

Sugar Cane

& The Milling Process

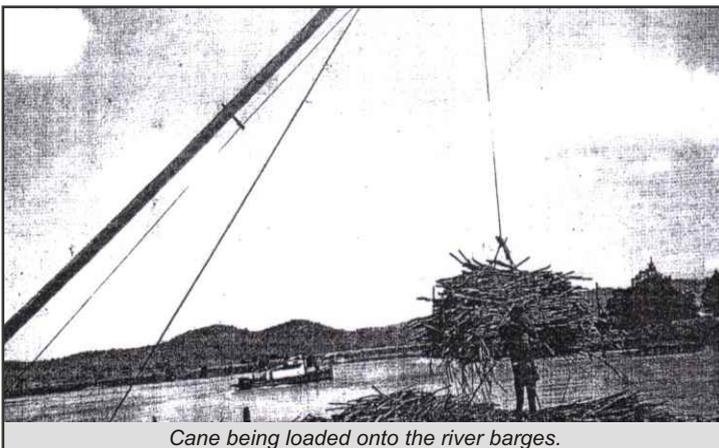
The Early days on the Clarence

By 1870, 27 sugar mills operated in New South Wales which grew to a staggering 102 mills by 1885. But a rapid decline in numbers saw 3 large mills survive - 2 of these large mills built by the Colonial Sugar Refining Company at Chatsworth and Southgate on the Clarence. These were so successful that CSR moved its Darkwater Mill from the Macleay River to Harwood Island and after 14 years only the Harwood Mill survived and flourished into the 20th century and continues its life today as the oldest operating sugar mill in Australia.



Cane cutters in the early days of cutting the cane by hand.

In the early days cane was cut by hand. The cane cutters hand-cut and loaded the cane stalks onto a horse drawn cart for haulage to a cane derrick on the river. The cane was transported to the sugar mill in river barges towed by tug boats. Mechanical harvesting and road transport was not introduced until 1976.



Cane being loaded onto the river barges.

THE SUGAR INDUSTRY

The sugar industry has been part of life in the Northern NSW for more than 100 years. The industry is a significant contributor to the economy of the area and provides the community with employment opportunities, growth and prosperity. There is 450 mill and refinery employees and 600 cane farmers. The NSW Sugar Milling Co-Op was formed when cane growers purchased the 3 NSW sugar mills in 1978. The mills are located at Condong on the Tweed River, Broadwater on the Richmond River and Harwood on the Clarence River. In addition, the Co-operative now operates a sugar refinery which is located alongside the Harwood Mill. The NSW sugar industry occupies approx. 30, 000 hectares of the Northern Rivers region and extends from near the QLD border in the north to Grafton in the South.

THE CANE PLANT

All of life's energy originates from the sun. Green plants harness the solar energy and store it in the form of carbohydrates. By careful selection and breeding, sugar cane has become one of the most efficient converters of solar energy into food carbohydrates and fibre. The hard rind of the cane protects a softer fibrous centre which transports water and nutrients from the soil to the leaves where they are combined with carbon from the atmosphere to form sugar (sucrose). The fibrous centre serves as a reservoir for sugar as the cane ripens.

GROWING SUGAR CANE

An average cane farm is 65 hectares. Harvested cane yields around 110 tonnes per hectare. Cane is planted between mid-August and October. Cane stalks are cut into 300mm long "setts" and planted 100mm below the soil surface in rows 1.5m apart. Fertiliser is added and weeds are controlled for the next three to four months. The crops is harvested in the July to November crushing seasons, either one or two years after planting. Most NSW crops are harvested two year old. After harvest, a "ratoon" crops grows from the below ground parts of the previous crop. Two or three ratoons crops are grown from each planting.

BURNING THE SUGAR CANE



Clarence Valley cane farmer starting the burning process.

This practice significantly reduces the amount of trash (dried out and unwanted leaves) Cane fires are frequently lit late in an afternoon around dusk, making a smoky glow in the sky a common sight around the Clarence Valley of an evening.

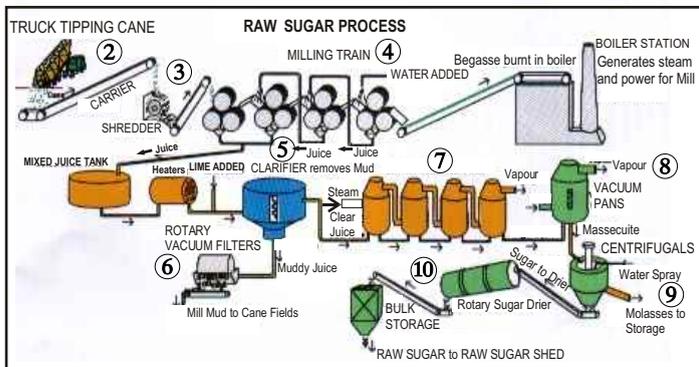
Many cane farms stretch along the Pacific Highway and tourists may be lucky enough to stop and watch cane being burnt from the side of the road. Motorist should always pay attention to road rules and always make sure there is enough space to stop or that a rest area is close by to park.

HARVESTING & TRANSPORT

NSW boasts one of the most efficient harvesting systems in the sugar cane growing world. A fleet of modern, high capacity harvesters are in-field cane transporters handle the crop efficiently and in all weather conditions. The harvesters cut and load into in-field transporters which either tip or elevate the cane into 24 tonne bins at central locations on the farm. These bins are then transported to the sugar mills by road.

Reeves Family Sugar Cane Tours

367 Kings Creek Road, Lower Lawrence NSW 2460 **Phone: (02) 6647 7215**
This is a working sugar cane farm. During harvesting time (May to December) it's the most noted tourism activity, the life of a cane farmer is an interesting one throughout the year and tours are welcome. Please contact Christine & Robert on the above contact number for further details.



Raw Sugar Processing

1. The Season.

The crushing or operating season can extend from May to January but typically it runs from June to December each year. Hours of operation are continuous - 24 hours per day, 7 days per week, with short shutdown periods for maintenance during the crushing season.

2. Crushing

When the cane trucks arrive at the sugar mill the sugar cane is weighed and then tipped into a cane carrier which conveys the sugar cane billets to the shredder.

3. The Shredder

The Shredder is in effect of a very large hammer mill. The Shredder disintegrates the cane billets into fibre which is then conveyed to the milling train for extraction of the sugar juice.

4. The Milling Train

The shredded cane is fed into the crushing mill which consists of three large rollers arranged in a triangular formation so that the cane fibre is crushed twice in the mill. After the mill the cane fibre is immersed in a bath of hot dilute juice recycled from a subsequent mill. The process is repeated through three sets of crushing mills until the last mill is reached. Prior to the last mill the dilution bath is made up of final mill crushing juice and hot water. The final mill dewateres the residual cane fibre (Bagasse) which is then conveyed to the bagasse bin and the boiler station for use as fuel.

5. Clarification

The juice extracted by the milling train contains impurities which are removed by heating the juice and adding lime. The process coagulates the impurities into flocks of mud which are settled in a large clarifier vessel. In the clarifier the mud settles to the bottom while the clarified juice overflows from the top of the vessel.

6. Filtration

The settled mud contains a considerable amount of sugar which is extracted by filtration and washing and is recycled back into the process. The separated mud solids are mixed with flyash from the boiler and are sent back to the cane paddocks as fertiliser.

7. Evaporation

The thin clarified juice is concentrated to a heavy syrup by boiling at progressively higher vacuums through the set of evaporators.

8. Crystallising

The heavy syrup, which is about 65% sugar is concentrated by boiling in a vacuum pan and is seeded with small sugar crystals. The sugar crystals are grown to required size by adding more syrup while boiling is continued. When the crystals reach the required size, the mixture of syrup and crystals is discharged from the pan.

9. Fugalling

Syrup is separated from the raw sugar crystals in perforated baskets which spin at a high speed in casing (centrifugals). The dark syrup surrounding the crystals is thrown off through the perforations and the crystals are washed with hot clean water. The separated syrup is repeatedly boiled again until all possible raw sugar crystals are obtained. Molasses is the syrup obtained from the final boiling and centrifuging operation.

10. Drying & Storage

The raw sugar from the centrifugals is dried by tumbling through a stream of air in a rotating drum. It is then transferred to the raw sugar shed at Harwood prior to dispatch to the sugar refinery.

Refining Sugar Process

1. Raw Sugar - colour about 1400

Why is it necessary to refine sugar? Raw sugar is after all a relatively pure food containing only 0.5 to 1% of impurities. The refining process removes virtually all colour to form white sugar which is more than 99.9% pure sucrose.

2. Affined Sugar - colour about 800

The raw sugar is firstly mingled with heavy syrup. This softens the external layer of dried syrup on the raw sugar crystals. The softened layer is removed by a centrifuge leaving a clean raw sugar crystal or affined sugar.

3. Melt Liquor - colour about 800

The affined sugar is then dissolved in a stirred steam-heated melter to produce this amber coloured liquor.

4. Clarified Liquor - colour about 450

The amber coloured melt liquor is clarified in a floatation clarifier by adding phosphoric acid, lime and air. This process removes impurities and some of the colour compounds. The impurities float to the top and form scum. The clarified liquor is taken off from the bottom of the vessel. Scum is discarded from the process at this point. The clarified liquor is then pumped through specially designed deep bed filters to produce a sparkling, clean liquor.

4a Scum

This scum is the resultant precipitate that is floated off during clarification and returned to the farmers as fertilisers after virtually all the sugar has been washed out.

5. Fine Liquor - colour about 100

The Clarified liquor is pumped through large columns packed with ion exchange resin. This resin has the ability to 'hold' the colour particles while allowing the clean sugar syrup to pass through. The result is a decolourised liquor (fine liquor) that is about 1/10th the original colour.

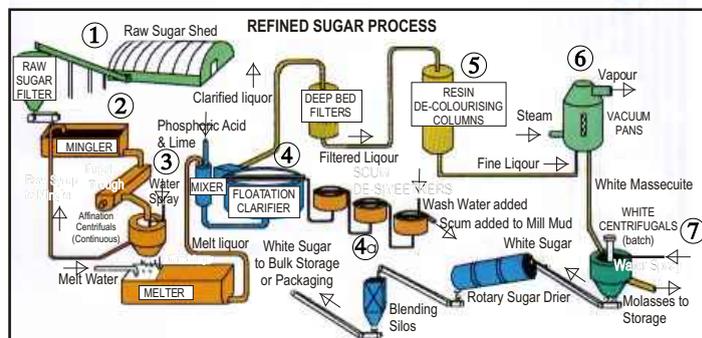
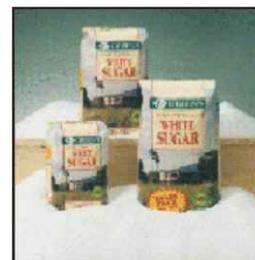
6. Crystallisation

The fine liquor is now concentrated and crystallised in vacuum pans. The liquor is boiled under vacuum in the pans until supersaturation and sugar is able to crystallise. Rather than allowing the crystals to simply grow randomly, a large number of very small nucleus crystals are introduced and a controlled number of crystals are allowed to grow using tight control of the process. The resultant product is called massecuite - a mixture of sugar crystals and syrup. The syrup is then spun off from the massecuite leaving wet refined sugar in high speed centrifuges.

7. Refined Sugar

The wet refined sugar from the centrifuge is dried and cooled in a rotary drier and then the sugar is sent for packaging or bulk distribution in a food grade container system.

Harwood refinery packages on line lines: Bulk bags, 25kg bags and retail packs.



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Credits: This brochure was compiled by Clarence River Tourism with reference to the following persons and publications

* Sunshine Sugar - NSW Sugar Industry
Linda Biddle

* Sunshine Sugar - The Sugar Milling Process

* Clarence Cane Growers, Maclean.

Mr Pat Battersby for History & Images

* Clarence River Tourism, Image Slide Library