, and that he personally [President Cannon] will raise the remainder."

This, of course, was only the first payment. Additional payments of $50,000 were due in February, March, and April, and substantial amounts in the months following. As the time for the second payment of $50,000 approached, the company and First Presidency joined in appointing Apostle Heber J. Grant as financial agent to produce the funds. He and others, including many company and church officials, devoted anxious weeks to the solicitation. They sought to sell stock, obtain credit, and make loans in any amount, no matter how small or humiliating, to make the payments to the contractors. Person after person was authorized to raise money. Upon the resignation of Arthur Stayner, Thomas R. Cutler, an English immigrant who was bishop of the Lehi L.D.S. Ward, was appointed general manager. Cutler and others made contacts with Mormon capitalists and with banks in Salt Lake City, San Francisco, Chicago, New York, and Boston. What little working capital the company was able to acquire was used to pay the expenses of officers' travel for the purpose of borrowing money. All told, something like $200,000 was subscribed by several dozen Utah citizens (though virtually none of these subscriptions was fully paid for several years), $50,000 was subscribed (fully paid up) by the Mormon Church; $130,000 was borrowed on a short-term loan from the church; $150,000 was borrowed from Salt Lake City banks on notes signed by the First Presidency of the church; and

12 As reported by Heber J. Grant, Ninetieth Annual Conference of the Church . . . (Salt Lake City, 1919), 8–9. Also statement of George Q. Cannon, Deseret Evening News, October 22, 1900.
Thomas R. Cutler (1844–1922), second general manager of the Utah Sugar Company.

E. H. Dyer, builder of sugar factories, constructed the Lehi Factory for $400,000. Members of his company remained at the factory to manage it through two campaigns. Another $100,000 was borrowed, on a similar endorsement, from Wells-Fargo in San Francisco.

The First Sugar

The financial problems became ever more critical as the stockholders, creditors, factory officials, growers, and others awaited the opening of the plant in October. Would it actually produce sugar? The cloud of uncertainty was darkened by the expressed doubts of many who had been involved in the earlier attempt of the Mormons, in which the only product had been a syrup so sharp that “it would take the end of your tongue off.” James Gardner, who had learned the art of boiling molasses in a church sugar cane enterprise in Hawaii, related the events of October 15, 1891, as follows: 13

The first strike of sugar was watched with great interest and considerable concern. Such a crowd of citizens were present in the pan room while the boiling was going on that it was difficult to get around. . . . Fred

13 Taylor, Saga of Sugar, 91.
Trane was the "doubting Thomas" who repeatedly stated that he wouldn’t be convinced that white sugar could be made from that black syrup until he saw the sugar right in his hand.

It was after midnight when the strike was dropped, but they all waited for that important event. Then everyone rushed to the centrifugal and when the first machine had spun off the molasses, Mr. [Ed] Dyer could hardly get room enough to perform the washing. However, he soon passed out the clear white sugar, giving each one of his audience some of it “right in his hand.” Immediately “hurrahs” and “hosannas” filled the air — even Fred Trane cried out, “I’m now convinced that sugar can be made from beets!”

Manager Cutler telephoned the Salt Lake Herald: “We have just made the first pound of sugar. By morning we will have 20 tons ready.” That morning, 20,000 pounds of sugar were sacked and placed on a Union Pacific Railroad car. Upon arrival at the Salt Lake City depot the sugar was transferred to three drays. Led by a yoke of oxen to dramatize the pioneering nature of the enterprise, the procession made its way to leading Salt Lake City retailers under the sign “First Carload of Granulated Sugar Made by the Utah Sugar Company.” At the retailers’ “there was almost a riot of people taking the sugar.” Within two hours after the sugar was unloaded, it was distributed throughout the city, and within a short time confectioners displayed signs “First Candy Made from Utah Sugar.” In the meantime, in Lehi, the shipment of the first carload of finished product was celebrated by a factory marriage, with J. C. Jensen and Agnes Anderson united in the bonds of holy wedlock by Bishop-General Manager Cutler.14

The thrill and pride of the accomplishment is reflected in a variety of contemporary stories. At one of the shops all present accorded high praise to the new product except a drummer, who persisted in making disparaging remarks about “Lehi sugar.” It had a yellowish tinge, tasted of the beet, and so on. The proprietor finally told the salesman that he was the first to object to the Utah product and that he (the proprietor) could not see that it was so different from California cane sugar, but if that was what he wanted he could have it. So saying, he winked at a clerk and told him to “Hand this man a scoopful of that California sugar.”

“That,” said the salesman, “is the stuff! That’s sugar; none of your beet juice about that; see the difference in color?”

"Salt Lake Herald, October 16, 18, 1891. Sacks of sugar from the first beets were sent to President Benjamin Harrison, Vice President Levi P. Morton, members of the cabinet, and prominent senators and representatives. Their letters of appreciation, containing comments on the infant beet industry, are in the George Q. Cannon Papers, 1888–1892, Manuscripts Division, L.D.S. Church Historian’s Library."
When everyone burst out laughing, he finally realized that it was a trick—all of the sugar in the shop was made from beets at Lehi!\(^\text{15}\)

A similar episode occurred at the Knutsford Hotel, where a practical joker filled a box with salt and placed it on the counter under the label “First Sugar from the Lehi Factory.” Soon a salesman came along and with a broad smile grabbed a fistful of the sugar and popped it in his mouth. The result was an exclamation so loud and painful that it interrupted the family prayers of Proprietor Holmes in Parlor A.\(^\text{16}\)

As agreed upon previously, the general superintendent of the factory during the first season was Edward F. Dyer, son of E. H., the contractor. Clarence A. Granger was assistant superintendent; Hugh Dyer and Guy Dyer, foremen; M. W. Ingalls, master mechanic; Hubert Dyer, chemist; James H. Gardner, sugar boiler; and George Austin, field superintendent. Gardner and Austin, in addition to Manager Cutler, were the only Lehi men in command positions during the first campaign. Some 120 men were employed in and around the factory.

The factory “campaign” during this first season of production ran from October 12 to December 17, and operated 58 days or parts of days. During this period approximately 10,000 tons of beets were run through; 12,500 100-pound bags of sugar were produced. All of the sugar was sold in Utah. Indeed, the demand for the product of this new “home industry” was so strong “that orders ran ten days ahead continuously and the factory could not fill nearly all of the orders.”\(^\text{17}\) Even so, revenue from the first year’s sale was hardly enough to pay operating costs, let alone the heavy burden of interest and dividends.\(^\text{18}\)

### Historical Periods

The history of the Lehi factory may be divided into three periods:

1. The learning period, 1891 to 1898, during which Utah Sugar groped to establish the basis for successful agricultural and manufacturing programs. This was a period of frank experimentation, of occasional failure, and of technical and financial uncertainty.
2. The teaching period, 1899 to 1919, during which the know-how acquired during the pioneer years at Lehi was used by the Utah Sugar Company

\(^{15}\) *Salt Lake Herald*, October 19, 1891.

\(^{16}\) Ibid.

\(^{17}\) Gutleben MSS, “Lehi,” January 1, 1892.

\(^{18}\) E. F. Benson, in a report of his tour of sugar factories in the United States, said that in the early years the Lehi factory received six and one-half cents a pound for its sugar, plus a federal bounty of two cents per pound under the McKinley law and a state bounty of one cent per pound, and that it nevertheless ran behind $60,000 because the farmers didn’t know how to raise beets. Gutleben MSS, “Washington,” February 12, 1896.
to establish new factories in Utah, Idaho, and Washington, and to assist other companies desiring to establish new factories in many localities in the West and Midwest.

3. The period of decline, 1920 to 1939, during which the Lehi factory came to be replaced by larger and more modern factories and was eventually dismantled.

It is the early "learning period" in which we are most interested on the occasion of this seventy-fifth anniversary of the Lehi plant.

During the first two of these years, as previously mentioned, the factory was under the superintendency of the construction firm. Completely on its own, beginning in 1893, Utah Sugar chose Clarence A. Granger as superintendent and Henry A. Vallez as chemist. Both were brilliant and energetic young men who had served apprenticeships with the Dyers at Alvarado. In collaboration with Manager Cutler, they were eventually able to make the factory pay. But in the meantime the perfection of techniques for growing and irrigating beets, the technical problems confronted in their manufacture, and the decline in the world price of sugar produced losses year after year. Each year, as additional problems were solved, the company hoped for "good profits" the following season. Not until 1897, the seventh year of operation, did the books show a profit. The company's persistence, despite continued financial reverses, in working out technical and practical solutions to the many problems involved in growing beets and manufacturing sugar, illustrates the innovative contributions of this truly pioneer enterprise.

The significant activities of Utah Sugar during the learning or experimental period may be summarized under three headings: (1) production of seed; (2) growing the crop; and (3) operations at the factory.

Production of Seed

Most of the seed used in the experimental plots planted on Utah farms before 1891 was obtained gratis from the U.S. Department of Agriculture, which was seeking to determine the areas where the crop could be grown. The only available seed in commercial quantities was from France and Germany, and under a thoughtful act of Congress sugarbeet seed could be imported free from 1888 to 1892. Inasmuch as these countries tended to retain their best seed for their own use, that which was...
planted at Lehi during the early years was often of inferior quality. Much of the seed planted the first two seasons appears to have been mangel-wurzel, a variety of beets fed to stock. These pinkish beets fell far below the requisite percentage of sugar content and purity. Partly as the result of the urging of Henry Vallez, who knew there were better beets in France, Manager Cutler and Superintendent Granger spent several weeks in Europe visiting beet seed farms and factories and were able to contract for better seed. The varieties most often used were “Vilmorin Amelioree” from the great Paris seed firm of Vilmorin, Andrieux & Company, and “Klein Wanzlebener,” developed by a large seed establishment near Magdeburg in eastern Germany.

The uncertain supply, price, and quality caused the company to consider growing its own seed. In 1895, in cooperation with George Austin and the field department, Vallez selected the best beet fields in the Lehi district and saw that they were given good care. When the beets were grown, 30 tons of the best beets were selected for size and shape, tested for sugar content, and placed in pit silos near the factory. The following March these pits were opened, beets again selected and tested for sugar, and the best ones planted on a 13-acre plot of “good” land at the company-owned Saratoga Springs Ranch west of Lehi. These “Mother Beets” were planted by hand three feet apart in the row and in rows three feet apart, giving plenty of room for cultivation. This was the first attempt to grow beet seed in an arid, irrigated region.

Although the plants bloomed in profusion, the seed on the outside branches ripened first and had to be cut. To do this by hand was slow, expensive work in a pioneer country where labor was always scarce; but when the seed was threshed there was a crop of nine to ten tons of seed showing a high germination test. When the Secretary of Agriculture, James Wilson, visited the Lehi sugar works in 1897 he “expressed astonishment” at the magnitude of Utah Sugar’s seed planting activity, which he said was “the only one of the kind in America.”

This system was followed on an expanded basis in 1897 and succeeding years, with the company planting from 5 to 20 acres of Mother Beets yearly. In 1899, for example, the company produced more than 70,000 pounds of beet seed. Some of this seed was sold to other companies under

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20 Many contemporary sources indicate a prevalent belief that Germany did not want American sugar enterprises to succeed because this would destroy a potential market — hence the poor quality of seed exported. One can reject this conspiratorial theory and still acknowledge that the seed imported for use at Lehi was inferior.

21 There is some evidence that the company did not acquire the Saratoga farm until 1899. See Gutleben MSS, “Lehi,” October 29, 1899.
the name “Utah Klein Wanzlebener” and was said to be “superior in pure sugar per acre,” but “a little inferior in yield of tonnage.” \(^{22}\) When the American Beet Sugar Company and other companies took up seed growing on a still larger scale beginning in 1901, Utah Sugar’s seed production became less important. One difficulty was keeping the Mother Beets through the winter. Nevertheless, in 1904 when American sugar companies were seeking a monogerm beet seed (to replace the multigerm seed which caused several plants to come up in one spot), Utah Sugar proffered the U.S. Department of Agriculture the use of its Saratoga Ranch as an experimental farm. About 1,000 pounds of what were thought to be single-germ Mother Beets were set out, and several thousand pounds of their seed were planted the following spring. More than four tons of beets were harvested from this seed, and these were used as Mother Beets the following year. No success was achieved in this effort, but through continued experimentation scientists working for the Department of Agriculture and for such companies as Utah-Idaho Sugar eventually developed the commercial monogerm seed which farmers use today. \(^{23}\)


\(^{23}\) These early experimenters noted that there were occasional seeds which were single, i.e., were not part of a cluster. On the presumption that these were monogerm, they were planted and the beets which grew from them were used as Mother Beets with the intention of developing a
GROWING THE CROP

Sugarbeets are a relatively temperamental crop; they require special care and intensive cultivation. The ground must be well prepared; good stands depend upon proper planting, irrigation, and cultivation; and, until the mechanization of recent years, the heavy labor required at thinning, weeding, and harvest-time has tended to discourage all but the hardiest farmers.24

When George Austin planted the first sugarbeet seed on the farm of George Comer in Lehi in 1891, virtually nothing was known about the culture of sugarbeets in the arid West. Indeed, Manager Cutler estimated that the Utah Sugar Company spent $40,000 during the first two years just to educate Utah farmers in the art of growing beets. One aspect about which almost nothing was known either by the company or by the farmers was the proper procedure of growing beets by irrigation. Indeed, after unsuccessful experiments in Spain and Italy it was a common opinion that irrigation would ruin beets for sugar making.25 Clarence Granger had only his California experience to go by, and as he delivered lectures to Utah farmers on the growing of beets he instructed them not to fertilize for that would produce large beets — and size was incompatible with quality. Indeed, the factory refused beets that exceeded three and one-half pounds in weight. Granger also instructed farmers not to irrigate more than once or twice a year — and then only in midsummer.26 Too much irrigation — and here he was merely echoing what was generally believed — would diminish both the sugar content and the purity. Utah farmers, who had produced crops under irrigation for more than 40 years, did not accept this idea and were unenthusiastic about signing contracts with any such stipulations.

Consistent monogerm strain. But it is probable that these single seeds were the product of broken-off segments of multigerm clusters and that the Mother Beets from these segments could produce only multigerm seed and did not have genetic monogerm characteristics. Not until the work of two Russian-born Salt Lakers, V. F. and Helen Savitsky, were the genetically-bred monogerm seeds used today made possible. See U.S., Department of Agriculture, Bureau of Plant Industry, C. O. Townsend and E. C. Rittue, The Development of Single-germ Beet Seed, Bulletin No. 73 (Washington, D.C., 1905); Palmer, Sugar Beet Seed, 78–84; “A Life of Service for the Benefit of Humanity,” The U & I Cultivator, XXIV (Spring, 1964), 38–40, and (Fall, 1964), 20–21.


Mark Austin told Dan Gutleben that “if Granger strove for the wrong way to grow beets, he was completely successful.” Gutleben MSS, “Travel Diary, April 1931.” See also Gutleben, “Dear Harry,” December, 1945, p. 21 (mimeographed letter, Utah-Idaho Sugar Company Archives).
During the first season the company contracted with 556 farmers to grow 1,800 acres of beets. Many of these first hesitant contracts were for no more than one acre; the average was three acres to the farmer. One reason for the small plots was that Utah farms were characteristically small. Another was the lack of proper implements. Utah's primary field crop had been grain, which was irrigated by flooding, but sugarbeets had to be planted in rows and irrigated by furrows, as with garden crops. Granger had specified that beets be planted in rows eight inches apart, which was too close together to permit the use of horse-drawn equipment. Thus, under company direction growers used hand planters, hand-push hoes as cultivators, and pull hoes as corrugators. The only large operation was conducted by the company itself, which owned a 1,000-acre farm, with 146 acres in beets in 1891 and 400 acres in 1892.

Since the rate of germination of beet seed was not particularly high, seed was planted in practically a continuous stream in order to insure a good stand. Since the seed was multigerm many plants often sprouted from a particular cluster. But beets would not mature that did not have living space, and so the plants had to be "blocked" and "thinned." (The original instructions were to block and thin the beets three inches apart, but later experience demonstrated that beet plants should be 8 to 10 inches apart.) Thinning was "stoop labor," and farmers in many parts of the country would not do it. The solution in such places was to import families of newly arrived immigrants — Russians, Germans, Japanese, or Mexicans. Utah deviated from this pattern, and most of the work was done by the farmer and his family. For the factory farm and other large acreages, Utah's high birth rate insured an ample supply of boys, whose labor in a beet field was approximately equal to that of an adult. When the plants were two or three inches high, i.e., about the time school let out in May, brigades of boys from Lehi and other villages would congregate at the meetinghouse at 6 A.M. and ride horses or wagons out to the fields.

T. F. Kirkham and Al Yates recall their thinning experience when in their early teens.

We aimed to be in the fields to begin work at seven in the morning, took an hour out for noon, and quit at six in the evening. For that day of ten hours

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27 "Chinese and Japanese laborers don't get tired," while "white laborers refuse to get down on their knees." Gutleben MSS, "Labor," June 11, 1897, April 19, May 9, June 3, 1899, March 14, 1902.

28 Having settled according to the Mormon village pattern, the people lived in "town" and rode or walked to their fields each day to work. See Lowry Nelson, The Mormon Village: A Pattern and Technique of Land Settlement (Salt Lake City, 1952).

29 Paraphrased from recollections in Webb MSS, 13–14.
we received 50 cents — 5 cents per hour — and were very glad for the job. The beet gang consisted of a group of men and boys. Older boys with long-handled 4-inch hoes would block the beets, that is, chop the compact row of plants into bunches. The younger boys crawled behind on their hands and knees, with a short-handled hoe, thinning each block to a single good plant. To save wear and tear most of the boys wore knee pads — i.e., sack-like cushions tied with strings above and below the knee. Every thinner had for this highest ambition the time when he would have a crawler following him on hands and knees. Twenty rows 40 rods long was a good day’s work and parents had no trouble getting boys to bed by suppertime. One person could thin from a fourth to a half of an acre per day.

The transportation of beet workers to the beet fields in the 90's sometimes became a problem. Old Bill Cutler and Lawrence Hill with their teams and wagons with boards placed across the box as improvised seats, provided a big share of transportation. Some men took their buggies; many boys rode horseback. Each rider and each driver provided himself with long stake ropes and at the field of activity the horses would be staked to fences and ditch banks and allowed to feed while the owners worked. At noon the horses would be taken to water and staked again for the afternoon. At the close of day it was like a cavalry charging down the road to home with those horses and wagons stirring up the dust.

Similar gangs of boys were used for hoeing out “corrugates” or ditches down each row for irrigation purposes, and for hoeing and weeding in midsummer. Many hoeings were regarded as indispensable, and it was not uncommon to hear a farmer urge on the boys by repeating the German admonition, “The sugar must be hoed into the beets.”

The beet harvest approached in late September and early October. The original technique of digging was to use a horse-driven sub-soil plow with mold board and share removed, which would dig into the ground and loosen the beets without bruising them. Gangs of older boys, now let out of school for a two-week “beet vacation,” would follow with large butcher knives or machetes. Reaching down and grabbing the leaves with one hand, they whacked off the crown of the beet with one blow. The “tops” would be dropped to the ground to be plowed under or consumed by sheep, and the beet itself would be tossed into a pile. Other boys would throw the beets one by one into horse-drawn wagon boxes, which were then hauled by team to the factory and unloaded by hand. (After the first year or two, local blacksmiths fashioned “beet forks” for the unloading.) Farmers in outlying districts which were too distant for hauling by team took their beets to “loading stations” where they were dumped into bin cars and shipped by rail to the factory. Both thinning and

30 Hamburger, Beet Growers’ Manual, 70.
31 Walter Webb wrote that during one of the early campaigns a farmer from a distant town grew some beets which he hauled to the factory. After unloading them he waited around nearly
topping were back-breaking tasks, as the writer can personally testify, and Utah’s boys became men at an early age via the sugarbeet route.

At the time the Lehi factory was built in 1891 a farmer could earn about $20.00 per acre growing wheat, $13.00 from hay, and $36.00 from potatoes.32 With the company offering $4.50 a ton for beets (compared with $4.00 in California and $3.50 in Nebraska), a 10-ton crop would bring $45.00 per acre. But the average yield for the 1891 season was actually about half this much. The total crop amounted to 9,540 tons, with an average tonnage of only 5.3 per acre, or a cash value of approximately $24.00 per acre. It was a great disappointment to both the farmers and the factory men. Much of the explanation, of course, lay in the company’s insistence on only one or two waterings, and in its refusal to accept the larger beets.

Although it was feared that the farmers might not grow sufficient beets another year, the church joined in the persuasion, and 604 farmers signed contracts for about 1,800 acres the second year.33 Care was taken to level and work down the ground in a more systematic way, beet cultivators were fashioned by local mechanics, and more care was exercised in irrigating the crop. When the harvest was over the tonnage was up above 10,000, with an average of 6.7 tons per acre. This was not a large increase but enough to give some encouragement.

For the third season — the first which was completely directed by “local” people — new contracts were issued to 763 farmers which omitted some of the ill-advised instructions of the first two years. The quality of beets had not been specified in former contracts, and the company now indicated its refusal to receive beets under 12 per cent sugar and 80 per cent purity. Some 2,755 acres were planted. With better seed, greater knowledge of beet growing, more care in thinning, more frequent waterings, and better implements for planting, cultivating, and harvesting, the 1893 crop totaled 26,800 tons — an average of 9.7 tons per acre. The industry now had a better standing with the farmers, and the factory people were happy to have more beets to work — more than they had had for the two previous campaigns put together. This was a kind of turning point for the agricultural department. In 1895 the acreage was 3,300; in
1899, 5,000; in 1900, 7,500. Other districts watched the progress made at Lehi, and when the tons harvested per acre reached 12, other factories were planned.

One innovation which resulted from farmer enthusiasm was the construction of a cluster of satellite factories called “cutting stations” — the only such system in American experience. Erected at a cost of about $150,000 each, these slicing plants cut the beets, produced the juice, and pumped it through a pipeline to the parent factory. The first of these was erected at Springville in 1899, and was connected with the Lehi factory by means of a five-inch pipeline — the first such facility in the United States. Additional slicing plants and connecting pipelines were built in 1900 at Bingham Junction (West Jordan), and in 1901 at Provo. A fourth, erected at Spanish Fork in 1904, was connected with Lehi by means of a 22-mile pipe which was the longest beet pipeline in the world. (In 1916 this station was removed to Pleasant Grove.) These four auxiliary slicers, each with a capability of cutting 350 tons of beets per day, served to expand the acreage territory of the mother plant at Lehi. Beets from as far north as Bear River Valley, and from as far south as the Sevier River Basin were ultimately transformed into sugar at Lehi.

In the long run, however, the pipelines were not a success. Placed in alkali soil, the pipes corroded and developed thousands of small leaks. Even so, the stations at Provo and Pleasant Grove were still operable when the Lehi factory closed in 1925.

During the early years at Lehi, the factory recommended that the farmers plant their crops on land which had been planted to sugar beets the preceding year. The reason for this was that this land was already “worked up”; i.e., leveled, harrowed, and prepared for the intensive kind of cultivation which sugar beets required. Two problems arose as the result of this custom. The first was that the importance of crop rotation in maintaining soil fertility was overlooked. Since each crop took certain nutrients out of the soil, it was harmful to grow sugar beets on the same land year after year.

The second was the propagation of parasites which fed on the beet. In fields where beets were grown year after year “bad spots” appeared, yields declined, and eventually whole fields were not worth digging. The cause of this was not known until 1901, when Dr. E. G. Titus found beet nematode in two fields in the Lehi district. This tiny pest, hardly visible to the naked eye, had infected the beet growing districts of Europe and was probably carried to Utah on sugar beet seed. By working on the
The rootlets of the beet, the nematode effectively stopped growth. Clods of soil infested with brown cysts containing nematode eggs were gradually spread over the fields by cultivators, levelers, harrows, and irrigation water. They spread from farm to farm by means of machinery and by farmers carrying back infested dirt from the beet dump. Years passed before factory officials became aware of the problem, but when they did the growing of beets year after year on the same field was stopped.

A definite system of crop rotation was advocated so that crops were planted on which the nematode could not feed. Methods were adopted at the beet dumps so that each farmer took back only the dirt and screenings
from his own farm. While these practices were instituted too late to prevent the infestation of thousands of acres in the Lehi district (thus contributing to the closing of the Lehi factory in 1925), Lehi's lesson of the necessity of rotation saved other districts from the same fate.  

**Operations at the Factory**

Perhaps the most important pioneering aspect of the Lehi factory was the manner in which farmers and rural laborers, who knew nothing about machinery, were taught to manage the various factory stations. The California and Nebraska factories had made substantial use of immigrant-specialists, but the Lehi management took on men whose knowledge of power was restricted to horsepower and manpower and taught them to operate a factory making use of steam and electricity. Illustrative of the magnitude of the task was the astonishment of the master mechanic when his chief assistant, a few weeks after the plant was in operation, asked him if the armature revolving between the field magnets was for the purpose of keeping the magnets cool! On another occasion part of the plant went dark because a fuse was blown when a sacker began probing in a light socket with his big sewing needle in order to find out where the light came from. On still another occasion a man was killed unloading a centrifugal because the blade whirled with such rapidity and smoothness that he did not realize it could hurt him. Another workman was badly burned in the boiler room before learning the dangers of steam. These lessons were slow and painful, but unforgettable!

Relying on their California experience, the Dyers had cautioned that frosted or frozen beets would yield low percentages and purities of sugar. They suggested the erection of long covered sheds into which the beets hauled in by farmers were thrown. The sheds were made frostproof by a double wall filled with cinders, and a roof covered with earth. There was no screening of dirt and leaves brought in by the farmers, so that the well-protected piles of beets in the bins inevitably contained small bits of tops which began to heat. Because of poor circulation of air in the tightly covered sheds, a rot was eventually produced which had a far worse effect on sugar extraction than frost. It was several years before the company reluctantly abandoned the covered bins and left the piles out in the open.

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35 M. W. Ingalls, “Early Days at the Lehi Sugar Factory,” *The Cossette*, III (June, 1921), 1; Webb MSS.

36 *U & I Farm Messenger* (September, 1933), 5, 6.
The beets in the sheds were conveyed into the factory by means of a wooden flume through which flowed a current of warm water. Thrown by hand into the flume, the beets were carried to the washer in the factory. (Later, in 1900, a V-shaped wooden floor was put in the shed and sloped so that the beets would naturally roll toward the flume. This saved the labor of five men.) The beets were raised from the flume to the washer by means of a large 16-foot “beet wheel,” designed by Chief Engineer Merrill Ingalls especially for the Lehi factory and later standard equipment in all factories. From the washer the beets were conveyed by a bucket elevator to a “cutter,” in which special triangular knives sliced the beets into long slender slices (“cossettes”) that looked something like shoestring potatoes. Because of lack of screening the cutter knives were frequently damaged by rocks and other trash that went into the factory along with the beets. Trash catchers and rock catchers were then installed in the flume and beet washer which gathered wagonloads of fill every day.

After cutting, the cossettes were dropped by means of a revolving chute to a battery of 12 wrought-iron “diffusers,” with a capacity of two and one-half tons each. These cooked the “noodles” to extract the sugar. The primary problem here was to assure that the hot water soaked all the sugar out of the cossettes in the battery cells. This was a continuous process of cells being filled and pulp dumped out. While the water which went

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37 Early factory operations are described in Salt Lake Tribune, October 8, 1891; Scientific American, LXV (December 5, 1891), 360; and Webb MSS, passim.
into the battery was from artesian wells (the factory site had eight wells from 65 to 135 feet deep with a capacity of 500 gallons per minute), and therefore soft and pure, the beets were grown in “alkali soil” and produced an alkali reaction which had not been experienced in beet sugar manufacture since the pioneer enterprise of the 1850’s. The presence of alkali salt in the beets lowered the purity of the juice, resulting in more molasses and less sugar.\(^{38}\) As this difficulty came to be appreciated the contracts with the farmers gave increasing emphasis to beet purity, and there was a determined effort to improve the chemistry. The amount of sugar extracted rose markedly from 108.2 pounds per ton of beets in 1891 to 134 pounds in 1892, 153 pounds in 1893, 167 pounds in 1894, and 193 pounds in 1895. By 1900 it had reached 232.5 pounds per ton. After the “osmose process” was installed in 1898 the amount of sugar going into the bag increased to 254 pounds per ton of beets worked.

The next stage in the manufacturing process was to convey the dark-colored juice to “carbonators” where milk of lime and carbon dioxide gas were added to combine with impurities, which were then filtered out through canvas cloth.\(^{39}\) The lime cake was then washed out of the factory as a useless waste. The “thin juice” was now ready for the evaporator, where the excess water was evaporated to make it into a “thick juice.”

Relying upon European information, Dyer installed 20 large bone black filters in the Lehi plant. These were of upright boiler iron construction, with each holding five tons of bone black. The theory was that after “clarification,” the molasses had to be filtered through bone char. During the first two years the company learned that when the juice was in good condition these expensive filters were not necessary to make good white sugar. They were removed and not used in subsequent American factories. This production of superior white sugar directly from the juice was “a triumph of American industrial chemistry over the long experience of Europe.”\(^{40}\)

\(^{38}\) Sugarbeets contain various substances in solution other than sugar; e.g., proteins and salts. The presence of these substances makes sugar extraction expensive. They also decrease the amount of sugar that can be extracted, as these impurities must not pass into the sugar. Beet men refer to the per cent of sugar in the beet, as compared with the total amount of salts present, as the purity. It is commonly accepted today that beets must have at least an 80 per cent purity to be fit for sugar making, but Lehi beets tested in the first week of December 1891 showed purities ranging from a low of 70.6 per cent to a high of 75.7 per cent. The per cent of sucrose ranged from a low of 9.2 per cent to a high of 11.4 per cent. Obviously, there was nothing in these findings to warm the heart of a sugar man! “Laboratory Record Book C,” James E. Talmage Papers (B.Y.U. Archives), p. 195.

\(^{39}\) An interesting use of filter cloths was observed in 1899. R. Doerstling, a German sugar technician who became superintendent of the factory at La Grande, Oregon, reported that he had seen an occupied Indian tepee constructed of old filter press cloths from Lehi, Ogden Standard, July 8, 1899.

After being treated with sulphur gas in order to "clarify" the molasses and improve the crystallization, the "thick liquor" was pumped to the floor of the 35-ton capacity vacuum pan. There James H. Gardner, the only Utahn who knew anything about his station, performed the miracle of converting black molasses into white sugar. After each strike the centrifugals spun out the molasses, and the wet sugar went through a drier and out to the bags where it was sacked in a white cotton bag placed inside a burlap bag. Approximately 36 hours elapsed between the time the beet left the shed and the moment that glistening sugar was ready to sweeten Lehi's economy.

Lehi mechanics made a number of important changes in the centrifugals or "spinners." Although these machines ran at 1,200 revolutions per minute, they were unloaded by hand with a wooden paddle — a hot, sticky, dangerous job. Eugene Roberts, a young Lehi mechanic, developed mechanical unloaders and other improvements and eventually spent his life installing new machinery in sugar factories in many parts of the world.

The molasses which was spun off the white sugar by the centrifugals was boiled again to make a brown sugar. This was slow to granulate, and since there were no crystallizers it was run from the brown "pan" to one of the two 80-ton settling tanks, where it was allowed to stand over the summer until the sugar granulated and settled to the bottom of the tank. According to the plan, the liquor would then be drained off again and the brown sugar dug out with a hand paddle. Later, slow-turning horizontal crystallizers took over this work and dumped the load into the brown mixer and the brown sugar was spun out.

Work at the factory went on night and day during each campaign. Whereas three 8-hour shifts are customary today, two 12-hour shifts operated in the 1890's — a night crew and a day crew. Every two weeks the shift was changed and at the time of the change the men worked 18-hour shifts. There were some differences in pay scales, but the most uncomfortable work was perhaps that done in the boiler room where 10 hand-fired boilers furnished steam for heating and boiling the juice. The boiler crew was paid $1.80 per shift. There were, of course, no labor unions during this period, and little evidence of disputes with management. A large share of the workmen were farmers who had raised beets during the summer.

*41 If syrup is boiled in the open air it will burn, rather than produce sugar; i.e., it will carbonize, not crystallize. When placed in a vacuum, the syrup can be boiled at a low temperature until it is heavy enough for crystals to begin to form. At first, these are very small crystals, and the attendant leaves the juice in the "pan" until the crystals are built up to the desired size.*
Factory work was exacting, but there was something fascinating if not miraculous about the making of sugar. Those who worked in the plant were regarded with a certain awe. “The whole process of beet sugar making,” writes Walter Webb, “was considered a mystery. The boiling of the syrup was the greatest mystery of all. The sugar boiler was almost a superman.”

Their close juxtaposition during the campaign, and their mutual struggle to overcome the many problems, created among the workmen a strong esprit de corps. In a sense, Sugar Men were a breed set apart.

During the worst days of the Cleveland Depression of the 1890’s, the employees were paid no salary for several months. Most of them lived on credit extended by the Lehi People’s Cooperative. (Technically, they were paid in co-op scrip.) When the campaign had been completed and the factory put in shape for the next season’s run, the entire crew went camping in American Fork Canyon for 30 days. There they engaged in fishing, hunting, prospecting, and eating Merrill Ingalls’ “matchless baked beans,” cooked overnight in a large earthen jar in a pit of live coals. On a well-remembered occasion the people of Lehi, including the Lehi Silver Band and Choir, decided to spend Sunday and Pioneer Day (July 24) in the canyon with the Sugar Men. The outcome is told by Walter Webb:

They went up the north fork and a short way up Deer Creek near a grassy flat where the sugar group had camped. Here Bishop T. R. Cutler conducted services on Sunday with the choir doing the singing. A big celebration was held on Pioneer Day with pioneer speeches and music. In the afternoon the Lehi people left for home, a big parade of wagons and buggies down the canyon, leaving the sugar group in camp. That night heavy clouds came up bringing a sudden thunderstorm up the canyon near Silver Lake. The campers had to move to higher ground before the flood came down the canyon. The storm soon passed. In the morning they saw the little grassy flat where they had camped covered with large granite boulders washed down from the cliffs near Silver Lake.

Webb MSS, 16.

Sugar Men were almost a breed set apart. “The whole process of beet sugar making was considered a mystery. The boiling of the syrup was the greatest mystery of all. The sugar boiler was almost a superman.”
Of such events legends are made, and there are many such legends in the sugar industry.\footnote{The best introduction to sugar folklore is the collection of “Letters to Harry” and “The Sugar Tramp” by Dan Gutleben. Complete collections are in the University of California Library, Berkeley; the library of the Franklin Institute, Philadelphia; and the Library of Congress, Washington, D.C.}

**The Lehi Plant as Teacher**

Beginning with the 1897 season, the Lehi plant was doing well enough to be regarded as a technical and financial success. A large cattle-feeding program had been inaugurated to make use of the pulp, and other improvements had been made in both the agricultural and industrial aspects of the enterprise. Many contemporary writers, anxious to score a point for “protective” legislation, attributed the hard-won profitability to the Dingley Tariff, which was passed that year by Congress. But it must be obvious that six years of struggle and experimentation, of innovation and improvement, had prepared the way for whatever measure of success the plant and company had achieved. The Dingley Tariff may have been the frosting on the cake, but the cake itself had been baked many times before it came out sweet. Lehi technicians learned their trade in “the school of hard knocks” and in the process acquired a special capacity to devise imaginative solutions to problems. They became persons on whom
the emergent industry could rely as it expanded toward national stature. In the 20 years after Lehi's success, 116 factories were established in the United States, including 17 in Utah and 10 in Idaho. A substantial number of these factories, from Binghamton, New York, to La Grande, Oregon, employed Lehi "alumni" to pass on the benefit of their experiences.

The first of these factories to profit from Lehi's learning was established at Ogden in 1898. That enterprise was to form the nucleus for a chain of factories ultimately established in Oregon, Idaho, Montana, and Utah by The Amalgamated Sugar Company. A second group of factories was built with Lehi assistance in Colorado by The Great Western Sugar Company and other predecessor and competing companies, forming the basis for one of the largest concentrations of beet sugar factories in the world. Still other concentrations which profited from Lehi instruction were in Nebraska and Michigan. Above all, Lehi was the parent plant of the Utah-Idaho Sugar Company which built or acquired 29 different factories in the irrigated West. These have manufactured more than 160 million bags of sugar since the Lehi factory began producing in 1891.

While its "graduates" were distinguishing themselves, the Lehi factory was gradually becoming the little old red schoolhouse of the industry. Larger and more modern factories were erected. When Utah-Idaho built a plant at West Jordan in 1916, its capability included the absorption of the Lehi district. (The West Jordan plant now produces as much sugar each year as the Lehi plant produced during the first eight years of its existence, and the total production of sugar in Utah today is well in excess of all but two of the peak campaigns of yesteryear.) After the 1924 season "Old Lehi" was retired and the final dismantling took place in 1939. Nevertheless, even today in Toppenish, Washington, some of the Lehi machinery continues to produce the sparkling white crystals which delighted Utah's pioneers of 75 years ago.

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46 Examples of Lehi assistance to Colorado factories are given in Alvin T. Steinel, History of Agriculture in Colorado (Fort Collins, 1926), 301–3. When Mark Austin left Lehi in 1901 to supervise all the agricultural work for The Great Western Sugar Company at Loveland, Colorado, he took with him 70 boys from Lehi and adjoining towns to thin beets. One of these boys who went on to become vice president and general manager of the vast Utah-Idaho Sugar Company network was Douglas E. Scalley.