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NEW ZEALAND.

BEET-ROOT SUGAR.

CULTIVATION OF SUGAR-BEET, AND MANUFACTURE OF SUGAR THEREFROM IN VICTORIA, AND
STATISTICAL DATA OF OTHER COUNTRIES RELATING THERETO.

[Reprint of Paper presented in 1894 to both Houses of Parliament in Victoria by Command of His
Excellency the Governor.]

Laid on the Table by Leave of the House.

FOR several years past the conviction has been gaining ground that the Colony of Victoria is eminently suited for the beet-sugar industry, and in the Premier's manifesto to the people of Victoria, 11th November, 1894, the following sentence appears: "It is intended by every means to foster producing industries, and to encourage the growth of sugar-beet, flax, and other products for home consumption and export."

General attention having been thus prominently directed to this subject, the Minister of Agriculture has deemed it desirable to collect all the information available, and to herewith present it in a concise form to the honourable members of both Houses of Parliament.

The question of promoting this most important branch of industry in Victoria is by no means of very recent origin, as we find that almost thirty years ago the Melbourne Press has paid considerable attention thereto.

The *Age* of the first June, 1867, says: "At last the very great importance and usefulness of this branch of industry have been recognised; its beneficial influence is further seen in its tendency to diminish the curse of slavery still existing in some of the tropical countries where sugar is produced, and to improve in no small degree the condition of the working-classes in all countries where the cultivation of the sugar-beet and the manufacture of sugar therefrom have been introduced," &c.

The *Express and Telegraph*, 1868: ". . . . would not the practicability of experimenting upon the cultivation of beet-roots in this colony for the purpose of manufacturing sugar be a good subject for the consideration of our various farmers' clubs and chamber of manufactures? We commend the matter to the attention of practical men who are desirous of extending the sphere of colonial industry, and adding from time to time to the list of our products."

The *Daily Herald*, 1868: ". . . . there may be some delay in bringing about a large production of sugar-beet just at present in this country we have no doubt that in a year or two hence its culture in Victoria will be thoroughly established."

The *Australasian*, of the 10th November, 1866, says: "Although the prevailing opinion in Europe is that the beet does not grow well in warm climates, we may rest perfectly satisfied that Victoria suits it; and, after a few years' experience, as large crops will be carted off these soils as were raised in any part of Europe."

Practical experiments with the growth of sugar-beet have indeed been carried on in this colony for over thirty years past. So long ago as 1860 a "mixed crop yielding 43 tons of sugar-beet per acre was produced on the Government Experimental Farm at Royal Park," says Mr. Thomas Skilling, the then director, "thus incontestably proving the capabilities of our soil and climate in this direction, and enabling me, as the result of this experiment, to declare Victoria to be the home of the sugar-beet." Unfortunately, no record exists of the quality of the beet produced in this early Victorian experiment. Further tests, however, have clearly demonstrated the fact that, in conformity with all other countries, the beet cultivation in this colony, under increasing attentions to the growing crops, has proved itself to be of an emphatically progressive nature. Thus, for instance, the Secretary for Agriculture, in his report for 1874, says, "According to the returns sent in, it appears that the roots manufactured into sugar and spirit gave on an average 7·09 per cent. of sugar only, a quantity much too small to render the manufacture of sugar from beet-root a profitable industry in Victoria."

Continued experimenting with this plant by the Agricultural Department has been attended with very material success, so much so that in his report for 1889-90 the Agricultural Chemist was enabled to state that "the results remove all doubts as to the possibility of growing beets in this colony as rich in sugar as they are in Europe."

The highest sugar percentage in Victorian-grown beet-roots up to that time has been 15·7 per cent., which, however, has during the 1893-94 season been surpassed in a most satisfactory manner, when the Agricultural Chemist ascertained the highest sugar percentage in the juice at no less than 22½ per cent. of roots produced by a private grower, while sixty-four samples from Government experimental patches have averaged as high as 18·1 per cent., ranging between 14·74 per cent. and 21·14 per cent. Such most satisfactory results have led the Agricultural Chemist to the conclusion that this industry is one of the most naturally suited to Victoria.

Mr. Richard Gird, in the annual address for 1894 before the State Board of Agriculture at Sacramento, in California, says, "As a nation we should encourage the production of those products that are now purchased from abroad—for the double effect of diversifying agricultural industries, making every other kind of crop more valuable; and also to save our money at home among our own people, the necessity for which is so apparent at the present time."

This sentence meets and fits the conditions of Victoria in the fullest sense; and here, like in California, applies thoroughly to the production of sugar, of which our population is consuming enormous quantities every year, every ounce having to be imported from elsewhere, while nature has placed at our disposal sources of wealth which will most undoubtedly enable us with incalculable advantages to grow and manufacture our own sugar upon our own land with our own labour.

It will no doubt interest honourable members if the sugar question of Victoria, as our statistical records for the year 1893 present it, is briefly placed before them. According to these records, it appears that during the preceding year in all 45,598·4 tons of sugar have been imported into this colony. As of this quantity 5,370·2 tons have again been exported, the total consumption was 40,228·2 tons, for whose purchase a sum approaching three-quarters of a million sterling has left this country. The following table will show whence our sugar supplies during the year 1893 have been drawn :—

Name of Countries.	Refined Sugar, in Tons.	Raw Sugar, in Tons.	Total, in Tons.
United Kingdom	1·10	...	1·10
New South Wales	7·80	6,798·85	6,766·65
Queensland	1,025·30	8,489·60	9,514·90
South Australia	79·35	243·45	322·80
Fiji ... ..	...	3,233·80	3,233·80
Natal	39·40	...	39·40
Hongkong	81·60	0·75	82·35
Java ... ..	...	23,552·40	23,552·40
Mauritius	186·25	1,898·75	2,085·00
Totals	1,420·80	44,177·60	45,598·40

A closer analysis of the above statistical records shows that Australian sugar imported in 1893 amounted to 16,272·2 tons, and foreign sugar imported in 1893 amounted to 29,326·2 tons, which indicates that out of every 100 lb. of sugar imported only 35·56 lb. were of Australian origin, while 64·32 lb. were foreign—principally from Java, viz., 51·65 lb. These figures are very instructive indeed. It is generally supposed that the sugar Victorians are consuming comes chiefly from our sister colony of Queensland, but the above statistics prove how erroneous such assumption is. The following tabular statement—compiled from official sources, and referring to general sugar supplies of the Australian Colonies, Tasmania, and New Zealand for the year 1893—will probably dispel some more erroneous notions generally held :—

Colony.	Produced—Tons.	Imported—Tons.	Exported—Tons.	Consumed—Tons.
Queensland	76,146·00	33·50	52,528·95	23,650·55
New South Wales	20,000·00	35,754·00	10,174·30	45,579·70
Victoria ... ..	...	45,598·40	5,370·20	40,228·20
South Australia ... ..	...	20,183·30	3,596·30	16,587·00
West Australia ... ..	...	4,000·00	..	4,000·00
Tasmania ... ..	...	7,218·90	3·00	7,215·90
New Zealand ... ..	...	21,340·00	282·00	21,058·00
Totals	96,146·00	134,128·10	71,954·35	158,319·35

The preceding table shows that the only two Australian sugar-growing and manufacturing colonies (sugar-cane)—viz., Queensland and New South Wales—have between them produced only 96,146 tons of sugar, whereas the total consumption in the seven colonies named has amounted to 158,319·35 tons; so that the shortage, which had to be imported from foreign countries, has amounted to 62,173 tons, of which quantity, as previously shown, Victoria alone took 29,326 tons, or 47·16 per cent. The table also shows that in Queensland and New South Wales combined the excess of sugar production over sugar consumption has left only 26,916 tons available for the remaining five colonies, whose consumption was 89,089 tons; so that the latter have been com-

pelled to draw 69·78 per cent. of their sugar requirements from foreign sources, at a total cost probably not far short of one million and a half sterling.

For such reasons (clearly adduced by statistics) it must appear quite evident that there is ample inducement for increased sugar production in Australia, not only from an individual Victorian standpoint, but also from the intercolonial point of view—or, which is equivalent, from that of Federated Australia. As far as Victoria is concerned, we cannot produce any sugar from the cane; in this we are precluded by our climatic conditions. But, as already indicated, this colony is in the highest degree suited for the growth of sugar-beet. From this aspect, therefore, in the face of the above statistics, the prospects of the sugar-beet industry are most auspicious.

In looking deeper into the question of our sugar-supplies—more especially in view of the approaching intercolonial federation—naturally the question of the competition between cane- and beet-sugar will have to be dealt with, as well as the probable expansion of the cane industry in our sister colonies. Respecting the former point, generally speaking, it cannot possibly be denied that beet sugar has been eminently successful in its competition with the cane. The *British Export Journal* of the 15th November, 1893, says, "It has for years been apparent that beet-sugar is steadily replacing the product of the cane." This verdict of a renowned journal is based upon facts, for, according to Board of Trade returns, in the United Kingdom at the present time, out of a total of something like 1,300,000 tons of sugar consumed annually, no less than about a million tons are beet-sugar, produced on the Continent of Europe, which clearly shows that the beet article has not only held its own, but that it has entirely succeeded in its attempts of gaining the favours of the consuming public, which fact must appear all the more remarkable since beet-sugar has come into prominence only comparatively recently. But so rapidly has it made its progressive strides that at the present time it undisputably rules the world's sugar-market. In this sense Mr. C. Czarnikow, whose weekly "Prices Currents" are universally considered authoritative, says in that issued in London on 24th May, 1894, "The whole course of the market will naturally be guided by that of beet-root, which is now the regulating factor."

A remarkable contrast to this statement is afforded in said gentleman's "Price Current," dated London, 11th October, 1894, wherein he says, "In cane-sugar transactions are quite of a retail character."

It is a well-known fact that universally the consumption of sugar has increased enormously during the last two generations. The people have found out for themselves that sugar is no longer a mere sweetening agent or condiment, and therefore an article of luxury, but that it really is a food-stuff of high value. The cane industry could have never kept pace with the demands of consumers, increasing with a marvellous rapidity; and it was the much-despised beet which, thus receiving a great impetus, had occasion to step in and to establish itself on such a firm footing that it is now impossible to displace it therefrom. True, the prejudices of the people, and particularly of the English race, have managed for a long time to maintain a certain hostility towards this article; and to a great extent such prejudices still exist in theory, although in reality the very fact that by far more beet- than cane-sugar is consumed should have long ago banished them into oblivion. As a matter of fact, cane- and beet-sugar are absolutely the same thing—there is not the slightest difference between the two.

Mr. William Reed, in his "History of Sugar and Sugar-yielding Plants," says, "It may be proper to state that beet-root sugar is not only identical in every respect with cane-sugar, but that much of the Dutch lump sugar is actually the produce of beet-root. The circumstances cannot be too much insisted upon that the seeming distinction between yellow-beet sugar and yellow-cane sugar depends on the extraneous matters present. These, when eliminated by refining, leave white materials in all respects identical. There is practically no difference between these two, whether of colour or of grain." Under such circumstances, the people of Victoria need have no apprehensions that when we do begin to produce our sugar from our own beet-roots they will have an article foisted upon them inferior to that they have been accustomed to consume.

The large increase in the production of beet-sugar just referred to, in comparison with that gained from the cane, may be gathered from the following statistical returns referring to the total sugar production of the world for the years 1880–81 and 1893–94 respectively according to Licht: In 1880–81 the cane-sugar produced amounted to 1,979,900 tons, and in 1880–81 the beet-sugar produced amounted to 1,774,545 tons; total, 3,754,445 tons. In that year the quantities of the two articles were very much alike, but thirteen years later the respective quantities have experienced the following changes: In 1893–94 the production of cane-sugar was 2,960,000 tons, and in 1893–94 the production of beet-sugar was 3,881,945 tons; total, 6,841,945 tons. It is seen herefrom that the increase in the world's sugar production during the last thirteen years has been equal to 82·28 per cent., but the two articles have not increased at the same ratio during the said period, for in cane-sugar this percentage has been only 49·5 per cent., while for beet-sugar it has amounted to 118·75 per cent. The reversed position of the two articles for the indicated two years will be seen still more clearly if put in the following manner: Of every 100 lb. of sugar produced in the world—In 1880–81, 47·2 lb. were made from beet, and 52·8 lb. from cane; while in 1893–94, 56·7 lb. were made from beet, and 43·3 lb. from cane. These figures unrefutably indicate the success which the beet industry has achieved in its competition with the cane.

In regard to the consumption of sugar in these colonies, it may not be generally known that per head of population it by far exceeds that of any other country in the world. In this respect the following extract from the anniversary address delivered to the Royal Society of New South Wales by the president, T. P. Anderson-Stuart, M.D., Professor of Physiology in the University of Sydney, on the 2nd May, 1894, will prove very interesting to honourable members: "An interesting circumstance worthy of mention here has been emphasized by the financial panic in Australia, and the depression following it. In conversation with the manager of a large sugar business he mentioned that the consumption of sugar had not diminished notably—certainly not

to the extent one might have thought it would, considering what we have been passing through; and that, while there has been some small reduction in the total consumption of sugar per head here, he thought that such reduction has been only in the quantity used for brewing, and not in that used for food. Even now the consumption per head in Australasia is very largely above that of any other country, notwithstanding the enormous import of confectionery, &c., from England, which is all included in the British consumption, and although the people here are supplied with other articles of diet in infinitely larger quantity and of better quality than any other community can obtain."

Such most significant facts are borne out by the following figures, quoted from a lecture by Dr. O. J. Broch before the Statistical Society of Paris, according to which authority the consumption of sugar in the under-mentioned countries has been as follows per head of population:—

	Lb.		Lb.		Lb.
South Australia	... 102·10	United States	... 43·00	Norway	... 11·37
Western Australia	... 93·51	Denmark	... 29·69	Finland	... 11·22
Victoria	... 90·75	Holland	... 28·37	Portugal	... 9·56
Tasmania	... 90·49	Switzerland	... 22·81	Roumania	... 7·71
New Zealand	... 87·18	France	... 22·56	Russia	... 7·69
United Kingdom	... 68·99	Sweden	... 17·51	Spain	... 5·11
Queensland	... 62·93	Belgium	... 15·74	Servia	... 4·41
New South Wales	... 60·93	Germany	... 15·01	Italy	... 3·20
Argentine Republic	... 50·04	Austria	... 13·23		

Although, as per above table, our colonies occupy the foremost place, there are ample evidences that our sugar consumption is still on the increase, and there is no telling at what figure the maximum is likely to be estimated. It may be mentioned that the Victorian Statist places the colonial figures somewhat higher all round than those of Dr. Broch as above; but, adhering to the latter gentleman's data, and assuming that our seven colonies would all be consuming at the same rate as South Australia—viz., 102·1 lb. per head per annum—then, on the basis of the 1891 population census of the respective colonies, the total annual increase in the sugar consumption would amount to no less than 37,055 tons, which quantity, if not produced within the colonies, would, of course, have to be imported from foreign countries at a cost considerably exceeding half a million sterling.

Looking at the just-quoted table in a general way, we cannot fail to arrive at the conviction that undoubtedly there is an enormous field and most brilliant prospects for the sugar industry generally in the world's market. Statistics demonstrate that the consumption of sugar is increasing very rapidly, and evidently no nation has reached the maximum yet—most of them are, indeed, very much behind, although recently their demands for sugar have been growing up in leaps and bounds. In the face of such facts, Mr. C. Czarnickow's announcement, dated London, 4th October, 1894, that in beet-sugar, "barring the unforeseen, a minimum excess of 800,000 tons over last year's production may be looked for" during the 1894-95 season on the Continent of Europe, needs not to cause much alarm, although the market may thereby be temporarily depressed.

Having thus in a general way demonstrated the success of best-sugar in its competition with the cane, it will be necessary before leaving the consideration of our sugar-supplies, as already indicated, to deal with the probable expansion of the cane industry in our sister colonies. To do this aspect of the question full justice would require entering elaborately into the various factors at work or at influence in connection with the Australian cane industry. This would open a very wide field, which is altogether beyond the scope of this paper—at least, as far as an elaborate treatise is concerned, at which no systematic attempt will be made.

The two sugar-producing colonies so far are Queensland and New South Wales, where cane is more or less extensively cultivated, especially in the first-named colony. In New South Wales the area suitable for cane-growing is naturally limited, and there is not much room for expansion in that colony, while matters are entirely different in Queensland. In both cases the difficulty of the day seems to be the absence or insufficiency of suitable mills to get the cane already grown crushed. As far as New South Wales is concerned, only on the 20th October, 1894, a deputation of cane growers appealed to the Premier to take steps to aid the sugar-growers. It was stated that a large area was under cane cultivation, but, on account of the absence of suitable mills, there was no scope for the development of the industry, nor any prospect to get the cane-crops crushed. In the northern colony of Queensland the same difficulties are manifesting themselves, although they have been foreseen to some extent by the Legislature, and greatly alleviated by "The Sugar Works Guarantee Act, 1893" (Queensland, No. 18, assented to 18th October, 1893), whose objects are to stimulate the cane industry by guaranteeing, under certain conditions, both capital and interest of debentures issued by a company erecting a sugar-mill. The difficulties which have arisen are due to the fact that in past years a great number of small primitively-furnished mills have been erected and working, which, under the prevailing high sugar prices, have proved fairly remunerative in spite of their perfectly-inadequate methods and scandalous wastes. Receding market prices and keener competition of mills more modernly furnished for large scale work have placed small concerns entirely *hors de combat*, the consequence being that the State rightly stepped in and lent its aid to the greatly-imperilled industry. To remodel the latter so as to correspond with modern requirements will require the reinvestment of enormous sums of money, which circumstance undoubtedly must at least temporarily check the progress of that industry, as the major portion of it must be diverted into entirely new channels. The final effect hereof possibly will be that whole districts will have to give up cane-growing altogether, while, on the other hand, new districts undoubtedly will be opened up for it; obviously, however, such changes will not be established without at least a temporary check.

Of more important bearings upon the development of the Australian cane industry are considerations of quite a different nature, involving a deep and unrefutable principle. Examining the location of the cane industry throughout the globe, we find that it flourishes nowhere amongst any nation marching in the first ranks of civilisation. It needs no pointing out that in a prosperous civilised country agriculture, amongst many other achievements, necessarily must occupy a foremost position, and that forced labour cannot find room in it. It has been repeatedly asserted that the cane industry cannot exist without forced black labour—and general conditions of this industry throughout the world certainly support such assertion most emphatically—hence it cannot lay a claim to a *locus standi* in a civilised country. In Queensland, as is well known, the labour question is being most unpleasantly felt; so much so that the organ of the cane industry in that colony, the *Mackay Sugar Journal*, in its issue of the 15th May, 1894, is led to say, "The one great danger ahead of the industry in Queensland is the increasing scarcity of labour." The cane is not an agricultural crop—that is to say, it is not a crop which in rational, systematic, and scientific farming in conjunction with other crops will tend to make the land more productive for each other, not even in subtropical farming, which is merely a more or less dormant science. Under such circumstances, cane-growing cannot claim a place under the agriculture of a civilised nation, hence its life in a civilised country must naturally be limited, eventually it will be incapable of existence therein. As the population and settlement of a young country, as vast as it may be in expanse, will increase, so will also the demands for varied productiveness of the land be increasing, to which irresistible force even the cane industry will eventually have to give way. This, in the natural course of events, is as yet in a very distant future, no doubt, and it is not our intention to discount such sure eventualities at the present time. Consideration has merely been given to such opinions of experts in order to facilitate conclusions which are about to be made. That, as matters stand at present, Queensland cane-growing will still for some time experience an expansion there can be no doubt, neither is it intended to at all belittle this fact. That much, however, is quite certain—that such expansion will not reach that extent which some people expect. Taking everything into account that has just been alluded to and implied, as well as the attached statistics of Queensland's cane-sugar production, it seems to be the opinion of experts that during the next generation, even under the great efforts at work, that colony will not produce more than 125,000 tons of cane-sugar, while for New South Wales this figure is set down at an outside maximum of 25,000 tons.

From these considerations it will be evident that, should we not find means to supplement the ever-increasing demands of our ever-increasing population for sugar from some other home sources, we will be compelled to always look to foreign countries for our sugar-supplies.

The statistics in the following table, relating to Queensland's home production of cane-sugar, will be found highly interesting and instructive. These figures, embracing a period of the last twenty-five years, on the whole, show a decidedly increasing tendency, particularly so in the column containing the number of acres from which cane has been crushed. On analysing the three columns conjointly, however, a very erratic disparity will appear, which indicates that from the productive acreage no reliable deductions can be made as regards the quantity of sugar yielded therefrom. Thus, for instance, in 1886–87, 36,104 acres yielded 56,859 tons of sugar, while a few years later, in 1891–92, 36,821 acres gave only 51,209 tons, &c. :—

Year.	Acreage of Cane crushed.	Tons of Sugar produced therefrom.	Yield of Sugar in Tons per Acre.	Year.	Acreage of Cane crushed.	Tons of Sugar produced therefrom.	Yield of Sugar in Tons per Acre.
1869–70 ...	1,238	1,490	1·20	1882–83 ...	16,874	15,702	0·93
1870–71 ...	2,188	2,854	1·31	1883–84 ...	25,792	36,148	1·40
1871–72 ...	3,078	3,762	1·22	1884–85 ...	29,951	32,010	1·07
1872–73 ...	5,018	6,266	1·25	1885–86 ...	40,756	59,225	1·45
1873–74 ...	5,380	7,978	1·48	1886–87 ...	36,104	56,859	1·57
1874–75 ...	6,978	12,108	1·74	1887–88 ...	34,821	57,960	1·66
1875–76 ...	7,668	6,322	0·83	1888–89 ...	30,821	34,022	1·10
1876–77 ...	7,245	8,214	1·15	1889–90 ...	31,239	44,411	1·42
1877–78 ...	8,043	12,243	1·52	1890–91 ...	39,435	69,983	1·77
1878–79 ...	10,702	13,525	1·26	1891–92 ...	36,821	51,209	1·39
1879–80 ...	11,409	18,714	1·64	1892–93 ...	40,572	61,386	1·51
1880–81 ...	12,306	15,564	1·26	1893–94 ...	45,440	77,082*	1·69
1881–82 ...	15,550	19,051	1·22				

The third column of the above tabular statement—viz., that giving the yield of sugar per acre—is especially instructive, for it shows that, except in quantities produced, the Queensland cane industry has made very little or practically no progress at all during the last twenty-five years as regards both cane-culture and sugar manufacture. Indeed, it cannot be denied that, in the face of the reputed richness of the cane, the above official figures demonstrate, technically speaking, a rather deplorable state of affairs. Thus, it appears, that the average sugar yielded per acre during the last thirteen seasons has been 1·39 tons, while for the preceding twelve years it has been 1·32 tons, therefore practically the same. The highest yield recorded has been 1·77 tons per acre—viz., during the 1890–91 season; but sixteen years previous to that—viz., in 1874–75—this figure has very

* The apparent discrepancy of this figure with that previously quoted is explained by the fact that the two refer to different periods. In the above table the respective industrial seasons are taken, while in the former case the calendar year has been referred to.

nearly been reached with 1·74 tons. It is evident, then, that if cane-growing has qualitatively as well as quantitatively improved, as is reputed, then manufacture must have deteriorated; on the other hand, if manufacturing methods have made progress, as they are also said to have done, then obviously cane-culture must have gone backward. Accordingly there is a great incongruity and anomaly in the reputed development of the Queensland cane-sugar industry as a whole, which admits of only one conclusion—viz., that during the last twenty-five years, the output excepted, it has made very little or practically no progress at all. It must not be overlooked that this refers only to that industry as a whole, in a manner as statistical averages admit of doing. It is well known that there is quite a number of modernly-equipped mills in Queensland, which would scorn with derision the imputation of such small yields as the above statistics indicate. This circumstance, however, only emphasizes the fact that there must be a large number of small primitively-fitted mills which cannot possibly work remuneratively, and must succumb.

Before leaving to consider the general conditions of the Australian cane industry, the following calculations will prove highly instructive in view of the facts to follow in pursuing the subject herein dealt with. According to New South Wales statistics for the past ten years, 1884–93, the average yield of sugar-cane per acre has been 25·08 tons; Queensland official data not recording the corresponding quantity, it will not be inadmissible to apply the New South Wales average, of, say, in round figures, 25 tons, to the northern colony. As reliable data, referring specifically to the quality of Queensland or New South Wales cane-juice, are also wanting it cannot be considered unfair to call statements of authorities to aid in this respect. Unfortunately, there is in this respect a difference of opinion amongst them, and a selection of their verdicts will be best made by averaging their figures. Thus the mean quantities of sugar contained in cane-juice are given by authorities as follows:—

E. W. Vincent, in his "Chemistry applied to Arts and Manufactures" ...	18·20 per cent.
"Encyclopædia Britannica" ...	14·55 "
Thorpe, "Dictionary of Applied Chemistry" ...	19·64 "
Payen, "Chimie industrielle" ...	18·20 "
Mean sugar in cane-juice ...	17·65 per cent.

According to the general opinion of authorities, cane contains "about 88 per cent. of juice, of which best mills express only 60 to 65 per cent." (Thorpe). Adopting 60 per cent., it would follow that a crop of 25 tons per acre yields 15 tons of juice containing the above mean of 17·65 per cent. of sugar—that is, 2·64 tons per acre. The highest result obtained during the last twenty-five years in Queensland (see previously quoted table) has been in the 1890–91 season—viz., 177 tons per acre. Hence there appears an enormous theoretical loss of 0·87 tons of sugar per acre, which is equal to no less than 22·42 per cent. on the total theoretical quantity contained originally in the cane—viz., 3·88 tons of sugar per acre—and to 32·96 per cent. on the quantity of sugar—2·64 tons per acre—actually gained in the expressed juice.

Financially, looking at the above, it appears that at the usual price of cane—viz., 13s. per ton—the mill will pay £16 10s. for the 25 tons cropped from 1 acre, which, as above, will yield 1·77 tons of sugar, so that 1 ton of the latter will involve outlays of £9 3s. 5d. for the purchase of the raw material only. Expressed in terms of the latter by weight the sugar yielded amounts to only 7·08 per cent.—that is, 1 ton of sugar was produced from 14·12 tons of cane. The *Mackay Sugar Journal*, 15th September, 1894, states that last year the cost of cane per 1 ton of sugar has averaged £8 10s. to £9.

NOTE.—The preceding calculations presuppose that all the sugar produced is perfectly pure, which in reality it is not. The "finesses" the calculations would involve, were this taken account of, have been purposely omitted in the above consideration.

In pursuing our subject we now arrive at the point of paying some attention to the sugar-beet industry generally. This opens up a very wide field, and for obvious reasons we can only skim, as it were, through its very principal features as past experience of other countries presents them.

It is a well-known fact that beet-sugar has had only a very short life as yet, for it was only in 1747 when the German chemist, A. S. Marggraf, discovered its existence in the humble beet-root. This discovery led to exhaustive investigations, as a result of which the first factory for the production of beet-sugar was established in 1776 at Kaulsdorf, near Berlin, being followed three years later by a second one at Kunnerio, in Silesia; both establishments are in existence up to the present day, although, needless to say, in a vastly different form. Omitting altogether the many varying vicissitudes through which the young industry thus established a little over a hundred years ago had to pass in its infancy, it must suffice to say that it has not only survived all the crushing obstacles encountered on its progressive course, but that its development affords a most strikingly remarkable and thoroughly unparalleled example. The Governments of the various countries soon recognised its importance, and in a praiseworthy manner encouraged and subsidised its growth by wise legislation, as a result of which incalculable benefits have been reaped. Thus it progressed in amazing strides, so that at the present time it occupies the foremost industrial place in all the principal countries of the European Continent.

The importance which attaches to this industry, before quoting some general statistics, may be best gleaned from several verdicts of unquestionable authorities. Thus the great Frenchman, Basset, in his work "Guide Pratique du Fabricant de Sucre," says, "The manufacture of sugar from beet-roots has become one of the most important elements of national prosperity. Based upon agricultural progress and the requirements of an ever-increasing population, allied on account of the cattle which it supports with the production of meat and bread, resting on improving cultivation of the soil, it has rendered to modern society the greatest services, at the same time attaining for itself the highest degree of prosperity and glory to which any industry ever had the ambition to aspire."

Similar convictions are shared by all beet-producing countries, there being no dissent. This industry has even been termed "the greatest agricultural conquest of our time," while the historian Thiers has called it "the Providence of the Empire," which, according to E. B. Grant, "in the opinion of eminent French statesmen, has twice within fifteen years saved France from famine."

Indeed, it is the opinion gained from experience in all beet-producing countries that the cultivation of beet materially increases the production of cereals and other crops and of animal food; and that, therefore, it stands pre-eminent as a beneficent industry. In this respect we have not only the testimony of Europe, but we have also that of California, where the beet industry is now firmly established on a sound and solid basis. The British Consul at San Francisco, under instructions from his Government, has very recently reported as follows: "The sugar-beet industry has proved itself to be a most sure and satisfactory agricultural proposition in California to-day."

Such testimony from the named State of the American Union, which admittedly most resembles Victoria in climate, in people, and in products, must therefore be considered most valuable for our own conditions, and further verdicts from that part of the world will be most significant for us. Mr. R. Gird, in his annual address for 1894 before the Californian State Board of Agriculture already referred to, says, "The sugar-beet is a plant the cultivation of which under the scientific methods necessary for its success, increases the productiveness of the soil for other crops, and makes such division and increase of labour as to help solve the question of profitable employment, and of the instilling of these habits of industry into the rising generation, which at present seems such a difficult problem in our industrial labour system."

Dr. H. W. Wiley, the chief of the chemical laboratory in the Agricultural Department of California, says, in April, 1894, number of *The Engineering Magazine*, in regard to sugar-beet: "There is no other way in which the plethora of agricultural products can be so readily relieved and renewed prosperity brought to our agricultural interests, thus stimulating every other interest in the land."

The *Pacific Rural Press*, of 7th April, 1894: "There is no crop which will repay a farmer better for the labour and care devoted to it than the sugar-beet."

The beet industry is most emphatically an agricultural industry of the first order—that is to say, it has the tendency to enlarge infinitely the productive capabilities of the soil; it leads to increased production of other crops which it does not exclude, but on the contrary demands; it is of a progressive character; and therefore its success in a civilised world is assured. It has brought about that state of affairs which J. R. Dodge has so ably summed up in the following words in his admirable essay on "The Future of Wheat," see *Pacific Rural Press* of the 17th February, 1894: "The incoming of diversified cropping, having a scientific basis, and conducted systematically and on business principles, and not as a haphazard speculation, will regulate the area of all products, reduce the cost of production by increasing the yield, modify the losses from insect depredations and incursions of weeds, and reduce agricultural production to an equilibrium, at the same time increasing materially the margin of profit."

These considerations briefly represent the general—more particularly the agricultural—aspect of the sugar-beet industry, whose industrial progress will now be illustrated by statistics of its general results referring to the quantities of sugar manufactured from beet, in tons, and put on the market, and representing a period of the last thirty years.

These statistics are partly taken from *The Sugar Cane* and partly from Licht:—

Year.	Germany.	Austria.	France.	Russia.	Belgium.	Others.	Totals.
1865-66	180,000	80,000	270,000	64,000	30,000	6,000	630,000
1871-72	189,166	161,527	335,351	90,000	72,236	25,000	873,280
1875-76	305,000	170,000	475,000	150,000	75,000	30,000	1,205,000
1880-81	594,223	498,082	333,614	250,000	68,626	30,000	1,774,545
1884-85	1,155,000	558,000	308,000	387,000	88,000	50,000	2,546,000
1890-91	1,331,965	778,473	694,037	544,162	205,623	156,635	3,710,895
1891-92	1,198,156	786,566	650,377	550,994	180,377	135,450	3,501,920
1892-93	1,225,331	802,577	588,838	455,000	196,699	160,070	3,428,515
1893-94	1,390,000	841,809	579,111	650,000	235,000	186,015	3,881,945
1894-95		Estimated by Licht, of Magdeburg, Germany					4,680,000

From this tabular statement, which is compiled from reliable sources, it will be seen that during the period embraced between the years 1865 and 1894 the increase of the world's beet-sugar production has actually amounted to no less than 616·18 per cent. Obviously, the individual countries fully participate in that increase, more particularly those where this industry is of more recent origin. The respective corresponding increased percentages in the lands enumerated are the following for the same period: Germany, 772·22 per cent.; Austria, 1,052·25 per cent.; France, 214·49 per cent.; Russia, 1,015·63 per cent.; Belgium, 783·33 per cent.; other countries, 3,100·25 per cent.

The above are very significant figures, which naturally and demandingly call for our attention and inquiry. The beet-sugar having become a *sine quâ non* in the social economics of most civilised countries, we are forcibly led to ask ourselves earnestly about our own position to the question.

Amongst the "other countries" in the preceding statements there are two wherein the beet industry is but very few years old, and it will therefore be all the more interesting to note its

progress there. The one in Sweden, where the first factory was established in 1882. The quantities of sugar produced were these: During the 1882-83 season, in one factory, 1,472 tons; 1889-90, four factories, 10,822 tons; 1890-91, six factories, 16,307 tons; 1891-92, eight factories, 27,241 tons; 1892-93, ten factories, 30,781 tons; 1893-94, fourteen factories, 49,200 tons.

The second country referred to is California, which affords an instance of especial interest to us, inasmuch as the general conditions prevailing there are very much the same as our own. In that country beet-sugar making on an industrial scale has commenced only during the 1887-88 season, and since then it has prosperously developed and gained popularity in a marvellous manner. It must be mentioned, prior to the year stated—viz., in 1875—the beet industry had been entered upon with excellent prospects of success, but it has failed, for the simple reason that it was attempted in a manner contrary to the experiences taught by other countries. They thought that as their crops yielded considerably more per acre, and were on the average by 2 per cent. richer in sugar than those grown in Europe, small establishments would answer at the outset. As a consequence, those earlier attempts resulted in failure. However, since the recommencement of the industry on an industrially sound basis, the following quantities of sugar have been produced in California: In 1888, 1,786 tons; 1889, 2,678 tons; 1890, 3,572 tons; 1891, 5,359 tons; 1892, 12,091 tons; 1893, 19,486 tons.

Having thus illustrated the progress of the beet industry generally, it appears necessary to now somewhat elucidate the inner working of the same. This will be best accomplished on the hand of statistics referring to the beet-sugar manufacture of Germany, which is now the chief sugar-producing country of the world. The statistical data are drawn from official sources, and are perfectly accurate, more so than those of any other country; for, owing to their excise arrangements, not only are all the beets put through, but also the sugars produced are officially weighed and recorded. The figures are the following:—

Year.	Number of Factories.	Tons of Beet-root worked.	Tons of Sugar produced.	Tons of Beet to 1 Ton of Sugar.	Sugar Yield in per Cent. of Beets.
1836-37	122	25,346	1,408	18·00	5·50
1840-41	115	241,487	14,205	17·00	5·88
1845-46	96	222,755	15,153	14·70	6·80
1850-51	184	736,215	53,349	13·80	7·25
1855-56	216	1,091,990	87,359	12·50	8·00
1860-61	256	1,719,966	145,759	11·80	8·47
1865-66	295	2,172,639	185,696	11·70	8·58
1870-71	303	3,050,647	262,987	11·60	8·62
1875-76	332	4,161,284	358,048	11·62	8·62
1880-81	333	6,323,779	573,021	11·06	9·04
1885-86	399	7,070,317	838,105	8·44	11·85
1886-87	401	8,306,671	1,023,734	8·18	12·32
1887-88	391	6,603,454	910,698	7·24	13·80
1888-89	396	7,896,183	944,505	8·36	11·96
1889-90	401	9,822,635	1,213,689	8·09	12·36
1890-91	406	10,623,319	1,284,485	8·27	12·09
1891-92	403	9,488,002	1,144,368	8·29	12·06
1892-93	401	9,811,940	1,345,904	7·29	13·71
1893-94	...	...	1,390,000	...	...

NOTE.—In comparing the foregoing table with some of the statistics previously quoted some slight discrepancies will be discovered, which, however, are insignificant. They are due to the various authorities adopting various standards—for instance, bringing the several grades of sugar to one uniform basis of equality. The preceding figures are taken from the returns of the Imperial German Statistical Bureau in Berlin. Particulars as to the year 1893-94, other than the sugar production, are not to hand yet.

The above table teaches several important lessons. In the first place, the almost uninterrupted upward tendency of the production is very significant, and needs no comment. In the second place, the progressive productiveness of the industry, as expressed in the last two columns, is very marked. In 1836-37 it took 18 tons of beets to produce 1 ton of sugar, giving a yield of only 5·5 per cent. Since that time these two figures have been improving in a remarkably steady manner, until in 1892-93 1 ton of sugar has been derived from only 7·29 tons of roots, the yield being equal to 13·71 per cent. Such result has been surpassed only once before, as the table shows, and then only very slightly—viz., in the 1887-88 season, during which the weather had been faultlessly propitious to the growing crops. The same is the case so far in the present season; therefore the already-referred-to expected large increase in the production. The success of the industry thus demonstrated from statistics, it may be added, is due not only to the perfections in the manufacturing methods (which have been of an exceedingly progressive nature, particularly so during the last ten years), but also to the vast scientific improvements in the cultivation of the crop itself. The sugar-beet grower and the beet-sugar manufacturer have in this respect, under the aid of wise fiscal legislation, co-operated in a perfectly harmonious manner, and the results speak for themselves. German statistics tell us that, with the rational scientific attention devoted to the crop, the yield of weight per unit of area has been increasing continually at the rate of something like 25 per cent. every ten years, while at the same time the quality of the roots has experienced corresponding

steady improvements. In the third place, the foregoing table demonstrates the tendency of the beet industry towards being carried on on a large scale, which may be gathered from the following figures, calculated out from the data quoted: In 1836-37, each factory put through, on the average, 208 tons of beet in the season; 1840-41, 2,100 tons; 1850-51, 4,001 tons; 1860-61, 7,963 tons; 1870-71, 10,068 tons; 1880-81, 18,990 tons; 1890-91, 26,166 tons.

Such tendency of the industry to large-scale work may be still better shown by the appended data, which are derived from another as reliable source, and refer to the quantity of beet-roots put through on the average by every German factory in twenty-four hours during the last few years, thus: In 1872-73 each factory has worked up, in the average, per day 73 tons of roots; 1875-76, 91 tons; 1880-81, 154 tons; 1884-85, 214 tons; 1891-92, 245 tons; 1892-93, 294 tons; 1893-94, 331 tons; and during the present season this quantity will be higher still. It is nowadays, indeed, a firmly-established principle, which is unrefutable, that no financial success can be expected from sugar-beet factories operating on a small scale. Authorities are most emphatic on this point. Thus:—

Dr. H. Claassen, of Magdeburg, says, "Necessity requires the greatest capacity for any individual factory."

The *Central Journal for the Sugar Industry* (Berlin, 14th June, 1894), "This industry can only exist by large factories and most modern working principles."

Mr. Savile Grant, of Paris, says, "Beet-root sugar-making cannot be conducted practically on a small scale profitably."

The same, in another place, "Beet-root sugar-factories can only hope to succeed when carried on on a large scale by competent persons, and with the help of machinery and chemical appliances requiring the command of considerable capital."

Dr. U. Schwarzwaller, a great German authority, states, "The time of small sugar-factories has passed."

The tendency referred to prevails also in other countries, especially in Austria, where the average daily capacity of factories is considerably higher than in Germany; while France affords a most striking example, the number of works there having dwindled down from 518 ten years ago to 368 in 1893, and yet their combined sugar output has been steadily on the increase. The same is the case in Russia, where originally they have started on a very miniature scale. In that country in 1859-60 there were no less than 424 factories, producing the small total of 26,519 tons of sugar, while last year 650,000 tons were manufactured in 262 establishments.

At this stage a brief glance at the inner working of the beet industry in California (the country to which we rightly like to look for examples) will not be out of place. General statistics of the industry in that country as a whole are not yet available; but we have the return of individual factories, which for our purpose will be just as valuable, and perhaps more so:—

1. The Western Beet-sugar Company's factory at Watsonville, the first properly-installed factory in California, during its first campaign in 1887-88 produced 1,640 tons of raw sugar from 14,077 tons of beet-roots (polarising in the mean 14·65 per cent.). This is equal to a sugar yield of 11·65 per cent.—i.e., 1 ton of sugar has been produced from 8·58 tons of beet-roots.

2. The same factory in 1893 handled 65,396½ tons of beets, from which 7,768½ tons of sugar were made—that is, it took 8·42 tons of beets for 1 ton of sugar, being equal to a yield of 11·87 per cent. This factory was in 1887 erected for a daily capacity of 230 tons of roots. Since then it has been annually enlarged, and during the present season it is working up the large quantity of 1,000 tons of beets per day.

3. The Chino Valley Beet-sugar Company's factory in Southern California, in its third campaign of 1893, has put through 51,311 tons of beets, at the rate of 600 tons per day; and the output of raw sugar was 6,746 tons, which means a yield of 13·16 per cent., or 1 ton of sugar requiring 7·60 tons of roots. This factory was originally installed for 300 tons of beets per day. For its third working season it has been enlarged to 600 day tons, as stated; while at the present time, after another expansion, it too is consuming daily the enormous quantity of 1,000 tons of beet-roots every twenty-four hours.

It will be seen from these facts that California has closely followed the experience the beet industry of Germany is teaching. Their sugar yields come up to those of Germany at the present time, and shortly, no doubt, they will surpass them on account of the more favourable Californian climatic conditions. They have, irrespective of the large outlays connected therewith, adopted the large-scale work (the Chino factory now represents an investment of £150,000); and they have most positively succeeded, whereas (see above) small factories had previously met with disasters in that country. These facts from a country to which this colony bears such a close resemblance in every respect are very significantly instructive for our own case. We will not go wrong if we follow the example set by California.

So far the manufacturing aspect of the beet industry has been principally dealt with, and it remains now to look at the sugar-beet from a grower's point of view. We will omit the consideration of claims which systematical beet-culture lays upon the numerous beneficial influences it exercises—we will take them for granted; but we will inquire into the question briefly as to whether it will prove a remunerative crop to our farmers, who are well aware that our land and climate will produce most excellent sugar-beet in satisfactory quantities. In pursuing the subject it will be well to again look to California for parallels, which will be best illustrated by figures:—

1. Mr. George C. Moore, of Chino, San Bernardino County, Southern California, in 1893, has planted 36 acres of beets. He did the team-work and a large part of the labour upon the crops himself, hiring no more than he could avoid. He is an energetic, painstaking, and careful man, and his care has been well rewarded. In making a statement of his expenses on the crop, he included his own labour and that of his teams. His actual expenses in money were, therefore, much less than the figures given. His account on the 36 acres stands as set out in the first

column of the following table, columns two and three being calculated out per acre and per 1 ton of beets respectively:—

	Cost of growing 36 Acres.	Cost of growing 1 Acre.	Cost of producing 1 Ton of Beet-root.
	£ s. d.	£ s. d.	£ s. d.
Ploughing	14 8 0	0 8 0	0 0 5·3
Preparing ground	5 8 0	0 3 0	0 0 1·9
Seed	12 16 0	0 7 1·5	0 0 4·7
Planting	2 10 6	0 1 5	0 0 0·9
Thinning	21 12 0	0 12 0	0 0 7·1
Cultivating	5 0 11	0 2 9·6	0 0 1·7
Hoeing	14 0 0	0 7 9·4	0 0 5·1
Pulling and topping	74 18 0	2 1 7	0 2 3·7
Hauling to factory	59 18 6	1 13 3·5	0 1 10·2
Factory expenses	10 19 9	0 6 1	0 0 4·1
Totals	221 11 8	6 3 1	0 6 8·3

Gross returns from the 36 acres = 649 tons (=18 tons per acre), at 17s. = £551 13s.

Gross returns per acre = £15 6s. 5d.

Net returns from the 36 acres = £330 1s. 4d., being equivalent to £9 3s. 4d. per acre.

2. Among the very successful sugar-beet farmers on the Chino Ranch are the Gustafson Brothers (Louis, Victor, and Charles). They came to Chino three years ago without any capital whatever, and commenced beet-farming on their own account, doing their work themselves thoroughly. The result was that they have been successful in every crop they have planted. They bought 20 acres of choice land for £35 per acre, and they have to-day a clear deed, having paid for it from beets raised on the land. They have for the 1893 season kept a carefully itemized account of their expenses of their 20 acres of beets, including their own work (which they counted at 6s. per day, and which amounted to £55). They harvested from the 20 acres 436 tons—that is, 21 tons 16 cwt. per acre—for which they received 18s per ton. The figures are,—

	Cost of growing 20 Acres.	Cost of growing 1 Acre.	Cost of producing 1 Ton of Beet-roots.
	£ s. d.	£ s. d.	£ s. d.
Ploughing	8 0 0	0 8 0	0 0 4·4
Harrowing twice	2 8 0	0 2 4·8	0 0 1·3
Seed	6 0 0	0 6 0	0 0 3·3
Sowing	1 12 0	0 1 7·2	0 0 0·8
Thinning	16 0 0	0 16 0	0 0 8·8
Cultivating twice	2 8 0	0 2 4·8	0 0 1·3
Weeding	4 0 0	0 4 0	0 0 2·2
Topping	21 12 0	1 1 7·2	0 0 11·8
Ploughing out	8 0 0	0 8 0	0 0 4·4
Hauling	34 17 0	1 14 10	0 1 7·1
Sundries	12 1 0	0 12 1	0 0 6·6
Totals	116 18 0	5 16 11	0 5 4

Gross returns from the 20 acres = 436 tons (=21 tons 16 cwt. per acre), at 18s. = £392 8s.

Gross returns per acre = £19 12s. 4d.

Net returns from the 20 acres = £275 10s.—i.e., £13 15s. 6d. per acre.

The applicability of these two statements to Victorian farmers must be left to their own judgment. It seems fair enough, however, to assume that what they can do in California we can do here to. In any case, the data just supplied indicate that our farmers will be well enabled to sell their beet-crops to a sugar-factory, with not a small margin of profit, at even considerably less than 16s. per ton. The yield per acre in the two cases quoted has been 18 tons and 21 tons 16 cwt. respectively. Besides these two returns there are twenty-four others to hand, relating to the 1893 season, for a total area of 308 acres, which gave 6,098 tons of beets—i.e., an average of 19 tons 18 cwt. per acre—their mean quality being represented by 14·118 per cent. of sugar, and the price realised averaging 17s. 5d. per ton. In the face of the above facts, coming from a country which is all but a replica of our own, the assumption must appear quite justified that a yield of 20 tons to the acre on the average may rightly be anticipated.

After having thus prepared the way, let us now proceed to demonstrate what the probable cost will be to produce sugar from beet-roots in this colony. This will be deduced from a practical instance from Germany, for which purpose the beet-sugar factory at Rostock, in the Grand Duchy of Mecklenburg, during its 1890–91 campaign has been chosen. This factory has a daily capacity of 300 tons of beet-roots. The paid-up capital of the company is £30,000; debentures, £11,050; other creditors, £12,669. Therefore the company has been working with a total capital of £53,719.

The cost of the works has been £44,000, including site, buildings, machinery, &c. During the season stated the factory has worked up 34,385 tons of beet-roots, from which 4,155·8 tons of raw sugar were produced—that is to say, each ton of sugar was made from 8·27 tons of roots, the corresponding yield being 12·09 per cent., which, by the way, is the exact average result of the 406 factories at that season in operation in the whole German Empire (see previously-quoted statistics). Therefore the instance selected is a thoroughly representative one. The total working-expenses of this establishment were £48,380 14s. 4d., which is at the rate of £1 8s. 1d. per ton of beet-roots, including their own purchasing price; while the producing cost of sugar has been £11 13s. per ton. The expenditure side of the balance-sheet is as follows, with the items at per 1 ton of beets:—

	£	s.	d.		£	s.	d.
1. 34,385 tons of beets	30,109	17	8	Per ton of roots	0	17	6
2. Fuel	4,784	9	6	"	0	2	8½
3. Limestone, &c.	1,385	5	10	"	0	0	10
4. Labour	3,137	0	7	"	0	1	10
5. Technical management	1,151	17	6	"	0	0	8
6. Sundries	4,116	19	4	"	0	2	5½
7. Depreciation, &c.	3,695	3	11	"	0	2	1
Totals	£48,380	14	4		£1	8	1

It will be right to state here that the Rostock factory, chosen for purposes of comparative estimates, is by no means one showing a very cheap manufacture; it is, on the contrary, one considerably above the average in this respect. This can be very briefly demonstrated. In all, eight complete factory returns have been available to choose from. They respectively refer to the following factories in the German Empire, against the names being placed the proportion of cost of beet-roots to working-expenses, the former being taken as unit for the purpose of rendering the comparison more readily intelligible: (1) Ebeleben, 1 to 0·72; (2) Ringelheim, 1 to 0·62; (3) Rostock, 1 to 0·61; (4) Gilbach, 1 to 0·53; (5) Gottingen, 1 to 0·53; (6) Culmsee, 1 to 0·52; (7) Harsum, 1 to 0·49; (8) Bedberg, 1 to 0·44. It will be seen that the Rostock factory figures third highest in this list, exceeding the mean of the eight cases by very nearly 10 per cent.

Looking now at the items of expenditure above quoted seriatim, and considering what notifications we have to make on account of the difference of conditions in this country against Germany, the following conclusions will be arrived at:—

1. *Beet-roots*.—There is no doubt that our fertile soil and delicate climate will admit of this crop being produced considerably cheaper here than is the case in Germany or Europe generally. For one thing, our yield per acre will undoubtedly exceed that of the Old World. True, labour is very cheap in Europe—different from here, greatly so in fact; but against that we have the offset of our land being much cheaper—viz., only about one-third of its value in Germany. Taking all these facts into consideration, an average allowance of 16s. per ton of beet-roots will assuredly meet the case amply, and satisfy the farmer as well as the manufacturer.

2. *Fuel*.—Under this heading there appears above the sum of 2s. 8½d. per ton of beet-roots for the Rostock factory. Generally speaking, coal is about one-third dearer in Germany than it is here; and, as it is of very much the same quality as our own—viz., about 12,500 B.T.U.—it is only fair to reduce our anticipated cost of fuel by 25 per cent. against the Rostock one, which will leave for our case the sum of 2s. 1d. per ton of beets.

3. *Limestone, &c.*, which in our German instance required 10d., will in this colony certainly require no higher outlays—in all probability lower ones. It will therefore be safe to adhere to the same figure for our estimates.

4. The question of labour is vastly different here to what it is in Europe. On the whole, it may be taken that in this country it is two and a half times higher, and by multiplying the Rostock figure accordingly 4s. 6d. per ton of beets will result.

5. Technical management, like labour, should be increased to 250 per cent., thus giving 1s. 8d.

6. Sundries may be placed at 3s. here, against Rostock's 2s. 5½d., which latter, in comparison with other establishments, is somewhat high; but an increase to 3s. for our case will assuredly cover every eventuality.

7. *Depreciation, &c.*—It is but right to allow a little more under this heading in this colony, for our works will cost more by about 20 per cent.; and, increasing the Rostock amount that much, 2s. 6d. per ton of beets will result for our adoption.

Recapitulating now these figures, we find that to work up in this colony 1 ton of beet-roots on a scale corresponding with that of Rostock—viz., at the rate of 300 tons per day—will require the following outlays: (1) Beet-roots, 16s.; (2) fuel, 2s. 1d.; (3) limestone, &c., 10d.; (4) labour, 4s. 6d.; (5) technical management, 1s. 8d.; (6) sundries, 3s.; (7) depreciation, 2s. 6d.: total working cost, £1 10s. 7d. per 1 ton of beet-roots. Anticipating that it will take 8½ tons of the raw material to each ton of sugar (= to a yield of 11·77 per cent.) of at least 91 per cent. refining-value, it follows the producing cost of the latter would be £12 19s. 11½d., or, say, £13. With higher yields—which even our young experience, with the quality of our beet-roots, fully warrants us to expect—the producing cost of sugar would, of course, be materially reduced. Thus, assuming the high probability that we will attain the same yield as the Chino factory in California during the 1893 campaign—viz., 13·16 per cent., or 1 ton of sugar requiring 7·6 tons of beets—the producing cost of 1 ton of raw sugar would be only £11 12s. 6d.

It is but right to emphasize the fact that these figures refer to a 300 day ton (D.T.) factory. For one of a larger capacity the producing cost will be smaller, while it will be considerably higher for a smaller one. The relative merits of various-sized establishments in regard to producing cost of sugar may be gleaned from the following carefully-compiled table: (1) 500 D.T. factory,

producing cost of sugar, £12 10s. 9d. per ton; (2) 300 D.T. factory, £13 per ton; (3) 200 D.T. factory, £13 17s. per ton; (4) 150 D.T. factory, £15 5s. per ton; (5) 100 D.T. factory, £16 17s. 6d. per ton; (6) 70 D.T. factory, £18 10s. per ton; (7) 30 D.T. factory, £27 per ton.

From these figures it is easily seen on what scale beet-sugar manufacture is likely to begin to be a payable industry in Victoria.

In placing the foregoing facts, and deductions made therefrom, in the hands of honourable members of both Houses of Parliament, the undersigned Minister of Agriculture has been desirous of furnishing them with the best and most competent information on the large subject available. The beet-sugar question in this colony is a very important one, and sooner or later it will have to be dealt with by the Legislature, in order to devise means for its promotion or otherwise. Whatever may be decided by Parliament, I have considered it my public duty to submit the foregoing paper at this stage.

J. W. TAVERNER,
Minister of Agriculture.

Department of Agriculture, Melbourne, 19th November, 1894.

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