5-1928

A Study of the Economic Relationship of the International Smelter to Agriculture in Tooele Valley

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A STUDY OF THE ECONOMIC RELATIONSHIP OF THE INTERNATIONAL SMELTER TO AGRICULTURE IN TOOELE VALLEY

Submitted to the Department of Agricultural Economics
and Marketing
Utah Agricultural College
In Partial Fulfillment
of the
Requirements for the Degree of
Master of Science

By

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May, 1928.

INTRODUCTION

Utah's position among the great commonwealths depends to some extent upon the degree of development of the agricultural industry of the State. But as a producer of wealth, the mining industry exceeds agriculture. The total annual value of Utah farm products is about $39,000,000 while the total output from the mines is valued at $82,663,000. The operation of the mines, reduction mills, and smelters necessitate the employment of a large number of people who swell the population of the State, and consume a large part of the agricultural products. Utah, which is an inland State, possessing, as yet, few large manufacturing enterprises, finds the markets afforded by the metal industry a decided advantage to the farm producer. On the other hand, the interest of all phases of metal ventures are furthered by the prosperous agricultural communities. Agriculture and metal production, the two great industries of this region, are naturally helpful, and aid in the development of the State.

Occasionally, the interests of these two industries clash, and it is necessary for one or the other to give way. The farmers of the State feel that they were the first here and that they have the right over the smelters and reduction plants. Many long and bitter lawsuits have been fought in the courts of the State by these two great industries and in

some cases the land owners have won and in others the smelters have won.

There was no question about damage done to agriculture close to the smelters and reduction plants from 1870 to 1920. Land owners who had paid large sums of money and worked hard to get a good farm did not want their crops burned up year after year by the wastes from the smelters without some adjustment or compensation for their labor.

Millions of dollars have been spent by the smelter companies and farmers to prove or disprove that damage to crops was done by these wastes. In many cases the land owners have either forced the smelters out of the agricultural sections or held an injunction against them. In other sections where the land owners have failed to prove that damage was being done by the smelter, they remain on their location production lead, copper, silver, gold, zinc, and a number of other by-products which are placed on the market.

The future of the State of Utah is built around the mineral industry. Agriculture is second to minerals in dollars produced per year, but it brings in few people to consume the product. The state needs more people and it is going to take the large industries to bring them to the State. By bringing in more people a better market for our farm products is created. Many people coming into the State bring capital which is invested in the natural resources and it begins to produce wealth which in turn is returned to produce

more wealth and by so doing, more is received from the natural resources and placed in other lines of production. Agriculture is one of the channels into which some of this wealth is turned. Wages, which are paid to the employees, find their way to the agricultural producer, who is able to live better because of better markets for his product with better prices.

Without the metal industries, Utah would be a State of agricultural producers, living on what they could produce from the soil. The cities of the State would be little more than over-grown agricultural towns. The agricultural industries would be standing the brunt of the taxes, whereas at the present time they pay less than 15% of the total taxes in the State. Agriculture depends on the industries for its markets and the industries depend on agriculture for food for their employees. By having the two close together, the cost of production is cut to a minimum. It has often been said that if it had not been for the farmers of Heber City, the opening of the Park City mines would have been delayed for many years. As food was cheap and near at hand, the miner could live and work cheaply. This was a case of unity between the mineral industry and agriculture. The farms of this section prospered because of a market for the food and the miners prospered because of the cheap food near the workings. As more wealth is produced from the mines more industries come in for further production of the metals.

Smelters, mills and refineries are all dependent on the mines for their activity. These industries demand a large number of people to operate them, who in turn demand food from the agricultural producer who receives part of the wages paid by the mineral industries for their labor.

The separation of these two great industries is impossible; neither can exist to the best advantage without the other. Cheap food makes it possible for the employer to hire cheap labor, and cheap labor produces more wealth from our natural resources. The less the cost of production the greater the amount of profit that can be turned back to produce more wealth, which is the basis of the prosperity of a nation.

*The State of Utah would be in the same condition as the man with the fish hook referred to so many times in our recent Economics Books.

The farmer would be unable to produce enough wealth over and above the cost of living to invest in other enterprises which would produce more capital. He would be in a state of inactivity. Without the mineral industry we could not have the railroads, highways, schools and modern cities. The industry demands people; and people demand food, shelter, clothing and modern conveniences, all of which we have in the State of Utah.

Which of the two great enterprises is the most important to the State is hard to say. Nowdays transportation is so rapid and cheap that the people of the State could be

* Rufener "Principles of Economics".

fed by the neighboring States if the agricultural industry were completely lost. In fact, the outside States compete successfully with our local producers and place food on the markets just as cheaply as our own. But going back to the old argument, "one can't eat metal, coal and other products of this type and live," we should have to say that food is the basis of our State and the production of metal and other minerals, all of which produce wealth, second.

After showing the importance of the mineral industry to the well being of the State, I shall now center on the local condition I have selected for my Thesis.

In Tooele Valley there has been a general controversy between the farmers and the smelter men as to whether the smelter is of greater economic importance to the valley than the damage it does each year to Agriculture.

In my thesis I have set out to find which of these two enterprises is right. I want to know whether the Smelter contributes more to the Agricultural industry each year than the damage it does. In the following pages I hope to show that one or the other, or both, are bein benefited by the presence of the smelter in the valley.

Since 1870 there has been a clash between the farmers of the south end of Salt Lake County and the Smelter companies of the same section. Those smelters are located in the richest section of the agricultural district of Salt Lake County. The International Smelter was located in that same

section, but because the land values were so high and the cost of producing metal high, they had to look for a new smelter site. After making several surveys they decided that Tooele Valley would be the most economical place in which to locate, because of the proximity to ore, labor, low taxes, and cheap land.

The International Smelter was moved from Salt Lake County to Tooele County during 1909 and 1910. The smelter started operation late the same year. Soon after the smelter was finished and had begun operating a number of questions came up as to the effect of the smelter wastes on agriculture in the Valley; whether the smelter is an economic advantage or disadvantage to the valley; the effects on land values; extent of damage possibilities of farming under such conditions; and a great number of other questions mostly relating to the agricultural industry of the valley. In 1910-11-12 the clash came between the farmers of Tooele Valley and the International Smelter Company. The Smelter Company had purchased 6,115 acres of land and held an option on 20,672 acres close to the smelter and in the direction in which the prevailing winds carry the wastes. The farmers outside of the optioned area brought suit against the Smelter Company. This suit was carried on until 1917 when the Smelter Company was relieved of the responsibility of damage outside of the optioned area.

I happened to be working with the smelter research department during the last year of the suit and am able to give my own observation on some of the conditions we found in the

mountains northeast of the smelter and in the section in which damage was supposed to have been done by the smelter wastes.

The International Smelter Company was relieved of the responsibility of damage done, on the grounds that the section referred to was located between two smelters, the International and the American Smelter, each doing possible damage in this section. The farmers of this section won their point in one way which proved afterwards an economic advantage to the companies as well as to the farmers themselves. The courts ordered the smelters to increase the size and capacity of their bag houses which decreased the gases and dusts which were doing possible damage in that section.

The International Smelter located in Tooele Valley because of three distinct advantages: (one) close to the mineral producing sections of the State, (two) low taxes, (three) good water rights and plenty of good white labor.

A smelter without ores is like a ship without water. This is the condition the International Smelter Company was up against in 1902; they were in a section of country where too many smelters were being operated. Competition was too keen for them because of two factors: the cost of getting ores to their smelter was too high because much of the ore had to be hauled by teams from the mine to a railroad, where other companies in the same locality could put their ores directly on the railroad cars and ship it to the smelter; and, the

supply of ore the company had to draw from was too small, they could not run anywhere near capacity. When a company has five furnaces, it wants them going, because money invested and not working is poor business.

The International Smelting Company figured that they could overcome these three handicaps by moving into a section where the ore supply was greater and transportation charges would be less. The present location of the smelter gives them access to more ore because of the Stockton, Ophir, Dry Canyon, Eureka, and Nevada districts being on the main railroads. By building a tramway they have reduced ore rates from their mines in Bingham from $1.75 per ton, to $.25. This system of transportation is very efficient and has cut the cost of production considerably. It is one of the factors that has kept the Consolidated Mines at Bingham going. If the cost of transportation had remained the same as in 1902-3-4-5, this mine would have closed down.

The location in Tooele Valley has reduced the freight rates on ore coming in from Nevada. This has been accomplished by the Western Pacific, building a cut-off from Burmester to Garner Junction, which saves the extra mileage from Burmester to Salt Lake, and from Salt Lake to Tooele. Salt Lake has always been considered the "hump" in freight rates for the ore shippers; and it has been but through their efforts that the cut-off mentioned, was built. This hump was due to the number of handlings the cars were subjected to before they could be placed at the smelter. The other ore-producing

sections are on the main Union Pacific, or Western Pacific lines. The larger producers are given special rates, obtained by the joint efforts of the International Smelter and the ore producers.

The second reason for locating in Tooele Valley is the abundance of cheap land the low tax rates.

The International Smelter Company was operating in a County where land values were high. Several times they were subjected to law suits, and it looked as though they were going to be charged for a lot of damage on high priced land. In 1910 land in Salt Lake County was worth $95.45 per acre. If the damage on that land had been 10% of its total value it would have cost the Smelter company $9.45 per acre for every acre that was damaged. If the company had set out to buy as much land in Salt Lake County as they now own in Tooele County, it would have cost them $755,184.45.

The land in Tooele Valley was bought for $31.12 per acre, just 2/3 cheaper than the land in Salt Lake County. If the damage on this land had been placed at 10% of its total value, it would have cost the company $3.11 per acre. In place of allowing the people of Tooele County to sue them for damages, the company bought 8,115 acres of land for $247,495 and placed an option on 26,675 more which cost them $94,126. The total cost for all possible damage in Tooele County was over-come by paying out $341,618. If this company had remained in Salt Lake County on the high priced land and had been sued for

damages, no one knows what the amount would have been. One placed the saving at $1,557,750 besides a possible law suit. This alone is enough to make a smelter company consider a change in location.

The smelter company investigated the efficiency of the County officials, taxes, and possible chance of increase in taxes before they came into Tooele Valley. Upon investigating these conditions, they found that the county officials were very efficient. This was shown in all of their dealings in county affairs. The tax rates were very low compared with the section they were in being 6.7 mills lower per dollar over a 15 year period. The possibility of tax increase over their former location was not present in any form. This has been born out by the fact that Tooele County is the lowest taxed county in the State.

The condition of the tax situation in the two counties was one of the factors that placed the smelter in Tooele Valley. The tax levy from 1916 to 1926 was as follows:

Salt Lake County

Year	Mills	Year	Mills	Year	Mills	Year	Mills
1916	16.7	1919	19.2	1922	28.8	1925	29.3
1918	17.4	1921	28.9	1924	28.4		
1917	17.7	1920	27.7	1923	29.9	1926	29.1

In Tooele for the same period it was as follows:

Year	Mills	Year	Mills	Year	Mills	Year	Mills
1916	13.7	1919	12.4	1922	18.9	1925	23.0
1917	16.9	1920	20.0	1923	18.4	1926	23.4
1918	15.6	1921	18.9	1924	18.0	1927	21.0

Under this condition in 10 years the smelter company has saved $276,562.10 or $16,268.30 per year in taxes alone. The amount of money saved by the International Smelting Company on land, possible damage and tax in Tooele County shows that the smelter company enjoys as many advantages in the County as the County enjoys from the presence of the smelter.

The (third) and last advantage the smelter company enjoys is the abundance of good white labor. At first men had to be shipped in, to handle certain jobs at the smelter, but at present all positions are filled with local men who have made their homes in Tooele. The smelter is located close enough to Salt Lake City so that there is seldom a labor shortage. There are very good quarters for single men who come in to work. Wages are high and living conditions favorable. The labor supply therefore is of minor importance in that section of the State.

The History of Tooele County

The Utah Pioneers, under the leadership of Brigham Young, came to Salt Lake Valley on Saturday, July 24, 1847; on Sunday, they held religious services and rested; on Monday, they climbed Ensign Peak and there raised the Stars and Stripes; on Tuesday, Brigham, with a company of men, went out to Black Rock to view the Great Salt Lake and bathe in the water. While there, Professor Orson Pratt left the company and rode around the south shores of the lake and through Tooele

Valley as far as the Adobe Rock on E. T. Hill, just exactly six miles from the Black Rock where Brigham Young was camped, and then returned and joined the lake party again, giving Professor Pratt the honor of being the first of the Utah Pioneers to enter Tooele Valley.

In the winter of 1848, three or four government herders were establishing herding quarters at Black Rock. These herders were taking care of government stock belonging to Captain Stansbury, who was at the time engaged in surveying the Great Salt Lake, its islands, and other parts of Utah. However, it was not until some time in the middle of September, 1849, that the first settlers entered Tooele Valley with a view of finding homes and making a settlement.

Judson Tolman, wife and one child; Josiah Call, wife and one child, and Samuel Meeham and wife, were the first three families to enter Tooele Valley and settle down with the object in view of making homes for themselves and children. The three families came together, the exact date Mr. Tolman has forgotten, but it was sometime in the middle of September 1848.

In their travels through the valley, they took time to examine the best locations for homes, and made trips into the canyons and upon the mountains in search of springs of water and groves of timber. After a few days' exploration they concluded to settle down on a small stream just south of Tooele city and the stream has been called Settlement Canyon creek

to this day. (Extract published on history of Tooele, as copied from the Tooele Transcript of January 9, 1903)

From this small beginning, through hardships, hunger, pain and suffering came forth the beautiful city of Tooele, surrounded with wealth and opportunity.

Location of Tooele County and Valley

Soil

Tooele County is located in the West Central part of Utah, with an elevation of 4,500 feet. On the west side of the County is the Utah-Nevada State line; on the north, Box Elder County; on the east, Davis, Salt Lake, and Utah Counties; and on the south, Juab County.

Tooele Valley is located in the extreme eastern part of the County with the Great Salt Lake filling the north end of the Valley; the Oquirrh mountains on the east and the Standsberry on the west with a low gravel bar dividing Rush Valley and Tooele Valley on the south. Tooele Valley was once completely covered with water by Lake Bonneville. The soil is not fertile, generally. It ranges from a very coarse gravel to a very fine clay. The soil in itself of a limestone nature, which makes it good for raising alfalfa and wheat. The soil is from a few inches to 80 feet in depth, the texture differing in different localities; but as a rule four three is the average depth.

Toward the north end of the valley, there is found a

very fine, deep clay soil which produces good crops of alfalfa, sugar beets, and potatoes. This is one of the exceptions of the Valley. Along the east, south and west sides of the valley, one finds a mountain-wash soil which is fertile and produces fair crops of alfalfa and dry-farm wheat. This soil varies in depth from a few inches to several feet. The texture ranges from a coarse wash to a very fine, red and yellow clay, which holds the moisture until late July.

The bench land on the south, east, and west produces most of the dry-farm wheat and alfalfa. The land under the bench produces dry-farm wheat and wherever there is water for irrigation, potatoes, beets, truck gardens, corn, oats, and fruits are found.

In the North and northwest part of the valley are large salt beds, and just south of these, the soil is so impregnated with salt that agricultural crops will not grow.

Water

The water in Goose Valley is fit for irrigation, generally. Water is the limiting factor in the agricultural industry in the valley, and wherever water is found crops can be produced except in the north end of the valley, where the salt beds ren er the soil unfit for agriculture.

Early in the spring an abundance of water comes down from the mountain sides and from several canyons which are cut deep into the mountains. These high mountains and deep

canyons are the only supporters for late water. On the west side of the valley are three main canyons producing water for irrigation. These streams are small and can irrigate only a small area of land. These three canyons are called Box-elder canyon, South Willow canyon, and North Willow canyon. The waters from these canyons are used close to their outlets, and some very good crops are produced.

At the south end of the valley is a flow of water coming out of the Bauer drain-tunnel which is used for irrigating alfalfa and a 50-acre apple orchard which belongs to the company. On the east side of the valley are five canyons that produce some water. Silock canyon produces no water for irrigation, but enough to water cattle the year round. Settlement canyon produces a large part of the water that is used for irrigation on the south and west side of Tooele City. Middle canyon produces water for the irrigation of the eastern part of Tooele City and the Pine canyon district, four miles east and north of Tooele City. Pine canyon produces some water which is used by the smelter for the operation of a small concentrator which belongs to the smelter company. Waste waters from Pass and Pine canyons is used for irrigation. There are a number of small canyons that have water enough to water livestock the year round. This water is very valuable, because of its scarcity in the mountain districts. In the north end of the valley are a great number of flowing wells that irrigate several hundred acres of land. It is in this

section that one finds most of the irrigation in the valley.

Tooele Valley has several sources from which it could draw water for irrigation if a company could organize to put the work over. The flood waters of the early spring could be stored and used later in the summer. It has been estimated that twice as much land could be irrigated as is now under irrigation as shown by following figures: land irrigated in 1930 was 9,487, capable of irrigation 13,666 acres. The water now coming down the canyons runs to waste from September to May of each year. This nine months of waste water could be stored and used later. Some of the water could be brought from Utah Lake and used for irrigation. There has been some talk of driving wells in the north end of the valley and pumping water up to the land that needs it.

The water values in Tooele Valley are very high because of the scarcity of water in that section of the county. Water is the foundation of all the industries in the valley; without it, we could not have agriculture, grazing, mining, or industrial plants. The water running from the canyons is divided into shares. A share is the use of the stream for 30 minutes once every seven days. The streams vary in size so that no one knows just how much water he is using or is entitled to. The main stream is divided at the mouth of the canyon and each section has so many shares of

water. There have been many cases where the water has been transferred from one ditch to another. At present the distribution of water is uncertain.

To place a cash value on all of the water in Tooele Valley would be almost impossible. The figures I have here are summed up by the values some of the water owners have given me in different sections of the county. The estimated value is $2,500,000. These figures do not cover the water used by the smelter and mill, nor the small springs that are used for watering stock. A cash price on these springs would be impossible to obtain, because of the prices that are placed on them. One man informed me that his ranch depended upon a very small spring and that his cash price would be the value of his ranch plus what he now owns. I have found out that this man is worth over $15,000 and I feel that this is too much for a little stream of water. This goes to show how difficult it would be to place a value on all of these small springs.

The Climate of Tooele Valley

The climate of Tooele Valley is similar to that of the State of Utah, generally. The days are hot and the nights cool. The air is dry, due to the south west winds that come from the Prairie. The lake in the north end of the valley helps to moderate the climate keeping the extreme heat down and the cold out. From 12 to 16 inches of rain fall puts

Tooele Valley in the dry-farm wheat-growing district. The hot days and cool nights make the Tooele Valley wheat one of the best in the State. The average bushel of wheat per acre is low in the valley being between 16-20 bushels per acre.

The length of the growing season is from 130 to 140 days, which gives the crop plenty of time to grow and be harvested. The average date of the first killing frost in the fall is September 30; the last killing frost in the spring is June 25. The lowest temperature to be recorded by a government station in Tooele Valley is 38 degrees below 0. This means annual temperature of Tooele Valley is 48 degrees.

The winds in Tooele Valley blow generally from the south-west and north-east. The winds from the south generally bring storm, while those from the north are cool and pleasant.

The Size and Shape of Tooele Valley

Tooele Valley is from 12 to 20 miles wide and from 25 to 33 miles long, including the lake in the north end of the valley. There are no deep cuts or high ridges in the valley; it is mostly level and easy to cultivate. The Aquirrh mountains on the east and the Stansberry on the west keep the east and west lines almost due north and south.

There are 184,960 acres of land in the valley with only 8.5 percent of it under cultivation. There are 15,573 acres

of pasture lands that are fenced and used by private people, and 14,577 acres of pasture land that are used by the public. The rest is partly desert and not used for either agriculture or grazing.

Land

The average price of land in Tooele County in 1925 was $18.27 per acre. This is very low compared with the price in other sections, due to the fact that our pasture land is cheap. There is an average of 4½ acres of improved pasture land for every acre of cultivated land in Tooele valley. The price of land runs from $200.00 per acre to $5.00 per acre. One can readily see that this great difference in price would bring the average price of land down.

There is less than 6.3 per cent of the land under irrigation in Tooele Valley. The greater part of the land is in dry-farm wheat and alfalfa. The most popular size of farms in Tooele Valley is from 160 to 320 acres. This could be expected because of the type of agriculture practiced. The number of farms have increased from 336 in 1910 to 378 in 1925. This is due to the larger sections splitting up into smaller farms with very little new land coming under cultivation.

Crops, Livestock

The main crops are hays, grains, potatoes, sugar beets, and some fruit. The hays and grains are the most important

because of the number of livestock and the nature of the climate.

The total value of the farm crop in Tooele Valley was $405,836. I do not know whether this included the living expenses of the farmers or not, but I am inclined to believe it did not.

The livestock in Tooele Valley is mostly sheep and cattle. There are about 9,332 head of cattle in the valley of all ages, and about 30,000 head of sheep.

The total value of livestock in 1925 was $509,401 with cattle producing $166,175 of this amount and sheep $343,274.

The Manufacturing Industry in Tooele Valley

In 1930 there were 16 establishments producing manufactured products. These establishments employed at this time 1,055 men, steadily. They paid out in wages each year $1,586,358, and $68,085 in taxes and rent. The total cost of raw materials in 1925 was $11,064,830, while the total value of the product after it had been manufactured was $13,209,797. The cost of manufacturing left in the valley $2,144,967. The figures for 1910 are lacking and I could not compare them.

Population

The population of Tooele Valley is composed mostly native-born whites. The building of the smelter brought in a flood of foreign-born people but the foreigners live in

one section and the native-born in another. They very seldom mix.

Population of Tooele County 1910-1920

	1910	1920	Increase	Decrease
No. of people	7,224	7,965	741	0
Urban pop.	2,753	3,602	849	0
Rural pop.	5,171	4,361		710
Illiteracy	6.7	2.6		4.1
No. in school	2,109	2,253	145	
No. of dwellings	1,580	1,666	86	
No. of families	1,644	1,734	87	

Number of People in Tooele City

	1910	1920	Increase	Decrease
No. of people	2,753	3,602	849	0
Males	1,580	1,904	346	0
Females	1,195			
Number in School	532	1,095	500	0
Dwellings	520	729	209	0
Number of Families	565	774	209	0
Illiteracy	.39	.38		1

EXPERIMENT TO SHOW ENOUGH SMELTER WASTE IS LIBERATED TO DO DAMAGE TO PLANT LIFE NEAR SMELTER

There has been some work done by individual companies and the government on damages done by smelters.

The damage done near the smelter and a few miles away is mostly to plant life, some animals are affected by eating the plants close to the smelter. Plants damaged by smelter vates look as if they had been burned. They become spotted, striped, or whitearound the edges. The process interferes with the chlorophyl of the plant, which reduces the amount of starch.

The damage is caused by SO_2 arsenic and fine metals that are given off from the smelting of ores and the part burning of coal. The arsenic that goes out into the air is in a volatized state, this settles on the surface of the leaf of the plant and soil (Table II). The arsenic collects in sufficient quantities on the leaves of plant to poison animals(as shown in Table I). It was thought at first that particles of metal coming off in the form of dust was the direct cause of damage done to plants and animals, but through experimentation, it has been found that it is the SO_2 gas which unites with the moisture of the air and sunshine that causes a sulphuric acid reaction on the surface of the leaf that does the damage. Copper, lead and other metals are given off in sufficient quantities to do damage to plants and soil, near the smelter as shown by the following experiments performed at Deerlodge, Montana, by the

International Smelter Company.

TABLE # I

No.		(1)	(2)	(3)	(4)	(5)
4114	Bunch Grass	2 No.	0.103	18.0	.083	14.5
4106	Alfalfa	2½ No.	.069	12.2	.041	7.2
4115	Pasture Grass	3 No.	.069	12.0	.025	4.9
4116	Pasture Grass	4 No.	.041	2.2	.020	3.5
4117	Range Grass	Do	.054	9.5	.034	6.0
4107	Red Top	3 N.E.	.028	4.9	.014	2.5
4118	Clover	Do	.043	8.5	.028	4.9
4119	Range Grass	Do	.090	15.8	.020	3.5
4120	Alfalfa	4½ N.E.	.054	9.5	.020	3.5
4108	Red Top	5 N.E.	.055	9.6	.028	4.9
4121	Range Grass	Do.	.090	15.8	.069	12.0
4122	Do	6 N.E.	.105	18.2	.041	7.2
4123	Do	8 N.E.	.045	9.5	.020	4.9
4109	Alfalfa	10 N.E.	.070	12.3	.042	7.4
4124	Red Top	1 N.W.	.069	12.1	.041	7.2
4112	Field Grass	3 N.	.042	7.4	.020	3.5
4110	Hay	5 N.	.045	9.6	.041	7.2
4111	Range Grass	Do	.041	7.2	.026	4.9
4125	Bunch Grass	4 N.	.055	9.6	.028	4.9
4113	Range Grass	6½ N.	.055	9.6	.028	4.9

(1) Distance and direction from smelter.

(2) Arsenious-oxide per gram of dry sample.

(3) Arsenious-oxide per 25 lbs. of dry matter.

(4) Water soluble arsenious-oxide per gram of dry sample.

(5) Water soluble arsenious oxide per 25 lbs. of dry ration.

TABLE # II

No.	(1)	(2)	(3)
4176	2 N.	.50	40.2
4169	3 N	.30	24.1
4171	Do	.50	40.2
4173	4 N.E.	.20	16.1
4180	5 N.E.	.30	24.1
4174	6 N.E.	.30	24.1
4178	8 N.E.	100	8.4
4172	1 S.E.	150	40.2
4174	3 S.	.20	16.1
4170	6 S.	.08	6.4
4177	Do.	.08	8.4
4178	4 W.	.30	24.1
4175	6 W.	.25	30.1
4165	15 W.	.0	0
4163	10 S.W.	.0	0

(1) Distance and direction from the smelter.

(2) Arsenic per grams of soil, measured in milligrams.

(3) Arsenic in surface 2 in. of soil per sq. foot. Measured in grams.

It is shown in the following table that arsenic is found in considerable quantities around the smelter, and that the arsenic must have come from the smelter because the sample tested away from the smelter contained no arsenic.

HOW ARSENIC, FIRE FUMES AND SO_2 ACT ON PLANTS AND ANIMALS

Arsenic

In the ore that is handled at the smelter, the arsenic is found in a sulphide (As_2S_3) state. The average per cent of arsenic is placed at .87 of 1%. As the ore is put through the different processes of smelting, the arsenic is liberated in a volatized form (As_2SO_2) which passes into the large flue and

into the air, then settles on the vegetation close to the smelter. The distance away from the smelter, that arsenic is found, depends on the locality. In Montana .C75 grams per 1 gram of dry matter was found 10 miles away, but at Tooele, very little has been found 3.5 miles in any direction, because high winds are few and system of taking care of the arsenic is efficient.

The arsenic oxide as a general rule does very little damage to the plant itself, but the damage is mostly done to the live-stock that eat it. If animals are turned out to pasture on the exposed range, they receive the full benefit of all the arsenic that has been deposited on the leaves for some time.

As the arsenic passes into the animal's system, it sets up a burning process, which effects the lining of the stomach. The process is carried through to the small intestines where it interferes with the digestion of the food, and burns the intestines. This constant burning causes an inflammation, also a cloudy swelling and a degeneration of fatty tissues around the digestive system. It also causes an inflammation of the mucuous membranes of the upper air passages; running at the nose, thirst, emaciation, and incoordination of gait. From these general symptoms one can see that a horse effected with arsenic poisoning is worthless, and a cow that is effected has very little chance to produce milk, because of the condition of her digestive system.

The *arsenic oxide also does slight damage to the plant

*Arsenic will not burn leaves of plants unless it is in an acid medium such as H_2SO_4 which changes it in to an (As_2S3O_4).

through a caustic reaction on the leaves and winter killing. This is accomplished by the arsenic collecting on the surface of the snow during the winter. As the snow melts, the water runs over the crown of the plant and the arsenic eats its way into the tender growing shoots, thus killing them. The process is helped along by other wastes from the smelter, such as copper, lead, iron, and zinc.

Finely-divided Particles of Metal

It was first thought that these small particles of metal were responsible for the damages done by smelter wastes, but it was soon discovered that the sulphur-dioxide was to be blamed for most of it, although this metal dust does do some damage. When one is making a survey of the damage done by smelter wastes it cannot be over-looked.

As the metal is heated in the process of smelting the finely divided particles of metal are shaped off into the air, and due to a very strong draft that is needed to heat the metal, some of it is carried away to the flue and into the air. Anyone knows that fine metal will not stay in the air long because of its weight: so from common reasoning one can see that the area over which this metal is distributed is very limited. As the metal settles upon the surface of the ground it has a toxic reaction on the soil, and if it is present in quantities above 5 parts per thousand, it will be damage to plants through their root system. It might be well to mention

that this copper and *lead comes off in an oxide form which makes it comparatively soluble in water and can be carried down into the soil. The copper and lead oxides burn the surface of the leaves of plants in some cases, but seldom.

Sulphur Dioxide and Trioxide

Sulphur dioxides and trioxides** are the most important of the three wastes so far as damage to plant life is concerned, because of the fumes it can be carried and still do damage. There have been a great many disagreements as to the amount of sulphur dioxide that must be present in the air before damage to plants is detected. Some place the amount of 1 part of SO_2 to 50,000 parts of air. Schroder says that 1 part of SO_2 to 1,000,000 parts of air will do damage to plants if left to react for a certain length of time.

One can see by this figure that the amount of SO_2 that must be present in the air before damage is done is very small; and that almost any of our western coal will produce enough SO_2 gas to do damage to trees.

* Lead is not soluble and is not carried down into the soil as shown by experiments carried on by the American Smelting and Refining Company. They have shown that out of 1,500 tons of lead metal produced 50 tons of fine lead ore has been distributed over the land close to the old smelters that operated from 1870 to 1906. There are sections where fine lead can be found in quantities sufficient to warrant gathering and smelting under the present conditions, therefore showing that lead is not soluble under the present conditions.

** Sulphur trioxides have never been separated from smelter wastes up to the present time.

The SO_2 is liberated through the smelting of sulphide ores and the part-burning of coal. As the ore passes through the different processes, large quantities of SO_2 are given off and pass into the air.

The most damage done from SO_2 is in long narrow valleys where there is a continuous flow of gas over certain areas day and night. The reaction of the wind and the changing of the sulphurous acid into sulphuric acid helps to keep the damage down to a lower level.

The sulphur fumes are taken into the plant and the SO is retained in the leaves. Very little goes into the wood of the trees or the stocks of the plant.

The leaves of the plants are the main organs for taking up the poison. The number of stomata in the leaves determine the susceptibility of the plant.

Research has shown that there is a double reaction on the leaf whenever there is a continuous flow of gas. The SO_2 comes in contact with the moist surface of the leaf and forms a sulphuric acid which burns it, and the gas goes in through the stomates of the leaf and burns from the under side.

The reaction of the gas is faster through the stomates than through the upper side of the leaf because of the water content. If the water in the mid-cellular interstices of the cell walls is combined with acid in greater amounts than can be supplied by the walls, they become deficient in water and finally dry up, thereby losing their capacity to conduct water. Thus, only those cell bodies will remain that are well

supplied with water. Only those sections of the leaves which lie directly against the rapidly conducting tissue of the vascular bundles will remain green, while those sections between the vascular bundles will fade out into a light green or a brown. This fading color had led the way to sulphurous acid poisoning. The unfolding of the leaves in early spring is the most critical time for smoke injury, because of the abundance of moisture in the plant and the tender tissue. A cell that has been killed by acid gas causes a shriveling of the cell. It still retains the air, but the cells are not as close together as they should be. The leaf cells that have been killed outright have some plant food, but those that are faded and bleached show a complete impoverishment of cell content, or food.

Wieler has found that a continuous pouring of smoke over the land will poison it to the depth of 30 c.m. He also found that all of the sulphurous acid had not changed into sulphuric acid. This acid was not effective until the basis of the soil had been destroyed. The reason why the acid was not effective until the bases had been destroyed was that the bases in the soil, such as $CaCO_3$ would tend to neutralize the acid and keep it in a state where it could not do damage, but as soon as the bases were all destroyed and the acid could work on the soil, it would eat out all organic matter which the plant feeds on.

The reaction on lime stone soil would be something like this:

$H_2SO_3 - CaCO_3 \quad -- \quad CaSo_3 - H_2O - CO_2$

$H_2SO_4 - CaCO_3 \quad -- \quad CaSO_4 - H_2O - CO_2$

DAMAGE DONE BY SMELTER WASTES IN TOOELE VALLEY

The exact amount of damage done in Tooele Valley by smelter wastes cannot be determined because of two reasons: (first) it would be impossible to measure the damage done, and (second) the damage is not uniform over any given area.

Many surveys have been made from time to time in different sections of Tooele Valley to try to determine how much damage is done each year. But so far, these experiments have failed to bring any uniform results. It is a well known fact, however, that the climatic conditions play a very important part in the kind and amount of damage done. If the early growing season happens to be slightly damp and a general south-east wind blows for any length of time, the damage will be greater than if the growing season is dry. This is due to two factors: (1) That the wind blowing from the south-east carries the gases over the agricultural section of Tooele Valley, and (2) that the moisture in the air must mix with the sulphur-dioxide to form a sulphurous acid, which in turn picks up one more atom of oxygen to form sulphuric acid, which burns the vegetation whenever it comes in contact with it.

For some ten years or more the International Smelter has had a force of men working in sections of Tooele Valley trying to determine some way in which to measure the damage done by the smelter wastes but so far they have been unsuccessful, and have come to the following conclusion: That the amount of damage done on 8,115 acres of land close to the smelter is enough to render it unfit for individual agricultural purposes. They have purchased this land. They also came to the conclusion, after years of research, that there is a possible 10 per cent damage on some 26,672 acres of land in certain sections of the Valley. The smelter company now holds an option on this land the adjoining the 8,115 acres. This option is 10% of the total value of the dry farm land in that section. The owner of the land can operate it just as before and any time he wishes to sell his land to the company, they will take it at the average value placed on the land at the time of the option, which is $31.12 for dry farm wheat land. The owner of the land cannot at any time bring suit against the company for damages done by the smelter wastes on this land, but can sell if they feel that the damage is greater than the 10% paid for the damage done.

The smelter, coming into this section of Tooele County, has forced out of production sum, 200 head of cattle, 200 head of horses, between 1200 and 1400 tons of hay, about 13,000 bushels of wheat, oats, barley, and rye, and a few miscellaneous crops, such as fruit, corn and the family gardens. The

total value of all this put together would just about represent wages of one-fourth of a month paid by the smelter company (which is $144,000). As near as figures can be had to show this, it has been estimated that between $35,000 and $45,000 would cover everything produced in the damaged section each year, and still allow a fair margin for increase in land values.

STEPS THE SMELTER COMPANY HAS TAKEN TO OVER-COME DAMAGE DONE BY WASTES

The International Smelter started operations as a copper smelter in 1910. In 1912, the first lead furnaces were put into operation two in number. During 1913, three more were added, making a total of five lead furnaces.

The blast furnace plant, as originally designed, was provided with adequate facilities for taking care of the wastes from the lead plant. The coverting plant was provided with a baghouse in 1913 to recover the lead fumes produced from the blowing of the lead matte.

The first cottrell treater was placed in operation June, 1916, following a year or more of large scale experimental work. In 1917, a cottrell treater was put into operation on the copper converter gases, catching a high lead fume product from these converters.

The latter part of 1918 a Tooele flue type-treater was installed to handle the gases from the McDoogal roasting plant.

In a general way prior to the installation of the first cottrell treater in 1916 the percentage of flue dust, and fumes being caught in bag-houses was 60% of the solids, providing the equipment had been 100% efficient.

"Since the installation of our new sintering plant cottrell treater the first part of 1927 we are recovering 93% of all solids passing to the baghouses and cottrell treaters."

The above is a copy of a letter received from Supt. B. L. Sackett, October 25, 1927.

From this brief history of the beginning to overcome the damage done by these wastes and losses suffered by the company one can see that from 1914 on the smelter company has made rapid progress in bringing the wastes under control. Up to the present time, the smelter company has spent three quarters of a million dollars installing adequate facilities for catching the dust and fumes that did so much damage in Tooele Valley from 1910 to 1914.

Some of the first steps that were taken to overcome this damage to agriculture and loss to the Company was the purchasing of 8,115 acres of land close to the smelter. This land is included in the following sections: 4, 5, 6, 7, 8, 9, 17, 18, 19, 20, 30, 31, in Township 3 range 3 West Salt Lake Meridian; sections all of which, you will note, are very

close to the smelter and in a direction that the prevailing winds carry the smoke. These sections were selected and bought to prevent the owner from being damaged.

The next step was to find how far away from the smelter possible damage to agriculture was done. After years of experimenting the Company believed that by purchasing 10% of the value of 26,672 acres of land, they would be paying for any possible damage done in the Valley. This land is found in the following sections: 1, 12, 13, 24, 35, 26, 23, 14, 11, 10, 8, 16, 17, in Township 3 South, Range 4 West Salt Lake Meridian. The next step was to keep any stray stock, that might get loose, off the exposed range that was badly damaged and would poison the animals if left on it for any length of time. By building miles of fence around its land to keep these animals away from the smelter, the Smelter Company has saved thousands of dollars for stock men.

The options that were placed on the 26,672 acres of land around the smelter in Tooele Valley were obtained during 1911-12-13-14. This was one of the hardest obstacles the smelter company had to overcome in all of its control methods. The farmers of this section were opposed to the smelter coming in, because it was pointed out to them, their farms would be damaged by the gases and wastes from the smelter. It was hard for them to see that the Company wanted to pay for 10% of the value of their land for the probable damage done by the wastes. They seemed to think that this was not enough,

and many others figured it was a very close estimate on the damage done by the wastes, but at present the damage done to the same land is very little and in many cases none.

Under the agreement of the option the smelter company was to have men appraise the land and the company would give them 1/3 more than the appraisers placed the value. This practise brought the average land values in Tooele Valley up from $12 per acre to $31.12 for improved dry farm wheat land, and alfalfa land up to $50 per acre, which at once increased the assessed valuation of the land. At any time the farmers wish to sell their lands to the company they will buy it; paying them the other 90% of its value which is $878,254. If at any time the owners wish to sell the land to some party other than the Smelter Company, he sells it with the option on it. This is to protect the smelter company and prevent the new party from bringing suit against the company for damage done by the wastes. This option placed among a group of farmers who were destitute some $94,125.

It might be well to state here that the company has not taken over any of the land options up to the present time. This alone shows that the farmer of this section is at least satisfied with the conditons under which he is working. At the present time, land with the option on it is selling for the same price as land free of the option. The farm mortgage companies and banks are very anxious to loan money on the land that is covered by an option because they know that their

money is doubly safe. They are sure that if the individual cannot pay the mortgage they can take over the land and at once sell it to the smelter company. There has never been one case where an option has reduced the selling price of land in Tooele Valley.

Steps to Control Wastes at the Smelter

The baghouse was the first to be installed. This is made up of a large square tube, varying in size from 6 feet square to 25 feet square. Inside of these large tubes, which connect with the smoke stack there are thousands of woolen blankets stretched across the tube. As the smoke and dust pass through them, the finely divided particles of metal and dust are collected on the wool fiber. As there is a variation in the air current that pass through these tubes, it keeps the blankets moving which in turn shakes the dust to the bottom of the tube where it is collected and sent back to the furnace from which it came. The dust caught in the baghouses is oxidized lead, zinc, and other valuable metals which can be converted back into metallic metal, when reheated. If every bag is tight and no holes are present the company can recover 80% of all dust passing from the furnaces and converters with baghouses, but as one can plainly see keeping thousands of these blankets in perfect condition is almost an impossibility. June 1916 saw the first cottrell treater in operation at the International Smelter. This cottrell treater is a large square

structure divided into several chambers. These chambers are filled with rows of 14 inch copper pipe from 8 to 12 feet long. Each pipe is connected to a high voltage of electricity which makes a very powerful magnet. These magnets are placed close enough together so that there will be no space free of magnetic force. As the dust and fumes pass through the magnets lined chambers the dust is collected and shaken down into bins below the treaters, and then taken to the furnaces and retreated. If the percentage of copper is greater than that of lead it goes to the copper plant, and if lead is greater than copper it goes to the lead plant. Both plants are equipped to recover any small amount of opposite metal that might be present.

By constantly perfecting these baghouses and cottrells, the company has reduced the amount of waste going free from 60 percent to 7 percent in eleven years. Dr. George D. Hill, Head of the Research Department of the American Smelting & Refining Company informs me that the product caught by these cottrells will pay for their construction in 90 to 180 days when the plant is running normal.

THE EFFECTS OF THE FUMES OF THE SMELTER ON LAND VALUES IN TOOELE VALLEY

It is almost impossible to say just what effect the smelter wastes have had on the land values in Tooele Valley. If 8115 acres of land, which the Smelter Company owns, were left out of consideration, one would be safe in saying that there has been no general increase in the land values in

Tooele Valley above the average of the State since 1911.

The greatest increase came in 1910 as shown by the following chart.

Year	Tooele Valley	State
1900	$ 8.14	$12.98
1910	31.12	34.60
1920	25.22	48.26
1925	23.25	34.45
1926	30.54	43.97
1927	37.88	54.54

The sudden increase in 1910 was due mainly to the options placed on 26,672 acres of land in Tooele Valley by the International Smelter Company. This very noticeable increase in 1910 was an abnormal condition and was brought about by an artificial method of appraisement that was referred to in the first part of this paper.

After going into this work I wonder if the land owners of Tooele Valley were justified in increasing the value of their land outside of the optioned areas because it brought about two conditions that may offset the increase in the values of land over a period of years. These two conditions are as follows: By increasing the value of the land it would bring about additional tax cost which would be a decided advantage to the incoming company because it would increase the amount

of money collected in taxes from the farm land, which would lower the rate of taxation if the cost of running the county government was held down. This is just what happened, as can be seen from the following figures: From 1909 to 1927 there was an increase of 87½ per cent in taxes. There was an increase of 260 per cent in the value of the land in the same length of time. Following this through one can see that this would be a distinct advantage to the companies coming into the valley to operate. The second condition that increased land values brought about is: The farmer must produce more from the same acreage of land to overcome the additional expense that is attached to the land due to interest that must come from the investment. The following figures show that the average farm in Tooele Valley has increased $2,085 in 19 years. Interest on this amount at 6 per cent per year would be $125.10 which would have to come out of the crop produced on the same acreage.

As a general rule the value of land is determined by the difference in the value of the products produced on that land and on no rent land with a given outlay of labor and capital, but, the increase in land values in Tooele Valley was brought about in a very different way. The artificial value that was placed on the land in 1910 due to the options was a matter of choice to the farmer who was located outside of the optioned area. He could either increase his land and pay more interest on the investment or refuse the increase and receive less on the investment. This, however, would not take care of

the tax increase, but since taxes have decreased in proportion to the increase in land values I will not consider this question here.

It has been thought by some people that the placing of options on some land in Tooele Valley was for a purpose other than for damages. They seem to feel that through the placement of options on some sections of land in the Valley it has brought about the conditions stated above. This is an unprovent statement, however.

After considering these two conditions that have been brought about by the abnormal increase in land values, I am not so sure that the increase is going to be an advantage to the land owners. Due to these abnormal increases in land values each farmer has to produce $200.15 more each year from the same land if he is to break even with the other farmers of the County besides enough more to keep up with the general increase in the State.

It seems, as a general rule, land owners of every section are looking for opportunities to increase the value of their land without considering other factors that might come in and offset the advantages gained from the increase. The land owners who were directly benefited by the increase in land values were those who sold out to the Smelter Company and moved to other sections. There were thirty-two farmers who sold out and left the valley and received a direct advantage from the increased amount of money they received from the land.

There are fifty-four farmers in the Valley at present who have options on their land and who are working under the conditions just discussed.

It has been estimated that the coming of the smelter into Tooele Valley increased the value of land $1,896,000. This increased value came about in 1910 and since that time land values have decreased from $31.12 per acre in 1910 to $23.26 per acre in 1925. This is a very unusual condition because in 1917-18-19 land values were going up all over the State except in Tooele Valley. This can partly be accounted for through the wages paid by the Smelter Company. Common labor was being paid $4.75 per eight hours. Dry-farm wheat land averages 12 bushels of wheat per acre and sold for $2.00 per bushel. The average dry-farm in the county produced 1920 bushels of grain in 1918. It cost the farmer $1.30 per bushel to produce the grain which left him $.70 per bushel clear. At this rate the farmer could make for himself an average of $1,344 for his year's work, while at the smelter he could earn an average of $1,900. It was this very thing that seemed to draw the farmers from the farm and take them to the smelter to work. It was due to the large number of farmers leaving the farms that land values went down in Tooele valley rather than up as they did in other sections of the State. This made the demand for land less, and due to this fact land values have decreased from 1910 to 1925.

In 1925 land values in Tooele Valley were just $.58 less than they were in 1910 as shown on page of this paper.

It looks as though the general increase of the price of land all over Tooele Valley has just reached the point where the artificial price forced land values in 1910, and from 1926 on the value of land will increase or decrease with the State.

Looking at the increase in land values from a different angle, one cannot overlook the effects of the opportunity the farmer has close to the smelter, to work his farm in the summer and at the smelter in the winter. It seems that this has a marked effect on the value of the land close to the smelter. A farmer nearby can afford to pay a little more for the land where ever this condition is present, and by doing so it looks as if the advantage is represented in the value of the land itself. This condition has become more evident in the last two years because of the remarkable showing the Smelter Company has made in controlling the waste of the plant.

As a summary of this work, one could be safe in saying that the advantages under which land values have increased are offset by the disadvantages which it brings in; therefore, I feel that this question of increased land values can be set aside as having very little or no bearing on the question from 1914 to 1927.

THE ADVANTAGES THE FARMER RECEIVES THROUGH THE PRESENCE OF THE SMELTER IN TOOELE VALLEY

1. Increased borrowing power of the land.

2. Increased amount of money available for use by the farmer.

3. Better markets for farm products.

4. Winter work at the smelter for farmers who would otherwise be idle.

5. Lower taxes in proportion to the increase in land values.

Due to the presence of the smelter in Tooele Valley and the artificial value placed on land, it has made it possible for the land owners to borrow more money on the farms. The average increase in the value of the land in 1910 placed it in a position where real estate men, bankers, and loan companies would allow more money per acre whenever mortgages were applied for. These loan companies are very liberal with their loans where ever they find land with an option on it because they are sure that if the owner can't pay the mortgage they can take over the land and sell it to the Smelter Company for the price agreed upon in 1910. The average increase in the amount of money loaned on an acre of land has increased from $9.00 per acre to $14.00 since 1910.

The increased amount of money made available for agriculture comes from the payrolls of the International Smelter. Sixty-two per cent of the wages paid by the Smelter Company is spent in Tooele City. The savings of the smelter men average over a period of years $65,000 per year, all of which is available for use by the farmer if he needs it. This has helped to keep the interest rates down in Tooele Valley, and has been a direct advantage to the farmer as can be seen

by the following table:

	State	Tooele Valley
Farm machinery per farm	$308.50	$502.00
Value of Bldgs. per farm	1,256.00	2,362.00
Average investment per A.	12.95	21.05

Better markets for farm products have been brought about by the increased number of people brought in to operate the smelter. In 1900 there were 1,500 people in Tooele City and in 1925 there were 4,500 and 90 per cent of the male population over 18 years of age are wage earners. This does not include extra farm hands that are generally classed as wage earners. Along with this increased population the number of agricultural producers were reduced as can be seen on page of this paper. With the increase in population and a decrease in the number of producers one can see that the markets are bound to be good as long as the smelter remains in the valley. There are a number of small towns in the valley that are going to come in for their share of the farm products very soon. These towns are going to open up new markets for the producers which he must take advantage of because, as everyone knows, the metal market determines the length of time these towns will stay in the market for farm products.

WINTER WORK AT THE SMELTER

The International Smelter Company pays $30,000 dollars in wages to the farmers of Tooele County every year for their work. This amount divided among 421 farmers will given an average of $73.23. This money is all earned between the middle of October and the 13th of April. The exact number of farmers who go to the smelter for winter work is not known, but a close check shows that they are the poor farmers of the County.

The amount of money a farmer is able to earn at the Smelter depends on the kind of work he can do. Common labor is paid $4.00 per eight hours, while skilled labor is paid from $5.00 to $7.00 for the same length of time. If a man can work 90 days for $4.00 he will earn $360. Out of this amount he must pay for his board and room, car fare and Doctor fees. If he is lucky he will return home with about $180 to $200 in cash for his winter's work. There is a question in the minds of many of the farmers of the county as to whether it pays to go to the smelter for winter. It seems to depend on the type of farm one is operating. If it is a dry farm only, one has very little to do during the winter months, and $200 is a great help to a man who is in that business. On the other hand a man might be operating a dairy or beet farm than to go to the smelter for the winter. I might report an experiment on just such a condition. One farmer living in the north end of the valley increased his earnings $412 by feeding

cattle and hauling manure, over the year he went to the smelter. Here are the figures as they were given to me: 90 shifts @ $4.00, $360 less $121 for board and room, $22.00 for car fare and Doctor fees, leaving him clear $213.00. The total increase in his salary the following year was $650.50. Just whether this amount was earned under the same conditions I am not in a position to say, but if he had left his farm and gone to the smelter for the winter he would have lost around $400. The advantage of winter work at the smelter over the farm depends on at least three things: Type of farm one operates, location, and the kind of work one can do off the farm.

With a number of men leaving the farms during the winter months makes a shortage of some farm products. Many of the farmers have noticed this condition and have begun to produce sheep for mutton, eggs, pork, celery, and dressed poultry. In many cases they can show a better return for their work than the men who leave the farm for winter work at the smelter.

From the following questionaire sent to the assistant cashier of the Tooele County State Bank, one gets an idea as to how important the smelter is to some of the farmers of Tooele County.

1. What per cent of the smelter pay roll is spent in Tooele?

Answer: 60%.

2. What per cent of the money lent to farmers in Tooele County is the savings of smelter men.

Answer: 25 per cent.

3. What advantage has the farmer for borrowing money because of the smelter being located in Tooele Valley?

Answer: There is between 60 and 65 thousand dollars available every year for the farmer which otherwise would be impossible if the smelter were not here.

4. Do you think winter work at the smelter helps the farmer?

Answer: very much.

The Effects of the Smelter on Industries Outside of Agricultur

The mining industry in Tooele has been brought back into the productive stage in the last five years due to the experimenting of the smelter companies in the State. The International Smelting Company, which has taken the lead in this work, has brought about changes that have increased the former ore supply of the State many times.

Four years ago the International Smelter was confronted with the problem of securing an adequate ore supply for its operations. The fact was the smelting capacity in Utah was greater than required for the ore production.

A broad-scale-industrial-survey was made by the Company which showed that two-thirds of the ore supply for Utah lead smelters was coming from sulphide ores, much of which was

either heavily penalized or could not move profitably, due to its zinc content. Through this survey the miners are receiving $5,000,000 annually through producing zinc ores that were formerly thrown away as useless.

The International Smelter led out in this research, the information given them a first-hand advantage over their competitors in contracting for sulphide ores. By having this information along with the flotation experiment mill, and good advantages in location, they have forced the smelting cost to the minimu. Other companies, in order to stay in business, had to lower their smelting charges and have brought metal production in Utah with the lowest in the United States.

Because of the location, the International Smelter always pays its labor $.25 per day more than any other smelter company in the State. This came about through an agreement drawn up by the smelter company and the laborers. The company increases and decreases the wages of its laborers with the increasing and decreasing of metal prices. They are able to pay $.25 more per day for laborers than the other companies because of their comparative advantages over other companies of the state.

The experiments performed by the International Smelting Company on the sulphide ores in Tooele Valley have brought mines back into the productive stage and have increased the ore supply of the State of Utah. These reduced rates in ore smelting has placed 500 men in Tooele Valley with wages over $40,000 per month coming into the Valley. It

has been estimated by the officials of the National Lead Company located at Bauer, that before 1930, $5,000,000 worth of ore per year will be produced over and above all high grade ores now being taken out of its mines.

The International smelter Company at Tooele does not smelt ores any cheaper than other companies of the State, but they have forced other companies to come down to their figures or lose the contracts they now hold on lead producing mines in Utah and neighboring States. This condition has been brought about because the International Smelter can produce smelt ore cheaper than the other companies in the State.

The smelter's nearness to the mining district of Tooele has made the labor situation in that section much better than it was. Men who are dissatisfied at the smelter can go to the mines to work, and men who do not like the mines can go to the smelter. Wages are about the same, however. The average labor wage at the smelter is $4.00 less $.10 per day for transfers, while at the mines it is $4.50 per day less $.25 per day for transportation. Skilled labor is said more around the mines than around the smelter. Example: A millright at the smelter receives $7.50 per 8 hours, at the mine he receives $10.50 per 8 hours. This is one of the highest paid men in the mill outside of the Superintendent. Working condition are very favorable at both the smelter and the mines of that section.

The Limestone industry is becoming quite prominent in Tooele County. The smelter located at Tooele creates a demand for 75,CCC tons of limestone per year, which is furnished by lime quarries located at the north end of the Stansberry Mountains. There is a force of 3C men working there the year round, which adds to the wealth of the County. This industry depends almost entirely on the smelter at Tooele for its activity. The Western Pacific railroad Company built a cut-off line from Burmester to the Warner Junction which reduces the haul from the lime pits to the smelter of 5C miles. They have reduced the cost of lime-stone per ton, which is one more advantage in low cost of producing metals.

The General Effect of the Smelter on Business

Business in Tooele has developed by leaps and bounds in the last sixteen years. Every kind of business has been going and will continue as long as the smelter remains there. With a thousand men bringing $1,7CC,CCC into the town every year and spending 6C% of it locally there is no reason why business should not be good.

$1,C2C,CCC spent by 1,CCC working men in one year shows that business is good from the ground up. In 1909 Tooele was just a little village of four or five small stores, one drug store, and two or three saloons, no cement side-walks and few people with electric lights and water. Today it is a town of 4,CCC people and between 5CC to a thousand floaters. There are

several first class stores, butcher shops, three chain stores, hotels, pool halls, drug store, restaurants, and many other businesses that are all in a healthy state. All of the main streets have cement side-walks on both sides of the street, good roads, good lighting systems, first class water system. All of the modern conveniences one would ask for are found in Tooele City outside of concrete highways, and it looks as though they will be in sight before long. Tooele City has advanced from a small agricultural town to fifth in the State for size and number of population. This growth has all come from about through the presence of the smelter in Tooele Valley.

Real Estate in Tooele City began to increase shortly after the smelter was being built. One fourth of a mile east of Tooele City a new town site was opened up, and from then on Real Estate has increased 60% in 16 years. These figures were obtained from three leading Real Estate men of Tooele City: R.J. Huntoin, Hickman, and C. R. McBride, who handle all of this work for the International Smelter at Tooele.

The people who have made their homes in Tooele are of high class. They bought homes as soon as they were located. Without these thrifty, industrious people, Tooele would be a town of semi-slums, with nothing but transit laborers coming and going. The smelter has kept the later type of labor out of Tooele by refusing him work.

Illiteracy has been reduced in Tooele County from 6.7% to 2.6% in ten years. (1910-1920). In Tooele City it has

been reduced to .38 of one per cent since 1910. There is no doubt that the higher type of people coming into the City have helped to reduce this percentage. Good schools, better teachers, and better equipment have been the ideal of the people, and it is showing its effect.

SUMMARY

The mineral industry is one of the most important wealth producers of the State of Utah. The total mineral output for the State in 1927 was $82,663,000. Agriculture comes second with a total output of $39,000,000.

To convert these metals into a form so humanity can make use of them, certain processes are employed to separate the metal from the rock, or waste. It is through the process of extracting these metals that large quantities of waste are products, such as sulphur dioxide, arsenic, and fine metals, which are liberated from the reduction of plants. These waste products damage land, crops, and livestock. The land is damaged due to the settling of large quantities of fine metal and arsenic on the surface of the soil. These wastes have a toxic reaction on the soil which renders it unfit for the production of crops. Plants are injured through the burning of the leaves by SO_2 gas. Livestock is injured by eating the plants which have collected large quantities of arsenic on the surface of the leaves.

It has been proven by many experiments that SO_2 is the waste that does the most damage to plant life. It is the most difficult of all wastes to retain and when it is discharged into the air it does more damage than either of the two mentioned above. The distance it can be carried by the wind and still retain its damaging properties is the one character that makes it very detrimental to agriculture in Tooele Valley.

The amount of damage done by smelter wastes in any one section is hard to determine because of the number of factors involved, such as climate, type of smelting, kinds of ore handled, types of crops grown, and processes used to dispose of the wastes. The damage is seldom inform over any given areas, and the degree of susceptibility is not the same in all plants.

Since the building of the International Smelter in Tooele Valley there has been a dispute as to the economic advantage or disadvantage agriculture has been subjected to. The following is a list of the advantages agriculture has through the presence of the Smelter in the Valley:

1. Better market for farm products.
2. More money available for the use of agriculture.
3. Lowering of the tax rate in the county.
4. Relieving agriculture of part of the tax burden.
5. Winter work for farmers.
6. Increased the population of the county.

The following is a list of disadvantages to which agriculture is subjected:

1. Damage to crops.
2. Damage to land.
3. Damage to livestock.
4. Damage to water systems.
5. Damage to forests and pasture land.
6. Decreasing the total agricultural output for sections close to the smelter.

If the disadvantages and advantages could be compared and given their true value there is little doubt as to which would be the better for agriculture. Without a market for farm products, a farm is nearly worthless, and a smelter, without people to operate it is worthless. Industry needs people; people need food; and the farm produces the food; people buy it and there a market is created.

There is a general interlocking of the advantages and disadvantages with which agriculture had to contend, in Tooele Valley, but whether the agricultural industry would be better off without the smelter is impossible to say at present.

The following figures will give one an idea as to the amount of money the International Smelter has brought into the Valley, the amount saved by the Company and possible damage done since 1910:

POSSIBLE DAMAGE TO AGRICULTURE SINCE 1910

Damage done to 26,672 acres of land	$94,235
Damage done to 8,115 acres of land	247,493
Damage done to 2750 acres of land	42,675
Possible damage to crops	780,000
Possible damage to livestock	Unknown

MONEY THE SMELTER HAS BROUGHT INTO THE VALLEY SINCE 1910

Paid in Taxes	$1,404,000
Paid in Wages	31,300,000

AMOUNT THE INTERNATIONAL SMELTER COMPANY HAS SAVED BY RELOCATING IN TOOELE VALLEY SINCE 1910

In Taxes	$276,562.10
On land and damages	444,566.00

The above figures show that the smelter has brought more money into the valley than the cost of damage done. If the smelter continues to reduce the amount of waste set free, the agricultural producer of Tooele Valley is going to have a distinct advantage over other sections of the State, as a producer of agricultural crops and marketing conditions.

The distribution of the money brought into Tooele Valley is uncertain. Most of it, however, goes to the laborers who sell their labor to the Smelter Company. $2,298,000 that has been brought into the valley by the Smelter Company

has been distributed to the land owners who are standing the brunt of the damage. $1,164,293 worth of damage was estimated to have been done by 1920, at which time, the Smelter Company figured it would be controlling most of the wastes that were supposed to be doing damage to agriculture and livestock. This leaves a total of $1,133,707 to pay for any damage that is done from now on until the smelter is removed from the valley.

After going into this work I feel that the disadvantages Agriculture is subjected to, due to the presence of the smelter in Tooele Valley, is overcome by the money paid to the land owners for damage done, by better markets for farm products, and by lowering the taxes in proportion to the increase in land values. I also feel that it is to the Smelter Company's own advantage to catch the wastes that were doing damage to agriculture in the Valley and that they are receiving advantages through location in the valley that paid them for all the trouble, they have been subjected to by the Agricultural Industry of Tooele Valley.

ACKNOWLEDGEMENTS

The writer wishes to express his appreciation of the splendid encouragement, the council, and helpful suggestions given by Dr. W. L. Wanlass, Dean of the School of Commerce, Utah Agricultural College, during the progress of his graduate work.

He also wishes to thank Professor R. H. Rutledge, Agricultural Economist of the Utah Agricultural College, for his helpful suggestions during the writing of this paper; also Dr. George R. Hill, head of the Department of Agricultural Research for the American Smelting & Refining Company; and Mr. C. R. McBride, General Claim Agent for the International Smelting & Refining Company, for their splendid support and interest in this problem.

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