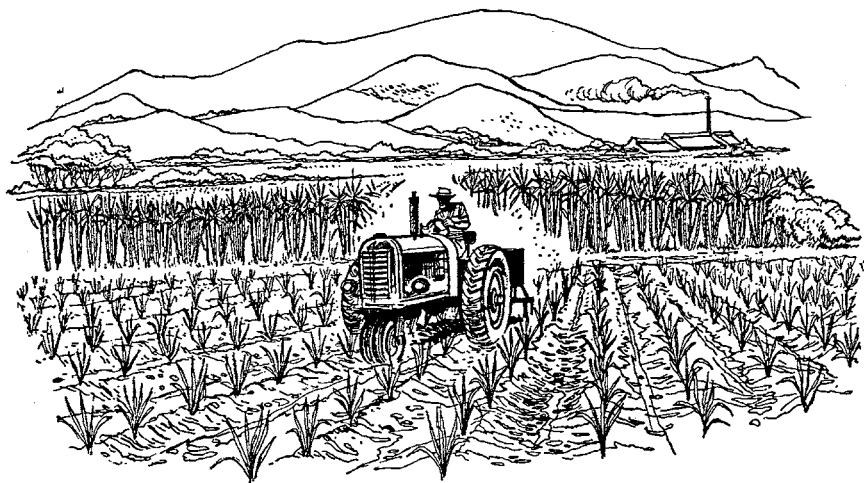




CHAPTER 5

The Australian Sugar Industry

H. W. HERBERT

This survey was originally written for C.S.R. early in 1955 as an examination by an economist of the industry as a whole. The company wanted an independent study to issue in response to the numerous requests it receives in the southern states for information on the Australian sugar industry. Mr Herbert investigated the industry on the spot and talked to farmers, millers, government officials, bank managers and many others closely acquainted with the industry. It was later decided to include his survey in this book because it provides a description of the whole Australian industry by an independent observer and serves as a background to more detailed description of the company's activities.

Mr H. W. Herbert studied at Roseworthy Agricultural College, farmed wheat in South Australia and read economics at Melbourne University. Later he became a research officer of the Queensland Bureau of Industry and is now in private consulting practice in Brisbane as partner of Mr Colin Clark in Economic Services.

May 1955

THE Australian sugar industry has some remarkable features. It is the only sizable cane sugar industry in the world operated solely with white labour, and has resulted in the most successful settlement of white men in the tropics ever. It is spread out in 9,000 farms along 1,200 miles of coast from the Clarence River to Mossman, north of Cairns, yet in some ways is the most tightly organized industry in Australia.

Its workers have much higher incomes than sugar workers in any other country, excepting only Hawaii and Louisiana which sell all their sugar on the protected American market. The Australian sugar industry for the last twelve years has averaged well below world prices for its output, and yet has provided wages and incomes far above coloured-labour standards, which indicates, on the face of things, a high level of efficiency.

This efficiency is indeed outstanding in many respects. The growing of cane on the farms has been completely mechanized. The horse has disappeared from the cane fields and so has the hand hoe. Cane harvesting is still largely done by hand; only in Hawaii and Louisiana, and to a very minor extent in Queensland, is cane mechanically harvested. But Australian cane cutters cut and load cane at two to three times the rate of plantation labourers in other countries.

Australian farmers get a high yield of sugar per acre—over three tons, compared with less than one and a half tons in 1900. The amount of scientific research and experiment to improve cane-growing in Australia is impressive and the speed at which the results are applied by the farmers is almost a legend. In standards of efficiency the thirty-four raw sugar mills and the six sugar refineries in Australia will bear favourable comparison with the world's leading mills and refineries. The transport of the huge weight of sugar cane, amounting to ten million tons in 1954, from the farms to the mills is mainly over some 2,000 miles of narrow 2 ft. gauge tramway lines, provided by the mills, at a cost per ton-mile lower than the rate charged for cane on the Queensland Government Railways. The mills provide this light gauge railway system which is nearly half as long as the total Victorian State Railways system. Over one of these toy railways across a main street in Ingham last season passed more than 500,000 tons of cane.

A constant ferment of technical improvement over the past seventy years or more has gradually transformed the Australian sugar industry into something vastly different from what it was with its Kanaka labour, its diseased and pest-ridden cane fields, and its 250 mills, mostly small and inefficient.

Yet the industry by no means gets unanimous Australian approval

and support. In the southern Australian states, in particular, there has in the past been strong opposition, some of which still continues, to the "privileged" position of the Australian sugar industry "supported by high home prices for sugar and an embargo on imports". Some of the criticism is fair-minded but some neglects to take into account what has happened in the sixteen years since 1939.

Before 1921 Australia grew only part of its sugar needs and, during the first World War, had to pay some fantastically high prices for imported sugar. In 1920 the Hughes Government substantially raised the price for Australian raw sugar to stimulate the industry to increased production. It succeeded too well. The best-laid schemes of men often go most awry when caught in an unexpected economic rip-tide. By 1925 Australia was producing a substantial surplus for export, and in that year world sugar prices fell from their post-war levels. They paused briefly, then gradually declined to their lowest point in the depression years, "dumped" refined sugar falling as low as £10 per ton, landed Australian port, which was only one-third of the home consumption price. The industry found the going rough, though some other farmers, such as wheat growers, were even worse off. The home price for refined sugar had been reduced by some 11 per cent and there were cries for further reductions or for abandoning this "artificial" industry. The critic in 1940 could point back to seventeen consecutive years in which some sugar (admittedly dumped) could have been imported below the Australian home consumption price.

Australian consumers had paid per head about £1 a year in higher prices for sugar to keep this major industry in existence in tropical and subtropical Australia. And, in view of what shortly followed, this proved valuable insurance.

The so-called "world price" for sugar applies only to a very minor part of the world sugar trade. It is mainly determined by Cuban exporters who have some sugar to sell on the "world market" after the bulk of their crop has been sold on the protected American market.

The second World War lifted "world prices" consistently above the Australian home consumption price and created sugar shortages. "World prices" climbed even further post-war; in 1950-51 to more than twice the Australian price. Britain pressed the Commonwealth sugar countries, including Australia, to grow and send her more sugar, largely to save dollars. For ten years, from 1942 to 1952, Australian consumers got cheaper sugar than they could have imported. They probably saved at least £1 a year per head, and in some years they would almost certainly have gone very short of sugar in the absence

of the Australian industry. Australians would have had a long period of sugar rationing, as did the British people. Industries such as fruit canning might have gone out of business.

The reader must also assess for himself the value of two other factors, one from wartime and one from postwar years. Strategically, the sugar industry in northern Queensland helped to turn the war against the Japanese, in particular by rushing good tractors from nearby farms to build the emergency airstrips which were so important in the Coral Sea battle. In the field of international politics, Australia's moral and diplomatic position is considerably strengthened by the use the sugar industry is making of tropical Australia and by the population and development it has brought there. This may be even more important in the future than it has been in the past. For these reasons all political parties in the Federal Parliament have consistently supported the Australian sugar industry.

After ten years the tide has turned slightly and refined sugar could now be imported into Australia at slightly less than the home consumption price. At the same time the Australian home retail price of ninepence a pound is still one of the lowest in the world.

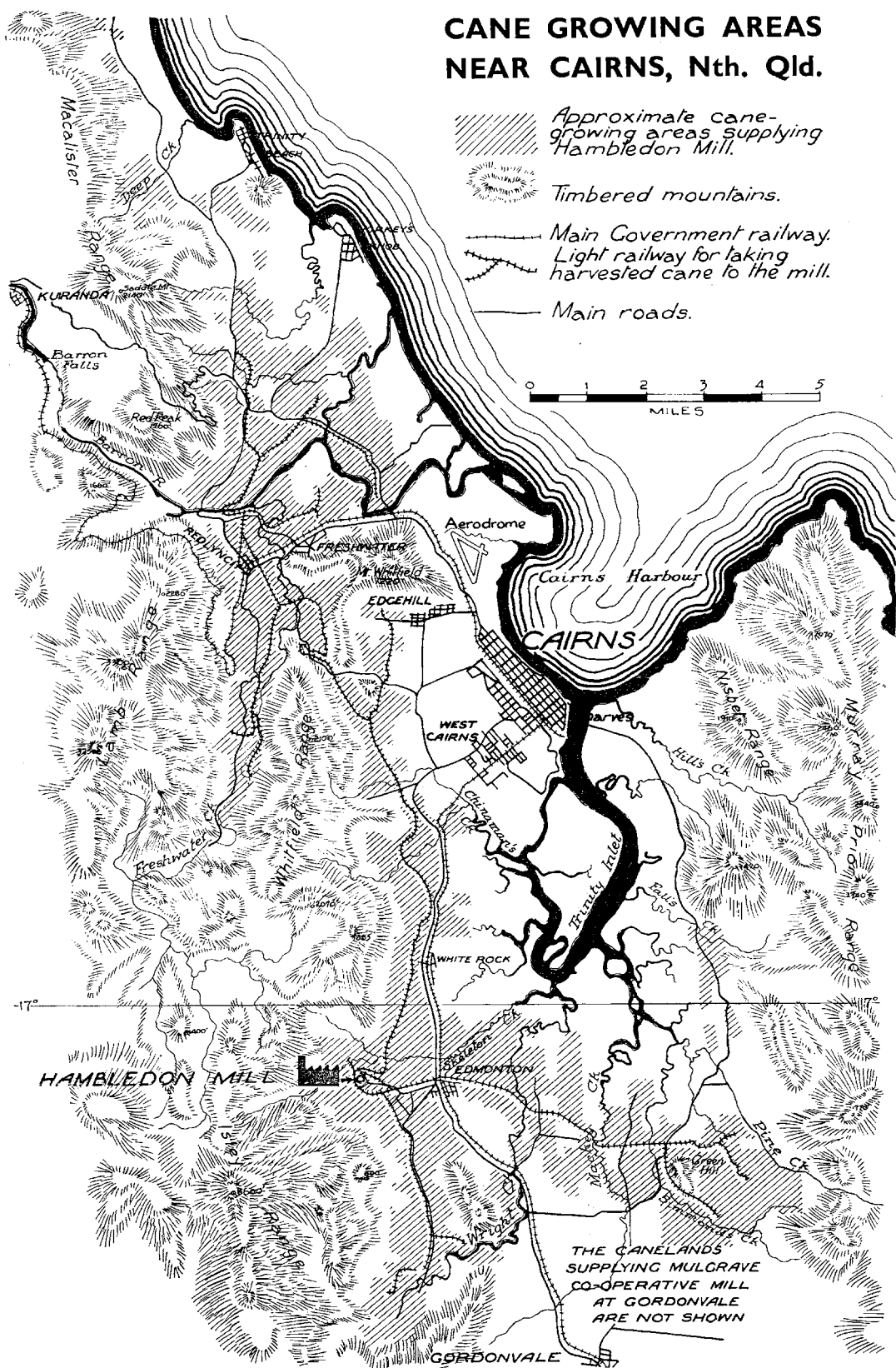
The first major weakness of the sugar industry, which it shares with many other Australian export industries, is the way it has been caught with rising costs by the great Australian inflation of 1950-52. A good plan has run into an unexpected and adverse economic current.

In 1950 the industry decided to expand, substantially but cautiously, after a Royal Commission inquiry and much thought, to a new annual level of 1,100,000 tons of raw sugar by 1953, compared with less than 950,000 tons in the best postwar year. The target was subsequently raised to 1,200,000 tons for 1954-55. The expansion was achieved by opening some new lands for new cane farms (including farms for soldier settlers) and by expanding the unduly small areas to which many growers had been restricted. To cope with the increased crop, all mills made improvements and some of them undertook enlargements. Victoria Mill at Ingham, in particular, was duplicated to make another 40,000 tons of sugar a year, mainly from the entirely new Abergowrie cane area. Since 1950 the sugar mills have spent about £13 million on capital improvements and the farmers have spent even more.

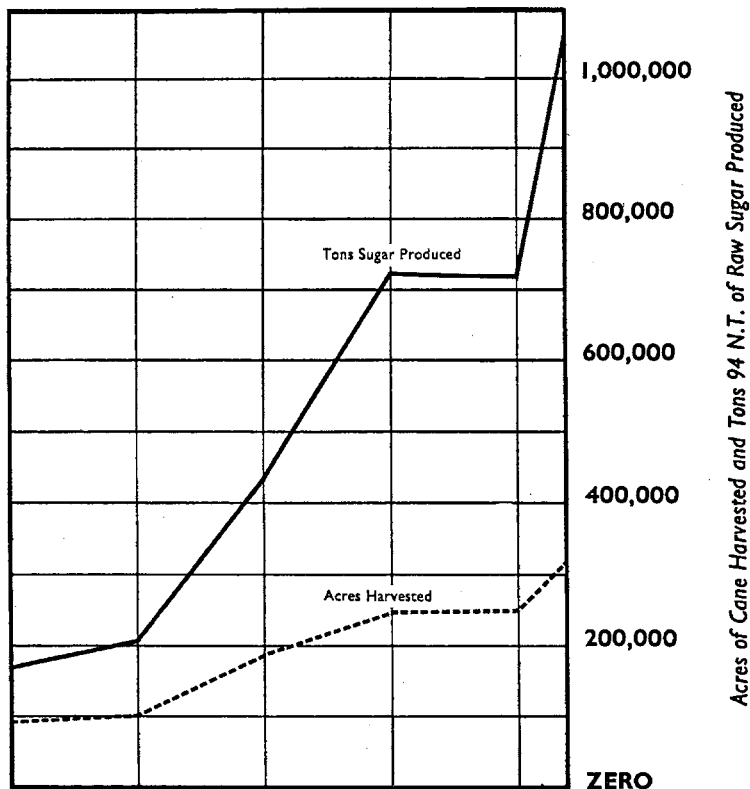
Science and nature helped, with increasingly good control of cane pests and diseases and with good seasons, and in 1954 a total of 1,300,000 tons of raw sugar was made.

This was a carefully planned expansion, compared with the unplanned expansion after World War I. A long-term market, particularly with Britain, had been arranged in advance. Only the last half of

CANE GROWING AREAS NEAR CAIRNS, Nth. Qld.



INCREASING YIELDS IN AUSTRALIAN RAW SUGAR INDUSTRY



10 years	10 years	10 years	10 years	10 years	4 years	Averages
1901-10	1911-20	1921-30	1931-40	1941-50	1951-54	
1.81	2.06	2.33	2.92	2.89	3.33	Tons of Raw Sugar per Acre of Cane.

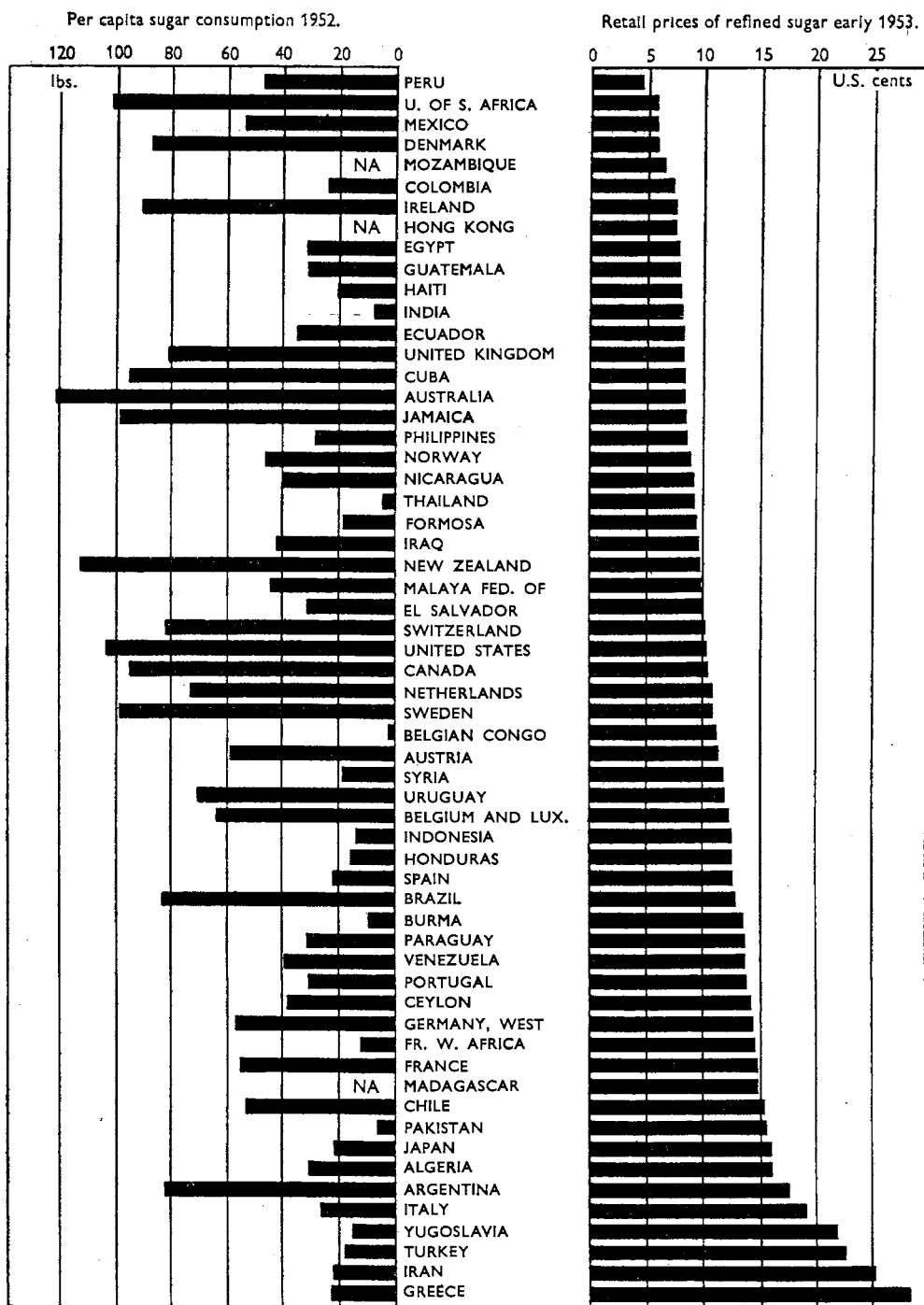
Yields per acre of raw sugar from Australia's cane farms have increased primarily because of greatly improved varieties of cane. Most of these new canes, which are rich in sugar and resist diseases, have been bred in Australia by the Queensland Bureau of Sugar Experiment Stations and by the C.S.R. Company.

Other factors which have helped to increase yields are improved cultivation

implements and agricultural practices; heavier and more skilful manuring; increased growing of leguminous green manure crops; chemical control of cane pests; increased and more efficient milling plant, and improved milling technology.

Sources: Annual Reports Queensland Bureau of Sugar Experiment Stations and C.S.R. Records.

PRICE AND CONSUMPTION OF SUGAR IN VARIOUS COUNTRIES



Australia is among the countries having relatively low retail sugar prices. Low prices tend to be associated with high consumption and vice versa. Consumer purchasing power is also an important factor affecting sugar consumption. *Source of data for graphs above—U.S. Department of Agriculture.*

exports, or one-quarter of total production, is sold at the "world price". During the 1950-54 expansion the "world price" fell back, but far more serious was that Australian costs doubled during this period. What seemed a wonderful prospect in 1949 looked rather sour in 1954.

It is true that there has been some over-production of sugar in Australia in 1954, but it is not a large amount and does not worry the industry unduly. In farming, it is impossible to achieve an exact production target each year. No further collapse of world sugar prices, similar to the calamitous fall of the early 1930s, is expected. For one thing, economic measures to prevent a serious depression are now well known and likely to be applied. Moreover, the world's exporting sugar industries are better organized with the International Sugar Agreement and the British Commonwealth Sugar Agreement. These agreements prevent serious over-production. They do not prevent countries bolstering up their own internal sugar industries by high protection, which in the long run tends to reduce imports of sugar.

The "Negotiated Price" which Britain pays for half of Australia's export sugar is related each year to the average costs of sugar production in the Commonwealth exporting countries. To the extent that Australia can reduce its costs of production compared with the Commonwealth average, it stands to benefit.

Moreover, nearly half of all Australian sugar is sold on the home market and the industry has been able to get a reasonable, but by no means generous, increase in the Australian price. Sugar now retails at 9d a pound, compared with 4d pre-war, showing an increase considerably less than the average rise in retail prices.

The price of sugar inside Australia is fixed by an agreement between the Queensland and Commonwealth Governments, and each time the price is raised the new agreement has to run the gauntlet of the Commonwealth Parliament. The present price was fixed only after an expert committee had in 1952 held a most searching inquiry into the industry—its costs, its profit margins to farmers, millers and refiners, and its efficiency compared with overseas sugar industries.

The combined political watchfulness of southern consumers and sugar-using industries (especially the fruit industry) keeps a fairly low ceiling on the Australian home price of sugar, and it is a ceiling that will make a tardy rise if there is further Australian inflation.

Thus, in the modern world of uncertain prices for basic commodities, the Australian sugar industry has its market fairly well tied up. In the absence of war it is most unlikely to see any boom prices, but the average price will not collapse. To get this security production has to

RETAIL PRICES OF REFINED SUGAR IN VARIOUS COUNTRIES

Compiled from cabled advices during January, 1955, and expressed in Australian currency at exchange rates then ruling.

SOUTH AFRICA	6½d.
NORWAY	7½d.
INDIA	8½d.
EIRE	8½d.
AUSTRALIA	9d.
UNITED KINGDOM	10d.
U.S.A.	10½d.

SWEDEN	10½d.
CANADA	10½d.
NEW ZEALAND	11½d.
FRANCE	1s. 3½d.
ITALY	1s. 8½d.
SPAIN	3s. 10½d.

be strictly limited: a surplus would be completely unsalable in most years. This virtually establishes a definite limit to the gross income from sugar sales in the near future. A bad agricultural season could give a gross income well below this limit, although this would be slightly offset by the fact that the shortage would be in "world price" sugar, which is at present, and is likely to remain, the cheapest of the three categories.

The thing that can most hurt the sugar industry, therefore, apart from a really bad season, is rising cost of production. If its rising costs are due to general Australian inflation, it may get some compensation from a higher home price, but this would be well after the event. It would get a little further compensation from its "negotiated price" sugar but only to the extent that Australian costs are a fractional item (18 per cent) in British Commonwealth export sugar costs. But high cane cutting costs, such as were experienced in 1954 owing to scarcity of labour, are borne by sugar farmers and the dislocation caused to the harvest is a burden to mills and farmers alike.

This leads to the second major weakness of the Australian industry—the high cost in current Australian labour conditions of cutting cane by hand and the difficulty of getting enough cane cutters.

The 6,000,000,000 sticks of cane that constituted the 1954 harvest were nearly all cut and loaded by hand. It costs about fourpence to cut and load every dozen sticks (some £8 million in total). As an average stick contains about ½ lb. of sugar, cutting represents about two-thirds of a penny per lb., or nearly 20 per cent of the 3.7d a lb. that the farmer gets for the raw sugar in his cane. When cane

THE AUSTRALIAN SUGAR INDUSTRY

cutters are so scarce that they can demand and get 25s a ton for cutting cane against the 15s award rate, as a few did in 1954, the farmer really suffers.

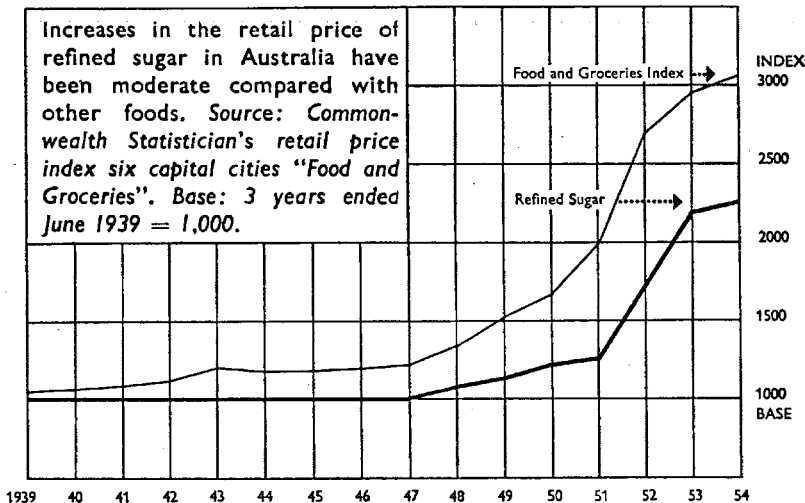
Cane cutting and loading is one of the hardest and hottest large-scale hand labour jobs left in Australia, particularly in the hot and often humid weather from September to Christmas. Cane cutters are on piecework and earn good money. They average about £5 per day but only fit and younger men are likely to stay at the work for long.

In 1954 some cutters made more than this (up to £10 a day) as the season progressed, by working hard and getting over-award rates per ton, but the number of cutters still dwindled. Some mills had frequent and expensive stoppages through shortage of cane. Delayed harvesting also hits the farmer, as the sugar content in the cane stalk diminishes after October, when the warm weather re-starts active growth in the plant.

Another source of loss is bad topping of the cane sticks, either by failure to cut off all the leaves at the top of the stick, or by cutting off too much good cane with the top. Topping is, of course, done worst when labour is scarcest. The cane top does not contain sugar but it does contain acids and other substances which make it harder for the

RETAIL PRICE OF SUGAR AND OTHER FOODS IN AUSTRALIA

Increases in the retail price of refined sugar in Australia have been moderate compared with other foods. Source: Commonwealth Statistician's retail price index six capital cities "Food and Groceries". Base: 3 years ended June 1939 = 1,000.



mills to crystallize the sugar. When a cane top goes through the crushing mills it adds to the juice acids and other matter which attack the sugar and at the same time the extra fibre absorbs valuable sugar; so tops cause a double loss.

Shortage of cane cutters probably cost the industry, in various ways, something of the order of £500,000 in 1954. Naturally, there is intense interest in how to avoid a repetition of this, whether by recruiting and holding more cutting labour or by doing either the cutting or the loading mechanically.

More immigrant cane cutters are being sought from overseas countries, particularly Italy, by a selection team of experienced cane farmers for the 1955 harvest. This will help, though some in the industry believe it is only a palliative—some of the migrants will drift away to easier jobs when the months of real heat arrive.

Mechanical cotton harvesting was achieved only after forty years of effort, and attempts to devise mechanical cane harvesters have been made for at least as long, but the problem is harder than it seems at first sight. Both Hawaii and Louisiana, the only places which have mechanical cane harvesting, were forced into it by labour shortages during World War II. The Hawaiian method, which is in fact more costly than hand harvesting was, depends on the use of huge machines which practically bulldoze the crop off the ground and load it by big grabs, which inevitably also collect considerable quantities of dirt, stones and cane roots. Mills are equipped with cane laundries and cleaners, expensive items using large volumes of water which incidentally washes away a good deal of sugar from any broken or crushed sticks.

This type of harvesting is used in Hawaii on large plantations and is unsuitable for the individual farms of Australia. Moreover, sugar millers here wish to avoid the cost and waste of cane laundries. The Fairymead Sugar Company at Bundaberg has a large plantation acreage of its own and has devised several mechanical harvesters. It cuts a portion of its cane mechanically and this is afterwards loaded by mechanical grabs. But its machines are still rather too big for the average cane farm, and it has had to install a cane laundry.

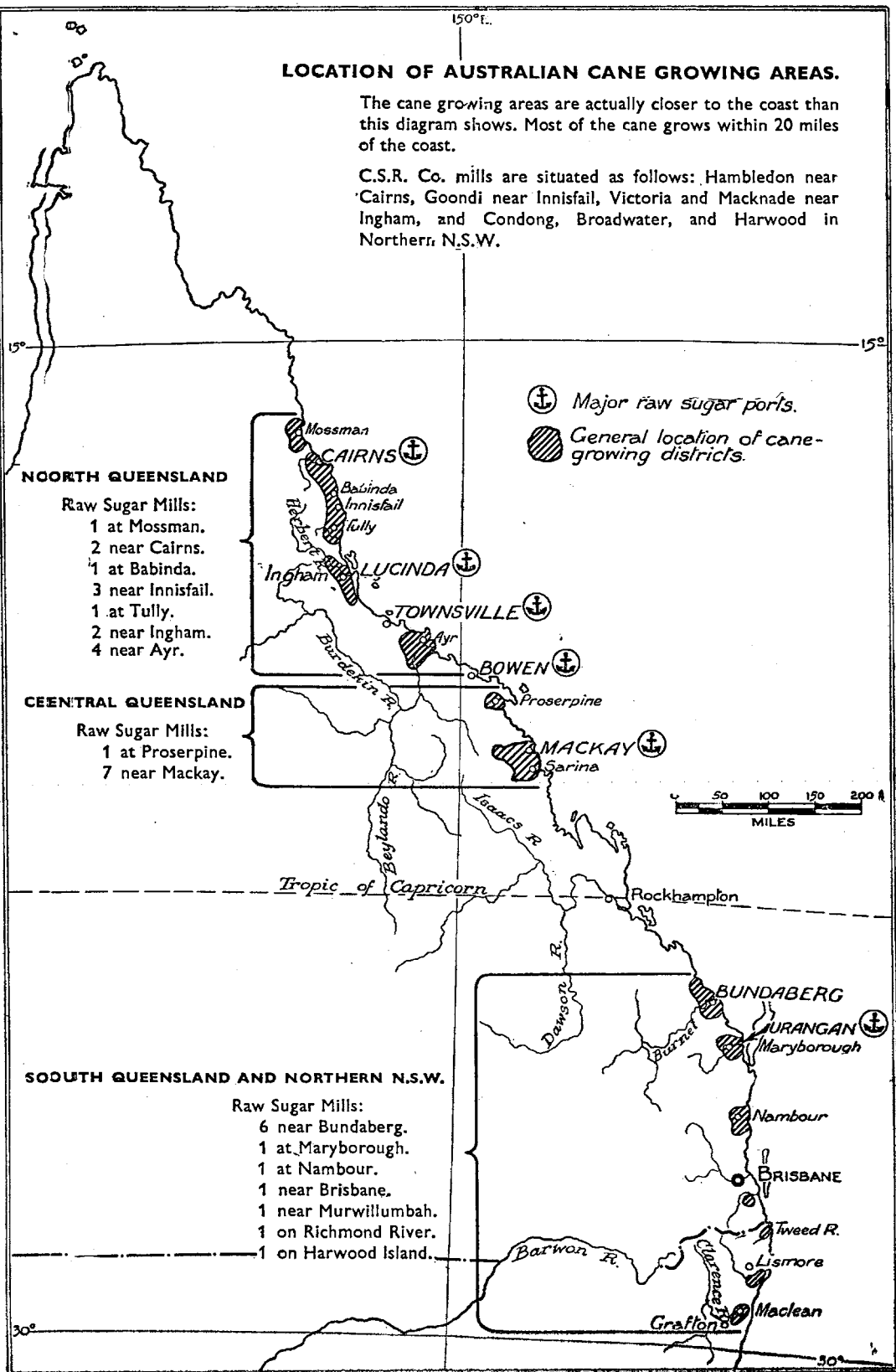
The harvesting problem seems to await a machine more in the lightweight tradition of the Australian agricultural implements industry. A good deal of effort is being made to devise such a machine, mainly by inventive cane farmers. But to produce a machine which is relatively simple and cheap and yet is capable of harvesting all types of cane, including tall and tangled and fallen crops, is really difficult.

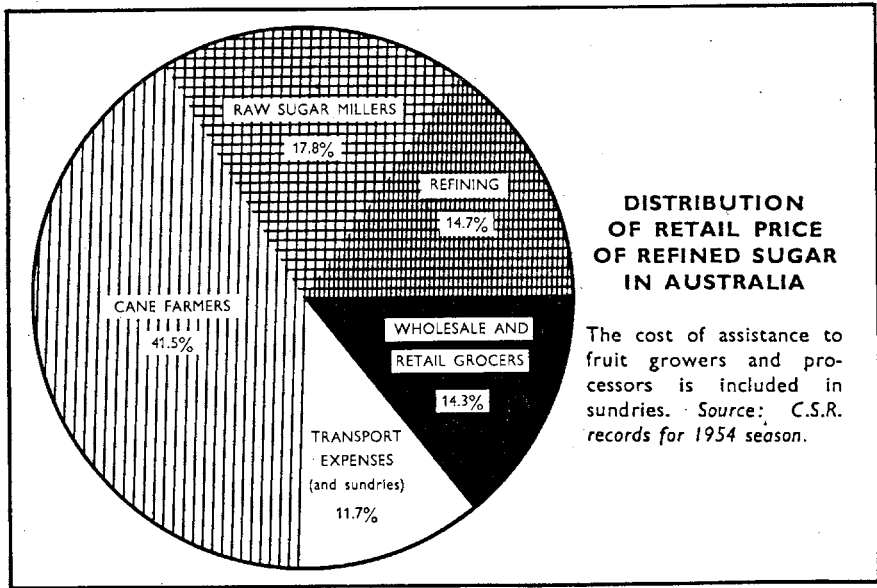
The sugar industry was caught unprepared for the labour shortage

LOCATION OF AUSTRALIAN CANE GROWING AREAS.

The cane growing areas are actually closer to the coast than this diagram shows. Most of the cane grows within 20 miles of the coast.

C.S.R. Co. mills are situated as follows: Hambledon near Cairns, Goondi near Innisfail, Victoria and Macknade near Ingham, and Condong, Broadwater, and Harwood in Northern N.S.W.





in the 1954 harvest. Migrants under a two-year bond had been sent to help with some of the big postwar crops and for a record crop in 1953 there was plenty of labour because of the Australian recession of 1952-53. But the even bigger crop of 1954 coincided with the return of overfull employment in Australia. Future crops may be smaller because of restrictions or less favourable seasons but there is no guarantee of an ample supply of cane cutters who will stay on the job for the whole season. It seems that mechanical harvesting must come if the Australian industry is to avoid chronic trouble in harvesting its crop.

Another major problem, which the industry is successfully tackling, is the bulk handling of raw sugar. This will reduce the heavy cost of transporting and handling raw sugar in 3-bushel jute bags. Not only are the bags expensive, though cheaper than a few years ago, but raw sugar in bags has to be man-handled into and out of mill stores, onto wharves and into ships' holds, out again and into refineries. Waterside workers are handling, per man per hour, only about half the prewar volume and strikes are more frequent and more costly.

C.S.R. investigations into bulk handling were started some six years ago and are now beginning to show results. Two of the company's three mills in New South Wales, Harwood on the Clarence and Broadwater on the Richmond, have been equipped for bulk sugar storage and bulk loading of ships. This was not so costly. But the company's bulk sugar installation at Pyrmont, Sydney, has cost £800,000. The

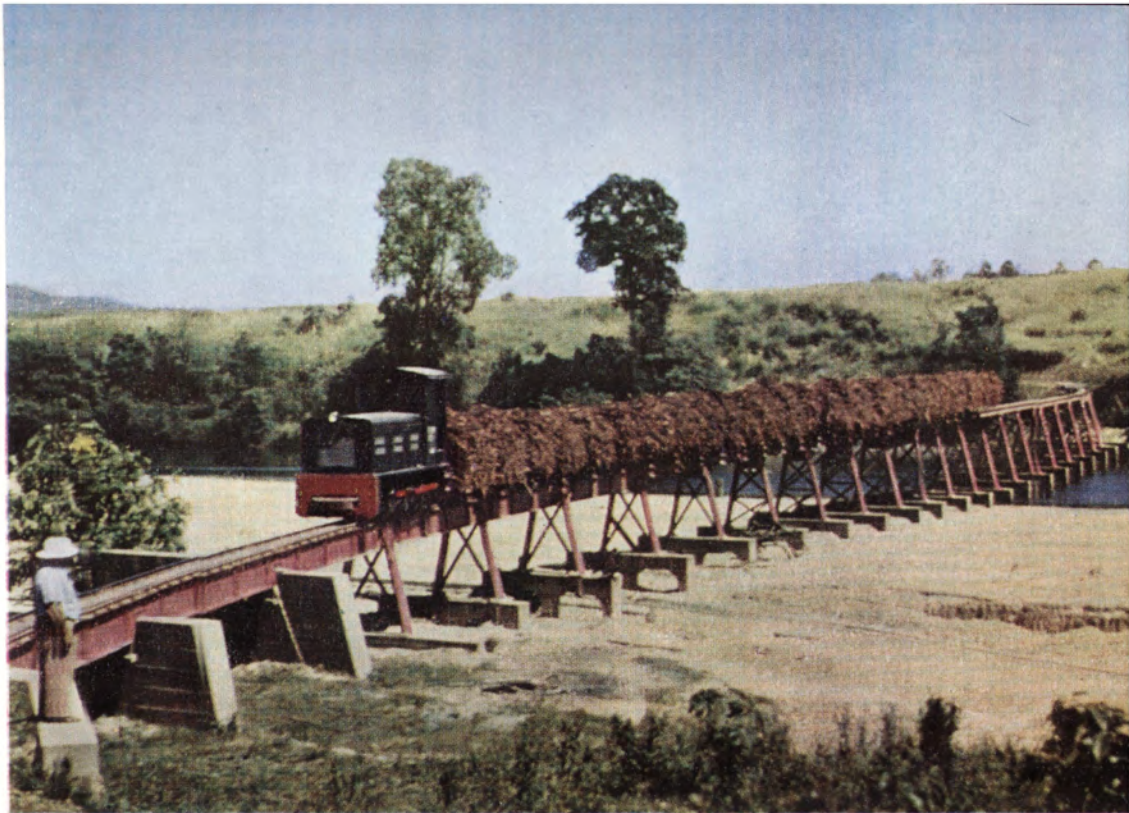


Farmer mechanically weeding and cultivating young cane near Cairns, northern Queensland.



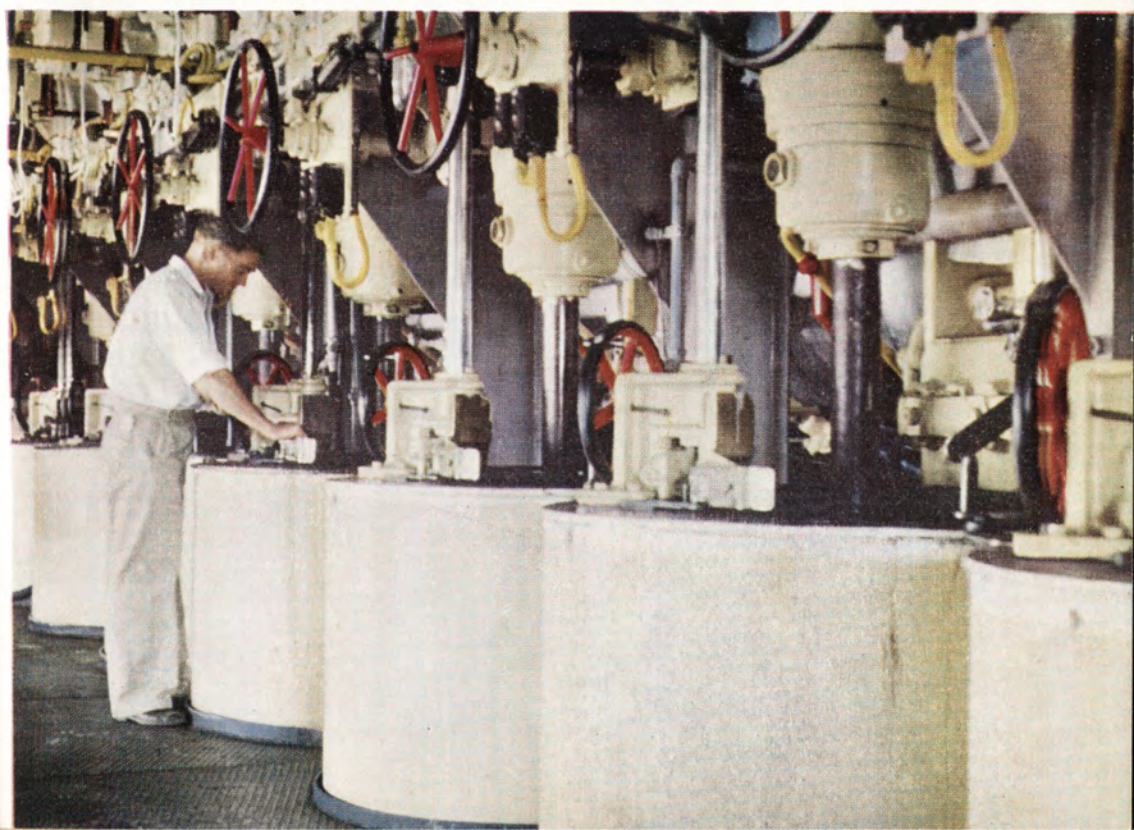
Two typical cane farm scenes, northern Queensland. Young cane in foreground, mature crops in middle distance, Great Dividing Range in background.





Diessel locomotive hauling trucks of cane over the Herbert River to C.S.R.'s Vctoria Mill, northern Queensland.

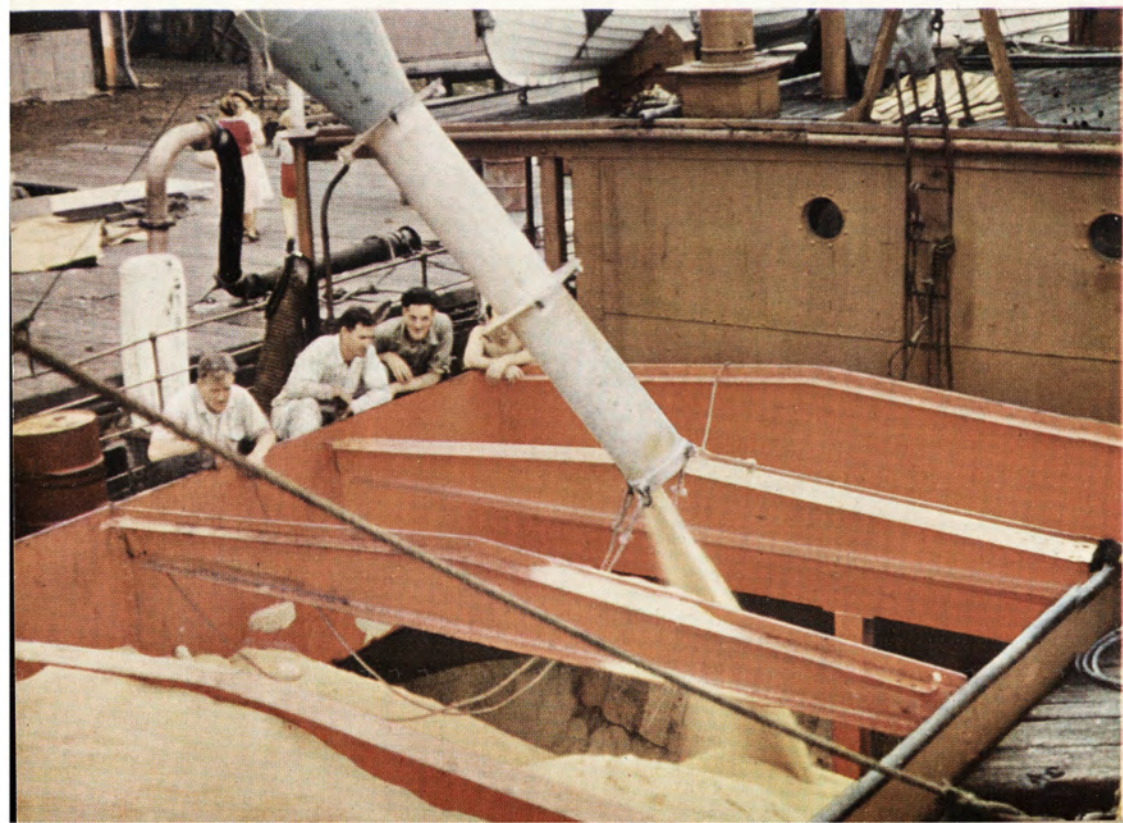
Newly installed high speed centrifugal machines, Vctoria Mill.





C.S.R.'s Broadwater Mill on the Richmond River, New South Wales.

Raw sugar being loaded in bulk at C.S.R.'s Harwood Mill, Clarence River, N.S.W.



THE AUSTRALIAN SUGAR INDUSTRY

grabs of two great unloading gantries lift the raw sugar out of ships' holds at a very fast rate and deliver it to conveyor belts; it is weighed automatically and put into bulk storage sheds. The installation will amply pay for itself in lower handling costs, savings on bags, and very quick turn-round of ships. Two ships bulk-handling sugar between northern Queensland and Sydney would move nearly as much as three ships would carry in bags, so the cost of one ship or its equivalent in lower freight charges can be set off against the cost of bulk handling facilities.

There is much more work yet to be done before Australia is fully equipped to handle all its raw sugar in bulk, and it is work which will have to be done at present high construction costs. The general scheme is to store only a limited amount in bulk at each mill and to transport most of the raw sugar in bulk rail waggons or tram waggons to large bulk sheds at the port. From these sheds band conveyors will load ships in much less than half the time at present needed.

Work on a £1,200,000 project at Mackay Harbour has started and a similarly expensive project at Lucinda will commence in 1955, although these installations will not be operating before 1957 and 1958 respectively. Sugar mills, Harbour Boards, the Sugar Board, shipping companies and refineries are all affected by bulk handling. C.S.R. is planning the overall operation and the time schedule, and helps with much of the detailed work. Plans are being considered to convert three-quarters of the industry to bulk handling. It would cost about £8 million, excluding the expense of new or adapted ships, to convert all mills, ports and refineries to bulk handling, and maintenance and depreciation would be heavy items. The savings on bulk handling will not be great enough to allow a reduction in the Australian sugar price but they will help to offset several other increases in costs that are taking place.

An idea of the cost structure of the industry as a whole, from the Australian consumers' viewpoint, is given by the following table showing the break-down of the Australian retail price of 9d a lb. The returns to growers and millers from raw sugar which is exported are at present somewhat less than those shown.

It will be seen that growing and harvesting the cane is by far the biggest single item. By contrast, the mass production factory processes of raw sugar milling and of refining are relatively inexpensive although the syrups and sugar have to be handled many times in each process and some is unavoidably lost or turns into molasses. Refining, for instance, a complex process of re-dissolving the raw sugar, filtering, decolorizing, re-crystallizing, drying and bagging, costs less than the

SOUTH PACIFIC ENTERPRISE

grocer gets for putting the sugar into 2 lb. paper bags and pushing it across the counter. But the grocer's job means hand labour, and he loses a little in giving everyone full weight.

	<i>Pence per lb. refined sugar</i>
<i>Farmers' share</i>	3.69
<i>Raw Sugar Millers' share</i>	1.66
<i>Raw Sugar Pool costs of transport etc. (mainly sea freight and raw sugar bags)</i>	0.94
<i>Refiners' (C.S.R. and Millaquin) operating costs excluding overheads</i>	0.98
<i>Payment to C.S.R. for managing, selling and financing raw and refined sugar, including overheads on refining and advertising, income taxes and profit margin</i>	0.36
<i>Assistance to Fruit Industry on home consumption and export market and assistance to other exporting manufacturers</i> ...	0.08
<i>Wholesale margin</i>	0.20
<i>Retail margin</i>	1.09
<i>Retail price:</i>	<u>9.00d per lb.</u>

The item above—assistance to the fruit industry and to exporters—is an arrangement whereby exporters of canned fruit, confectionery and similar products get their sugar at the cheapest possible price: the home price or the price of imported refined sugar, whichever is lower. In addition, the fruit industry gets some assistance on the home consumption market. Thus the fruit industry does not lose by the existence of the Australian sugar industry.

Transport and distribution accounts for a surprisingly large part of the retail price of 9d a lb. If earth was obtained, free, from Queensland cane fields, taken via mills and refineries (without processing it in any way) and sold by the grocer in 2 lb. brown paper bags, he would have to charge at least 2½d per lb. for it.

It is now worth looking at the Australian industry in some detail to see how it has built its high living standards in the domain of cane sugar, traditionally based on cheap labour. In its early years Australia relied on cheap labour, the Kanakas, and many plantation owners and farmers of the old days could not see how cane could possibly be grown here on any other basis.

It was a long struggle, with several setbacks, to remodel the industry

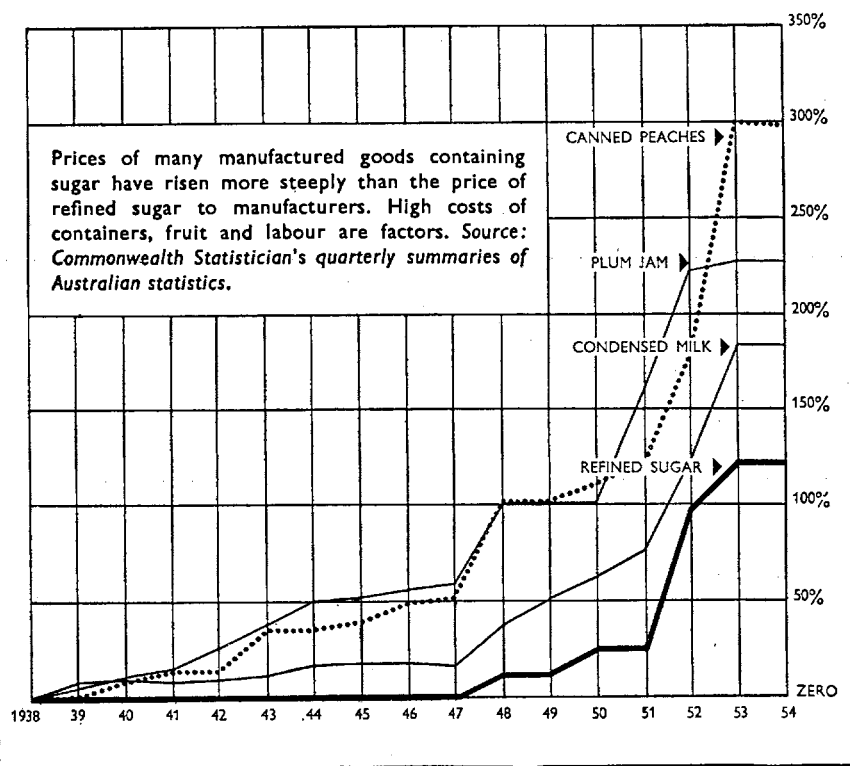
THE AUSTRALIAN SUGAR INDUSTRY

on white labour. In the process all but three of the plantations disappeared, and the successful system of individual working farmers owning their own land was established. C.S.R. gave an early lead in this by cutting up its own plantations. Moreover in the process of conversion many mills closed. In 1888 there were 106 Queensland sugar mills of which a dozen survive today, and of 36 New South Wales mills only 3 remain.

The progress that built the modern Australian sugar industry, that more than doubled the yield of sugar per acre between 1900 and now, and that enabled one present mill to make more sugar than all the 142 old-timers made, is the progress of increasing scientific knowledge, skill and capital equipment vigorously applied to an industry that sorely needed it.

C.S.R. pioneered scientific and technical improvement in its own

INCREASE IN PRICES OF SOME GOODS CONTAINING SUGAR



sugar mills and refineries and had earlier worked on crop improvement. A scientific paper read by the then general manager, E. W. Knox, in 1890, reads as though it might have been written in the last ten years. C.S.R. men evolved methods of chemical control in milling, known as "chemical book-keeping", by which the sugar received in the cane at the mill is all to be accounted for—made into raw sugar or lost in the molasses, in filter mud, and in megass (fibre); also a formula by which the efficiency of milling may be measured: these methods are still in use, with improvements and refinements, in all mills today. The system of paying farmers according to the sugar content of their cane as well as its weight, also pioneered by the company, has led to a great improvement in the quality of cane grown.

The interest of the mills in the success of the farmers is profound. Every modern mill with its transport system represents enormously expensive capital equipment and buildings—worth from £3 to £4 million if built today. The fixed charges of interest, depreciation and maintenance, almost irrespective of how much cane is crushed, amount to nearly half of a mill's annual costs. Only by making as much sugar as it can, up to its allowable maximum, can a mill get into a good financial position. To keep up cane yields per acre during adverse seasons, particularly during the partial droughts that are common in most Australian cane areas, needs really good farming, and mills try to encourage this. It also needs good farmers and good farm managers to keep the cane coming into the mill without interruption during crushing, farmers who will co-operate with the mill's officials (the cane inspectors) who have to organize the cane transport system, and farmers who can get the best out of the cane cutting gangs.

At the same time the farmers have a big stake in the success of their mill, even when it is not a co-operative paying them bonuses. Apart from bonuses paid to the farmer-millowner, a successful co-operative mill becomes a well-equipped mill, one that can crush at high rate without breakdowns, so shortening the crushing season into the mid-season months when the cane contains most sugar. A chronically unsuccessful mill has to close down, and some or most of the farmers lose their valuable cane assignments unless they are within reasonable distance of another mill. Even as recently as 1951 a mill in southern Queensland closed, and several of the smaller mills now operating would have been in a very precarious position but for the recent expansion of cane areas and the good seasons, which have given them a bigger throughput of cane.

In essence the sugar milling process is simple—crush the cane to extract the juice and boil off the water to get the raw sugar. The

complications, and there are many, arise from a multitude of technical improvements that have been added to carry out this process more and more efficiently and economically. A very great deal has been learnt about sugar milling in the past eighty years and Australia has been in the front rank of this progress, and still is, as the opinions of overseas mill technologists testify. There is progress yet to be made; on the other hand, the standard of milling is now very high and it is easy to slip back by bad mill management or by lack of the best plant or by poor technical staffs, as a few mills have found out in recent seasons. Like Alice and the Red Queen, the sugar mills have to run pretty hard just to stay where they are.

Much of the further progress now depends on the replacement of old plant with improved, highly efficient and labour-saving new plant, but it is enormously expensive. Nevertheless it often pays, but a number of mills have recently spent so much on new plant that they have run out of money and gone into heavy overdrafts.

Some elaboration is necessary of the idea that sugar milling is merely crushing the cane and boiling off the water. Crushing is a process of brute force that literally shakes the foundations of the mill and the earth around it. For all that, it is finely controlled and adjusted, with the great rollers correctly set within a thirty-second of an inch and the steam engines that drive them accurately matched against their varying loads. Basically, crushing is putting the cane through a series of giant steel wringers. Each mill has three rollers 5 ft. to 7 ft. long and about 3 ft. in diameter, one top roller meshing with the two below so that the cane is squeezed twice in each mill.

Between each set of mills the cane fibre is washed and stirred in dilute juice and at later stages in hot water to soak out as much sugar as possible, nicely balancing the amount of water added, because it has to be boiled away later, with the value of extra sugar recovered by adding the water.

The cane fibre coming from the final mill (bagasse or megass) is damp-dry. About 50 per cent of the weight of the megass is water and this contains about 4 per cent of the sugar originally in the cane and paid for by the mill. This is an appreciable item of expense and is one of the many figures closely watched by the mill staff. Even though the fibre is so damp it burns well in specially designed furnaces and, as luck has it, provides just about the right amount of steam and power which the mill requires to do all its work—driving steam engines, generating electric power for motors and lights, and providing steam for the boiling process, which also uses exhaust steam from the engines. Early in the season, when the fibre content of the cane is low, mills

have to buy firewood or coal to help keep the boilers fired. To reduce this expense they have to give great attention to efficient combustion and efficient use of steam.

The juice that leaves the crushing rollers is dirty and to remove many of the impurities it is treated with lime, heated, and allowed to settle. The mud that settles is filtered and washed to recover sugar and is then given to farmers as a fertilizer. The clear filtered juice contains about 14 per cent sugar and the water has to be boiled away until it becomes a syrup containing about 70 per cent sugar. This is done in a series of evaporators, the steam boiled off the first "pot" being used to heat the second and so on, with each succeeding pot kept under a lower pressure and therefore boiling at a lower temperature. In this way one pound of steam will evaporate as much as five pounds of water.

The syrup is dark, because of molasses in it, and is now dense enough for the final boiling under reduced pressure to prevent charring of the sugar. As more of the water boils off, the raw sugar crystals form. Crystallizing the sugar is carefully controlled by electrical and other devices and by adding more syrup so as to get correctly-sized sugar crystals and yet prevent the whole pan setting solid.

To separate the sugar crystals from the molasses, which still contains sugar, the mixture is spun in centrifugals (fugals) with finely perforated baskets through which the molasses drains. As much high grade sugar as possible is made and this after drying becomes raw sugar, looking rather like brownish table sugar. After repeated boilings the molasses syrup will only yield low grade sugar which is used to start the crystallizing of higher grades. Residual molasses contains an obstinate 7 per cent of the original sugar which came in the cane plus fruit sugar and minerals, and is used in distilleries or for fertilizer or for stock food. It is not economic to recover the sugar in the residual molasses.

Great advances have been made in recent years in the design of fugals, which are imported. One Queensland mill installed five large automatic fugals at an extra cost, compared with the older type, of some £35,000 but they save about £4,000 a year in wages besides giving better control by automatic timing of the spinning and automatic washing of the sugar. This is an investment that pays, though not with a large margin.

This problem is typical. Many of the older items of plant in the mills, and in refineries too, while often lacking something in efficiency compared with the latest available new plant, are in fact the best-earning investments considering their low original cost. The depreciation allowed by the Commissioner of Taxation will never suffice to

replace them. Replacement has to be provided out of heavily-taxed recent profits or from new capital or borrowings. Hence many mills present a strange and uncompleted hotch-potch of the old and the new. Sugar engineers could build a gleaming new mill but it probably would not pay. The skill of management during the period of expansion and inflation has been to make the replacements and enlargements which are most efficient and profitable for their cost, to harness old and new together and make the partnership work, to do as much of it as possible with the mill's own staff during the slack season, and finally to be prepared to switch back if items of new plant fail to arrive on time.

Sugar milling is a mass production industrial process, but it deals with an organic substance that is highly variable in composition. Chemists had to devise the modern process of sugar milling and its control and they are still improving it, assisted by engineers on the mechanical and power side.

The industry is doing much research into its mill problems through several organizations. C.S.R. has a large part of its big Sydney research organization working on mill problems. Being a centrally controlled company with seven mills in Australia and five in Fiji it can apply the results widely and quickly. Technical inspectors closely check the operating results of all C.S.R. mills, and they are in a position to supply expert technical assistance to mills in difficulties.

The other chief mill research organizations are the Queensland Government's Bureau of Sugar Experiment Stations (Mill Technology Section) and Sugar Research Limited, an organization set up in 1949 and supported entirely by the sugar mills of Queensland because they felt the need of more basic research into milling. In addition the industry pays all but £7,000 a year of the cost of the government Bureau. In relation to the size of the industry the extent of research into sugar is a record for Australia and it is paid for almost entirely by the industry itself. A Mill Research Programme Committee of senior technologists prevents overlapping in research work. There is also a great deal of international exchange of information in sugar technology.

Research on cane-growing is carried out by both the Bureau of Sugar Experiment Stations and C.S.R., and both have scored notable successes in more than fifty years of effort. The Government's Bureau provides a very comprehensive service to all cane areas in Queensland. C.S.R. grows no cane in Australia but develops new cane varieties and provides other agricultural services free to the farmers, in addition to meeting its share of the expenses of the Bureau.

Although some canes flower but shyly in the Queensland climate, the seedheads, or "arrows", give fertile seed and can be crossbred to yield an immense variety of canes. At present the Bureau and C.S.R. together have growing annually about 60,000 seedlings, which in eight or ten years may produce six good new commercial canes of which perhaps one or two will be outstanding. A new variety must yield well, be rich in sugar, be resistant to at least half a dozen diseases, and be able to ratoon well, that is, to throw up strong shoots from the root stock to provide crops in the second and third years without replanting. A new variety should not fall over easily and its suitability for mechanical harvesting may be a principal requirement in the future. For New South Wales and southern Queensland it should have some frost resistance and for all areas some drought resistance. Both C.S.R. and the Bureau have bred some outstanding canes and 80 per cent of canes now grown in Australia are of C.S.R. and Bureau varieties.

The early Australian cane growers imported dozens of cane varieties and with them practically every known cane disease and pest, and there are many. Australia became the place for scientists to visit for the study of cane diseases, and it has taken years of effort by Australian scientists, field workers, farmers and pest boards to clean out the diseases. A notable recent victory was the use of B.H.C. (*benzine hexachloride*) insecticide to control several types of beetles and grubs that previously destroyed whole crops. So effective was it in providing increased yields, even in some places where damage from these pests was not suspected, that some Italian farmers could hardly be convinced that this insecticide was not a fertilizer.

Two other major subjects of cane-growing research and experiment are fertilizers and cultivation methods. An average cane crop yielding twenty to twenty-five tons of cane per acre, plus another ten to fifteen tons (green weight) of tops and leaves, and with a big root system, naturally draws heavily on soil fertility. Six to ten hundredweight of mixed fertilizers are used per acre, the mixture depending on the class of soil, which varies greatly, and on the results of many soil analyses and experiments. Green manure crops are used to add nitrogen and improve the soil when the land is rested from cane before replanting.

In Australia, but in only a few other cane countries, cane fields are nearly always burnt before harvesting. Small blocks, of an area which can be cut in two days, are set on fire and the trash burns fiercely, but this does not greatly harm the cane if it is cut and milled promptly. It makes cane cutting easier, kills a lot of pests, and prevents the itches that attack cutters in "green" cane. Burnt cane does cause difficulties in the mill, however, and a slightly lower price is paid for it.



Cane farms, Tweed River Valley, northern New South Wales. Mount Warning in background.



This double row planting machine cuts "seed" cane into one-foot lengths, drops the short pieces of cane into the furrows with fertilizer, and covers in the furrows as it moves along.

Ploughing-in Gambia Pea. Leguminous crops are grown in a two-crop rotation with cane. They are not harvested or fed to stock, but ploughed in to improve the structure of the soil and enrich it.



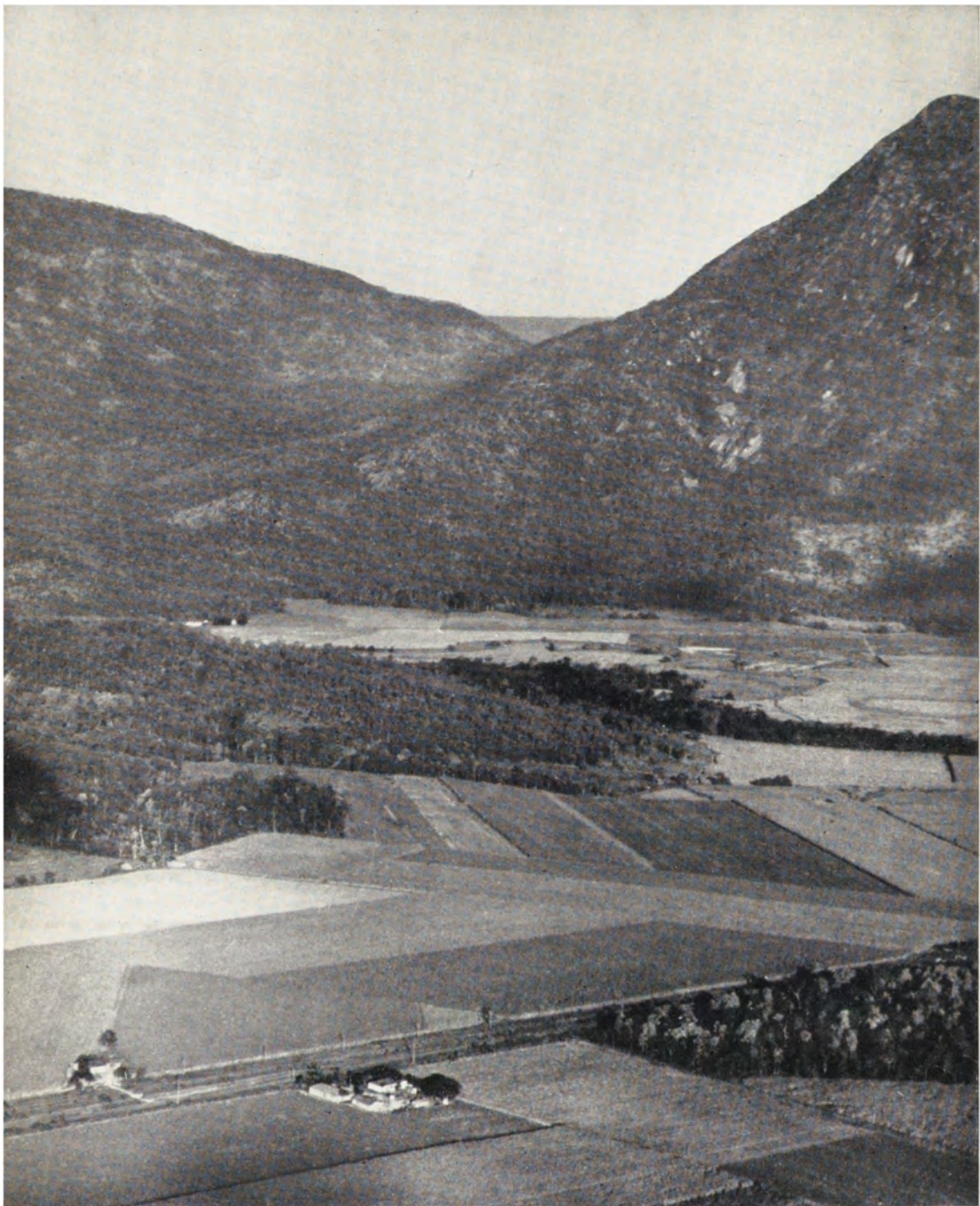


Australian cane cutters, working by contract, cut and load 6 to 8 tons of cane per man per day, average over the whole season—twice or three times as much as cutters in other cane industries.

A cane harvesting machine developed by the Fairymead Sugar Company, Bundaberg. Many machines have been experimented with but none has so far been developed to suit all areas and conditions.



Photograph of cane cutters by courtesy of Queensland Bureau of Sugar Experiment Stations.



Cane fields south of Cairns. The belt of cane country which stretches from Cairns south to Tully is the largest continuous area devoted to cane in Australia. It is nearly 100 miles long and a mile to fifteen miles wide. The main dividing range flanks the belt on the west and lesser ranges separate it from the coast. Much of this area consists of a trough between the ranges which has been partly filled in by depositions of soil scoured from the steep ranges by high rainfall. A number of river

valleys cross this belt, which is protected to some extent by the coastal ranges from the cooling effect of sea breezes. The area enjoys, in a high degree, the primary conditions for cane growing—rich soil, high rainfall and high temperatures.

The main north-south road and railway run past the homes in the foreground. Other farm homesteads can be picked out where the timbered foothills meet the cane fields.



Three generations of a cane farming family

The Ferrandos are typical of many farming families of Italian extraction in the Herbert River district. Immigrants of Italian stock and their descendants have proved themselves industrious and efficient farmers and good Australian citizens.

Annibale Ferrando, the grandfather, was born at Conzano, northern Italy, in 1874, and followed the trade of bricklayer. He migrated to Australia in 1912, coming direct to the Herbert River district, and commenced work as a cane cutter. Over a period of seven years he saved sufficient wages to purchase a small farm in partnership with a fellow cutter. This farm was situated in the Macknade Mill area.

He became naturalized in 1920, and in 1922 disposed of his share in the Macknade farm, and purchased his present farm in the adjoining Victoria Mill area.

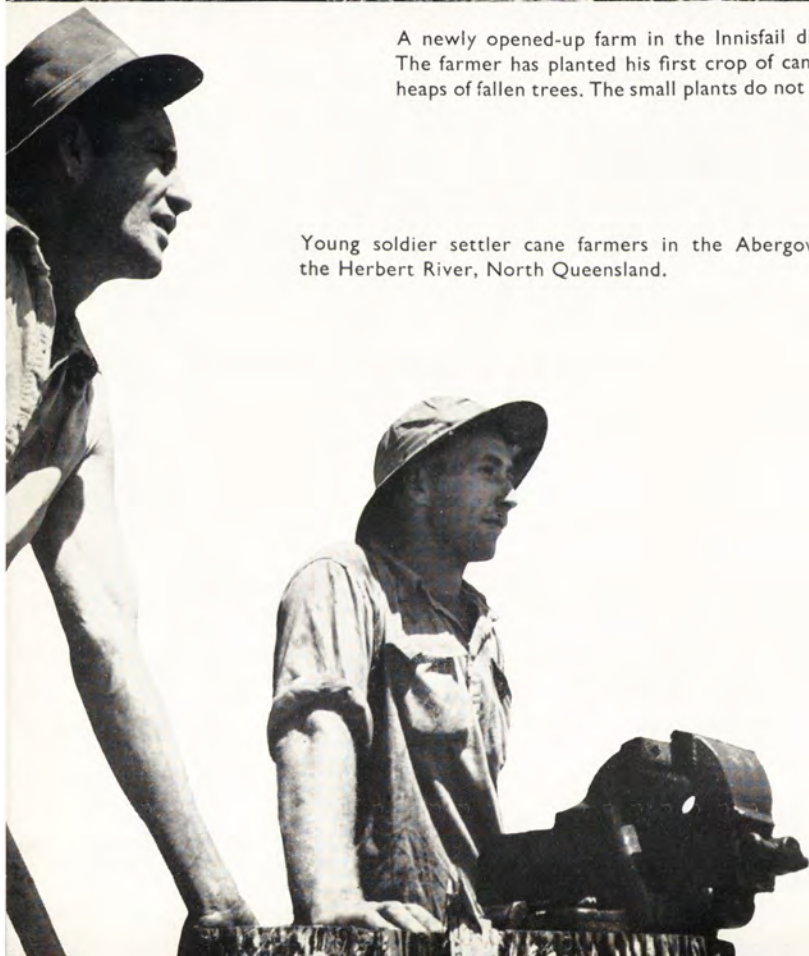
At the time of purchase the farm produced some 600 tons of cane, but at the present time approximately 3,000 tons are harvested annually. This increase called for much hard work clearing many acres of heavily-timbered land, mainly by primitive methods compared with the modern methods of using bulldozers.

In the early twenties he lived in a bark humpy with grass thatched roof, bringing up a family of three boys and two girls in rather primitive conditions. As success came his way he built a modern home and now lives in comfortable surroundings. His three sons, Giuseppe, Luigi and Vincenzo, have worked on the farm continuously. Two of them are married with a family and occupy their own homes.

The father retired in 1951, but still takes an active part in the organization of the farm. He performs many jobs of maintenance around the place, and is keenly interested in his six grandchildren.



A newly opened-up farm in the Innisfail district, North Queensland. The farmer has planted his first crop of cane between the stumps and heaps of fallen trees. The small plants do not show up in the photograph.



Young soldier settler cane farmers in the Abergowrie district, on the Herbert River, North Queensland.



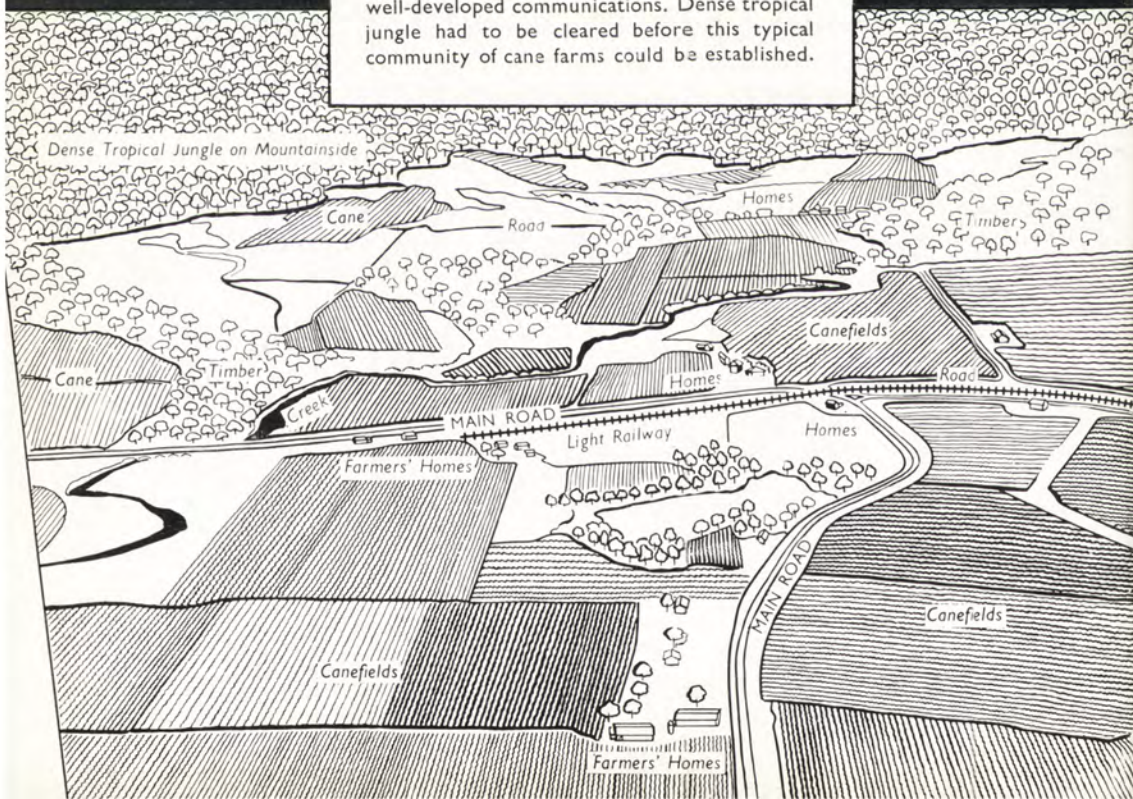
CCane farmer's wife and child, garden and farm, Ingham, North Queensland.

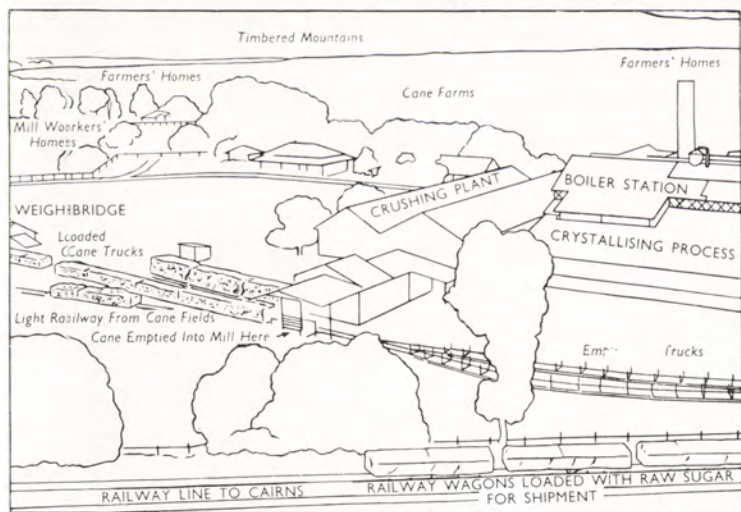
Home of established cane farmer, Cairns, North Queensland.





Cane farms near Cairns, North Queensland. The cane growing districts are closely settled, with well-developed communications. Dense tropical jungle had to be cleared before this typical community of cane farms could be established.





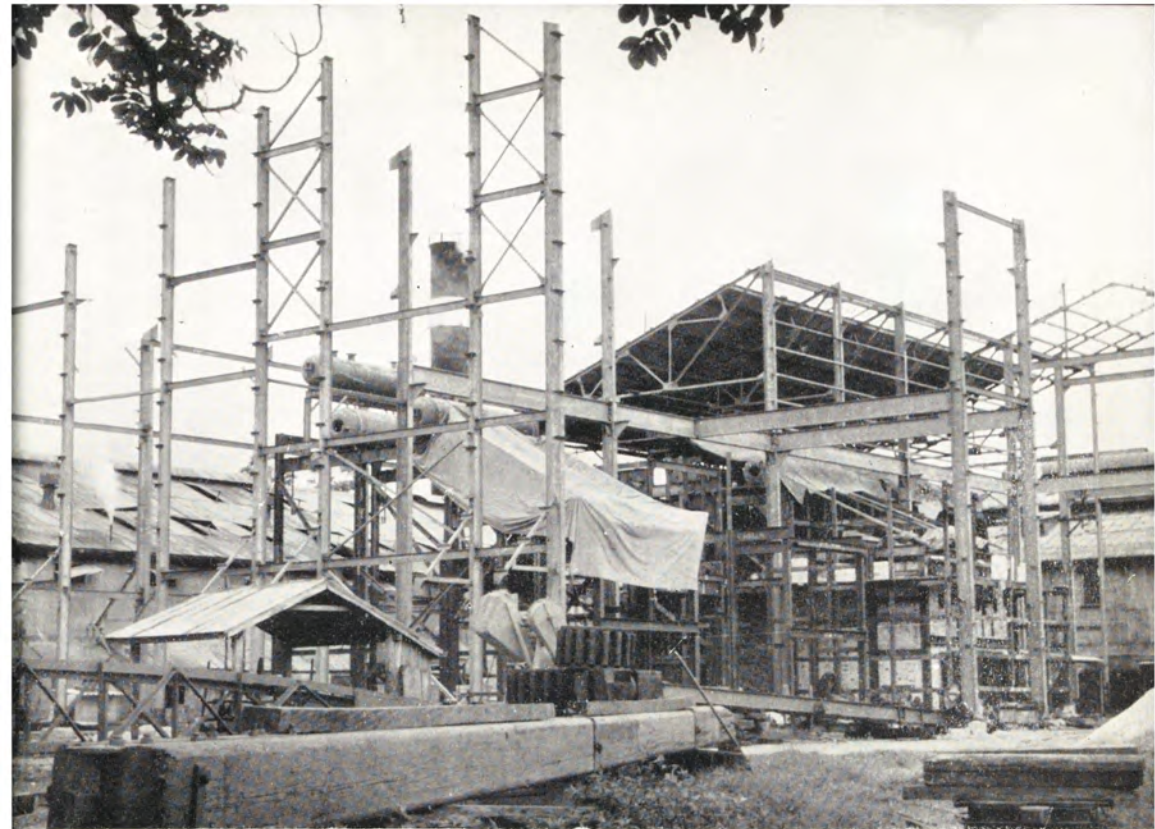
Mulgrave Mill, near Cairns, North Queensland. Mulgrave is one of 14 Australian raw sugar mills which are co-operatively owned by the farmers who supply them with cane.

Harvested cane is weighed at the mill, shredded into small pieces, and the juice crushed out by large iron rollers. The juice from each batch of cane is analysed and the farmer is paid according to its sugar content.

The fibre of the cane is used as fuel for the mill furnaces. Lime is added to the juice to precipitate impurities; the juice is filtered, concentrated by evaporation, and boiled under vacuum until crystals of raw sugar form. The crystals are separated from the syrup, dried, packed and sent to the nearby ports for shipment to refineries.

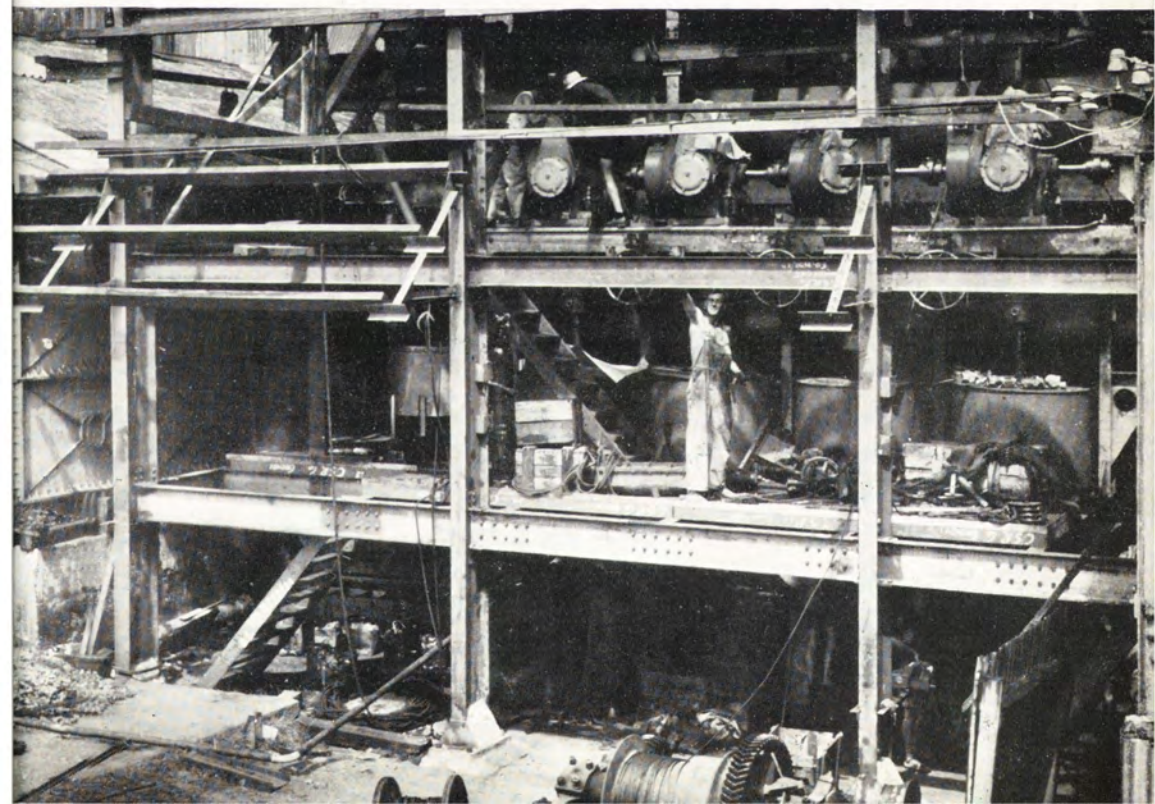


Laying a new light railway line to bring harvested cane from the recently opened-up Abergowrie district on the Herbert River, North Queensland.



Constructing new boiler station at Goondi
Mill near Innisfail, North Queensland.

Installing new high speed centrifugal
machines at Goondi Mill.





Cairns owes much of its development to the sugar industry.

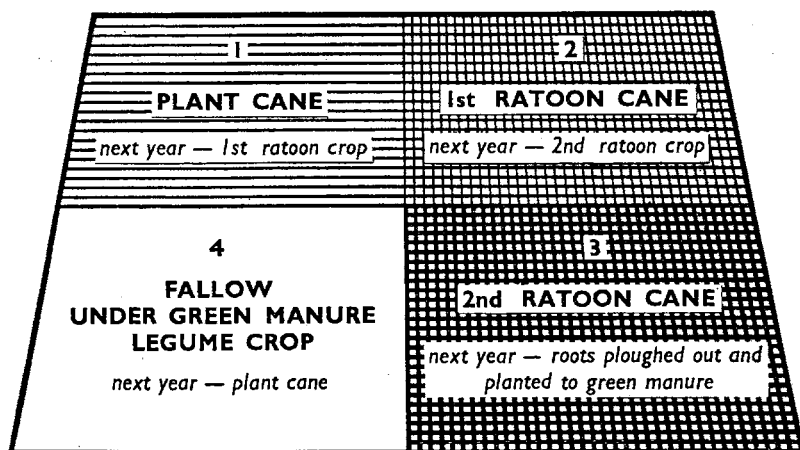
Mackay is one of the modern cities which the sugar industry has helped to develop in tropical Australia.



THE AUSTRALIAN SUGAR INDUSTRY

It seems wasteful to burn all this organic matter but, in a twenty-year experiment at the Bundaberg field station, areas where trash was regularly conserved and ploughed in showed no better yield than that of a burnt plot. One factor is that the cane's big root system itself adds much organic matter to the soil. An interesting cultivation experiment at Mackay, where cane soils are mostly shallow overlying clay, is deep subsoiling and allowing megass to trickle down the cracks to help keep them open and aerate the subsoil. Results so far are promising.

The skill of the scientist and the farmer plus the luck of the seasons can easily produce a bankrupting abundance of sugar as it did in the 1930s. One can scarcely blame the world sugar industry and the Australian industry for trying to organize themselves to prevent disastrous gluts. Consumers would have just cause for complaint if they were held to ransom by high prices for sugar with big profits and soft conditions inside the industry, because of its government-ordained monopoly position. Is this so in Australia? The short answer is—No. The long answer is given in the report of a 1952 Commonwealth committee of inquiry. After a full investigation of the efficiency of the industry the price it recommended included a modest return on the capital of farmers, millers and refiners, varying between 5 and 10 per cent on various types of assets. It allowed the farmer, in addition,



4-YEAR CROPPING CYCLE, TYPICAL AUSTRALIAN CANE FARM

In Australia it is usual to harvest three crops of cane from the one plant. A new crop which grows from the stumps of harvested cane is called a ratoon crop. Leguminous cover crops are grown and ploughed into the soil to maintain its humus content and to provide nitrogen.

an annual wage at award rates plus about £250 a year for managerial skill and work. Sugar is a low profit margin industry right through from grower to grocer.

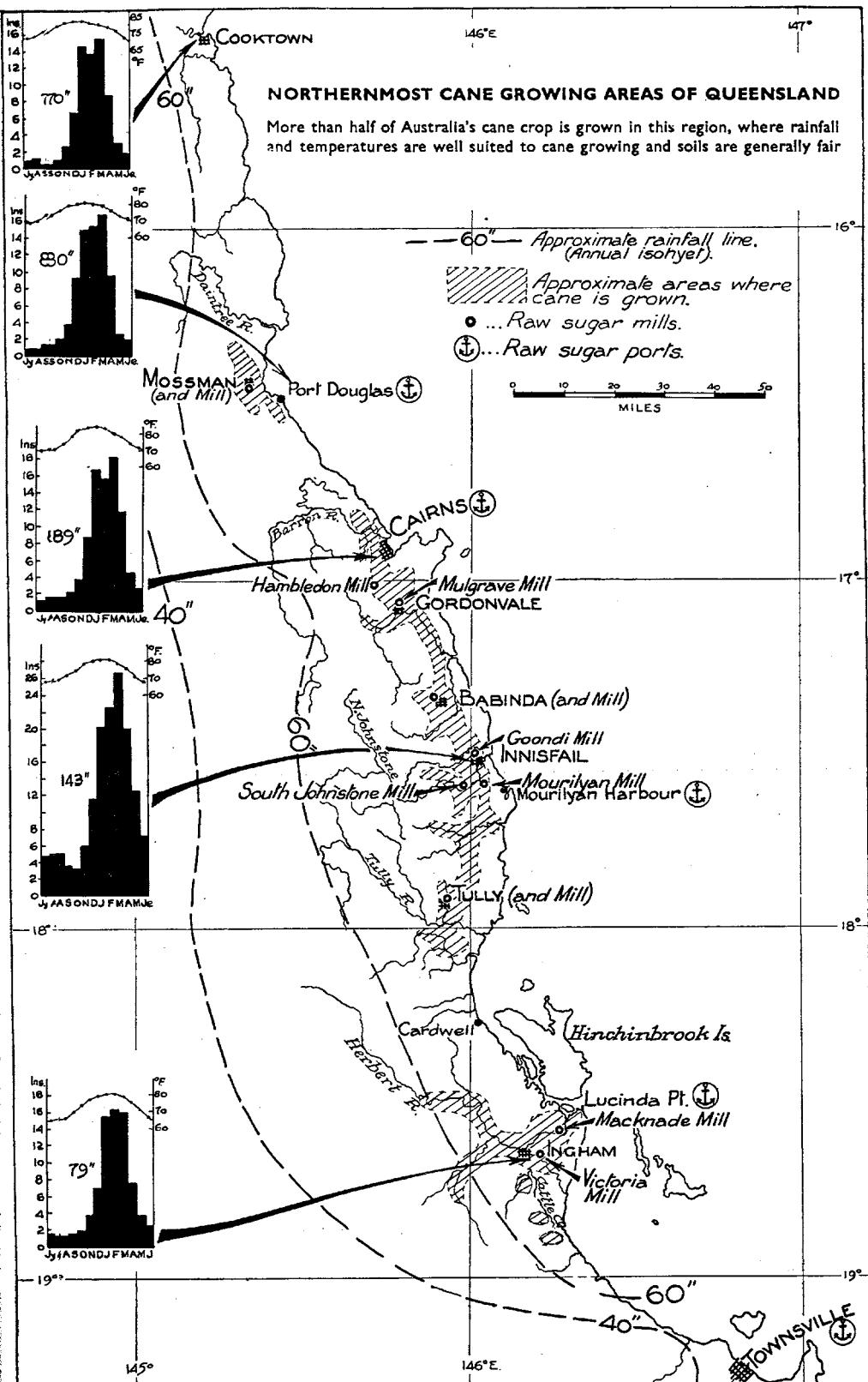
C.S.R., which mills some of the sugar, buys the industry's bags, acts as agent to sell all raw sugar, finances the mills and through them the growers pending sales, and refines nearly all Australian requirements, is under the closest official scrutiny. Prime Minister Hughes said during World War I, "Now I have C.S.R. in the shafts, all I have to do is hold the reins." C.S.R. has been a willing horse and has received a strict ration of feed.

Its success has not been mainly due to its so-called "monopoly" position, which is in fact a collection of controlled-margin jobs that nobody else wants. These have been bread-and-butter work but provided a base which allowed the company to grow in size. Size helps its other activities, its staff is more expert, its policy decisions often better. It can use its financial resources, its capital equipment and skilled personnel to better advantage than can smaller businesses. By this type of management efficiency C.S.R. prospers.

What about the efficiency of the farmers? They vary greatly, of course, like any other farmers. The good farmer on his own land has to keep himself abreast of the latest developments—cane varieties, cultivation methods, disease control, tractors and implements. His sixty to seventy acre farm, growing forty-five acres of cane for annual harvest, keeps him busy most of the year with the sequence of planting, cultivating (until the cane gets "out of hand"), harvesting, cultivating and fertilizing ratoons, fallowing and green manure cropping. His farming is more of the intensive style like potato-growing rather than wheat farming.

The cane farmer's slackest time is during the "wet" when there is little he can do but sit on the verandah and watch the cane grow in the rain. The repair of implements and tractors will, however, become a more important slack season job as his machinery gets older. The established cane farmer has rather less spare time than the established Australian wheat farmer. Compared with wheat farming the cane farmer is much less likely either to make a fortune or to be ruined by drought. Cane yields vary within a narrower range. Unavoidable expenses, including cane cutting, are fairly high.

The "soldier settler" cane farmers are mostly making good. To get the heavy timber bulldozed off their blocks and burnt cost them £40 to £80 per acre, depending on whether they had open eucalypt forest or "scrub"—the tropical jungle where to remove a single huge tree can cost £100. With a simple house, shed, tractor, implements and



working capital, they incurred debts of £10,000 and over which will take capable hardworking men about 15 years to pay off, with average seasons and no undue restrictions on production—not too bad if they are young, strong, and reasonably intelligent and if they can remain healthy.

There are, of course, a few poor farmers, even among the soldier settlers. Such men are often those who “spend too much time in town”. Their farms become overrun with weeds and grass, their crops are light. A poor farmer can exist in cane-growing if he has inherited a valuable property debt-free, but otherwise he cannot last long.

Cane farming has for many years rather been held in a straight-jacket by the system of cane “assignments” designed to prevent over-production. A farmer may grow only a fixed acreage of cane and, officially, this has to be grown on a certain portion of his land, even though he has spare land. Most mills hold detailed survey maps showing these areas on each farm. Each mill can be limited to a “peak” tonnage of raw sugar and, to enforce this equitably, each farm can, if necessary, be limited to a peak tonnage of cane. Such a necessity has arisen this year and restrictions are being applied. The Central Cane Prices Board, which finally adjudicates on these matters, has in recent years increased the assignments of many farmers whose assignments were too small. But some farmers with rather small areas cannot expand; they are using all their farms for cane and are hemmed in by other farmers doing the same, or by hills, rivers or swamps. In the northern Queensland cane areas particularly, i.e., from Mackay northwards, where 80 per cent of Australian sugar is grown, cane is almost the only form of farming. This has some disadvantages: no supplementary source of income, no livestock to increase soil fertility, and perhaps a tendency to the single-track mind. But there are some advantages, such as greater concentration on the main job of cane-growing and denser cane areas reducing the very important costs of cane transport.

Beef cattle on improved pastures would fit in with cane-growing better than would dairying, which takes too much daily time during rush periods. Beef cattle may come gradually in the fairly rare cases where farmers have enough spare land to carry, say, a hundred head and make a proper business of pasture improvement and stock raising. Preferably they should be allowed to rotate their cane around the farm to get the benefit of soil fertility, though this immediately increases cane transport costs. In the denser cane areas nothing short of a complete re-design of assignments and transfer of farm ownership on a grand scale would release enough land for livestock farming.

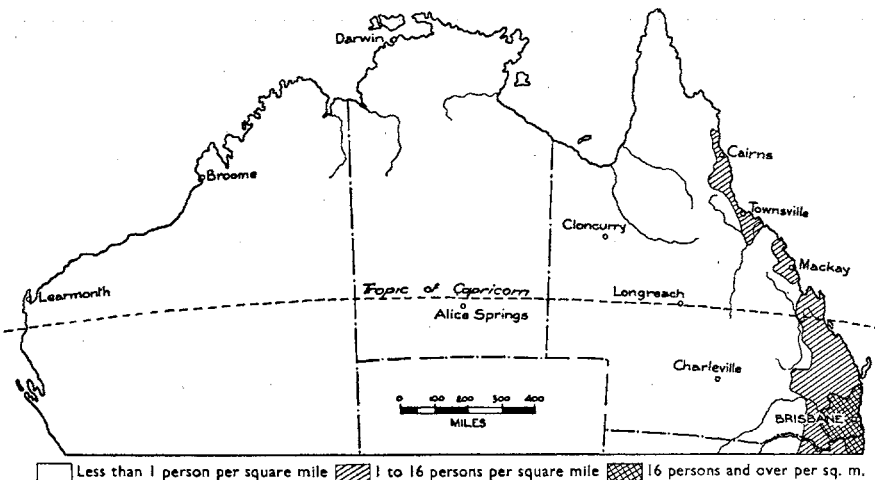
Sugar land sells at £100 to £150 per acre of “gross assignment”,

THE AUSTRALIAN SUGAR INDUSTRY

i.e., the total area on which the farmer is allowed to grow cane, and on about three-quarters of which he harvests cane each year. (Sometimes quoted prices are much higher than this but include tractors and implements and a standing crop which may be worth up to £100 per acre.) Cane land prices are, therefore, comparable with other intensive-crop land or good dairy land in districts which supply city demands for milk. There is no doubt that the granting of assignments does give the land great value compared with adjacent non-assigned land of the same quality. This is particularly so in northern Queensland where there is not much other intensive use for the land. The Cane Prices Board has to approve all sales and transfers of cane farms and, although the equivalent of "key money" sometimes goes into a sale, the influence of the Board in putting a brake on values and the modest margin of profit in cane farming have prevented the great increase in land values compared with prewar that has occurred in most other farming and grazing.

The cane districts and cane towns are now solid and prosperous, but not blatantly so. Most cane farmers have had several good seasons and have been conservative with their money, saving a good deal of it. They tend to spend first on new and improved tractors and farm equipment, then on motor cars or on their houses. Except on the older-established farms the standard of housing is usually not high.

NORTHERN AUSTRALIA—POPULATION DENSITY



Tropical Australia is sparsely inhabited except for those districts on the eastern coast of Queensland where cane is grown.

In northern Queensland the more recently-settled Italian farmers are not accustomed to good housing and spend reluctantly on their houses and on their wives. Their Australian-born children, however, are growing up almost indistinguishable in outlook and idiom from other Australian children, except for their ability to speak Italian.

The towns and cities of the cane fields are very like towns of the same size anywhere else in Australia, with their chain stores, milk bars, hotels and good-class shops. Many of them are well laid out and well kept, and are justifiably proud of themselves. Mackay, with 15,000 people, is wholly a sugar city; Bundaberg with 20,000 and Cairns with 21,000 are largely built on sugar. Innisfail with a population of 6,600 is a prosperous town in the "wet" belt and Ayr (7,000) is the chief town of the important Burdekin delta cane area, a drier district where some 40,000 acres of high-yielding cane are irrigated by pumping water from underground sands.

The Australian sugar industry is a peculiar mixture of competition and co-operation, and this is a main reason for its progress and relative efficiency. Consider sugar sold in Australia: its price as refined sugar is fixed from time to time by agreement between the Commonwealth and Queensland governments. It then becomes the concern of each of the three main sections of the industry, growers, millers and refiners, to see that neither of the other two is getting more than its fair share out of it. The growers and millers and their organizations (and the Queensland Sugar Board) watch the refiner closely to see that he does not allow his costs to be inflated by internal inefficiencies or make undue profits which, if taken into account in the official split-up of the price, would reduce their own shares. Yet they must allow the refiner sufficient profit margin to enable him to install improved equipment and thus keep costs down. The millers watch the growers and the growers watch the millers, for each year the Central Cane Prices Board, with a Supreme Court Judge as chairman, determines how the raw sugar price shall be split up between them. It collects its own samples of costs and listens to arguments on increased items of cost by counsel for each side. Mills operate on a fixed price per ton of raw sugar for each season and hence compete to get their own costs down and output up. Co-operative mills have a foot in each camp, but their boards and managements have to protect the long-term interests of the mill against growers who want too much of the profit handed back to them as bonuses, so starving the mill of better equipment.

Yet growers, millers and refiners co-operate on many occasions. They worked hard together to get the best possible market for export

THE AUSTRALIAN SUGAR INDUSTRY

sugar. They are all interested in producing sugar of good quality, both refined and raw. In the 1954 season C.S.R. was concerned over export sales of raw sugar which overseas refineries found hard to filter. The company arranged for every Australian mill to send twice a week by air to its research laboratory samples of the raw sugar being produced to find out the causes of poor filterability and this research work is still in progress. All three sections of the industry are vitally interested, too, in bulk handling which will lower costs.

Sugar men in each generation have had to overcome new problems. They had to replace the Kanakas with independent farmers, and the multitude of small mills with large efficient mills. Later they expanded too much and had to impose a rigid method of limiting production. They have virtually wiped out cane diseases, bred better canes, mechanized cultivation, and doubled the yield of sugar per acre. Now, with markets better organized, they have expanded again, re-equipped their mills and farms, but have run into vicious problems of costs and labour shortages. Today's sugar men are not short on energy or ability. By research, technical improvements and good management they are attempting to solve these problems and to keep Australia in the forefront of world sugar.