Sugar cane production

Sugar cane is a crop that has been used since time immemorial, which is why tracing its geographical origin and genetic ancestry has always been difficult, on account of its distribution and cross-breeding.
Its global spread was achieved by the Portuguese and Spanish who introduced it in new territories, particularly South America and the West Indies where, today, the cultivation of sugar cane is an important component in their productive structures. Later, in view of developments in agronomic science and in industrialisation and the transport infrastructure, cultivation expanded and reached other areas, where it constitutes an important element in the economy of the producing countries.
Nowadays there is no doubt that the areas adapted to sugar cane (See Figure 1) are quite vast. Being a crop characteristic of tropical zones and many subtropical zones, its probable area of cultivation is really extensive. Its northern limit is made up of the Island of Madeira, South-eastern Spain, Upper Egypt, Southern Iran, Pakistan, India, Southern China and Taiwan, the Hawaiian islands, Mexico and South Florida and Louisiana. The southern boundary comprises the province of Natal (South Africa), Madagascar, the islands of Reunion and Mauritius, Queensland (Australia), the Fiji islands, the Peruvian coast, the province of Tucumán (Argentina) and the northern state of Paraná (Brazil).

Figure 1

Its introduction in Madeira dates back to the beginning of the colonisation of the island, around 1425. Since its cultivation was a huge success, the crop grew immensely, and about 30 years later the island was already the largest European producer of sugar.
The expansion of the crop to the New World, namely to Brazil, owes much to Madeira: the first planting stocks, as well as the agricultural and industrial technology required, that arrived in Brazil, came from Madeira, which easily demonstrates the importance of the island in the dissemination of this crop.

Endafoclimatic conditions on Madeira

The total area of the Island of Madeira is 732 km2. Most of this area is on slopes with a gradient greater than 25%. The flatter surfaces are found in the urban and suburban areas of Funchal or located where the climate and altitude do not allow agricultural practice. Where agricultural land is found in areas with gradients between 16% and 25%, this is only possible due to the construction of terraces, the so-called “poios”, supported by walls of basalt stone that so typically characterise the agricultural landscape of Madeira.

On an island with scarce agricultural area, the pressure on the land is great, and it is common for organic matter to be added to the soil, so it often has high values in this parameter.
The small size of the plots combined with the orography of the land results in it being almost generally impossible for mechanisation to be used, so most agricultural practices are carried out using manual labour.

Currently, sugar cane cultivation, although considered extensive, is practised on small farms, usually sprayed (the total area of the farms normally does not exceed 5,000 m2, often broken down into 5 or 6 plots), and occupies a total area of 172 ha, corresponding to a production of around 10,000 tonnes.

The production of the raw material for “Madeira Rum” is strongly dependent on manual (mostly family-based) labour, without resorting to any type of mechanisation, not only to make the maximum use of natural resources, namely the arable surface available, but also due to the difficulties created by the steep slopes of the land.

The particular climate of the Island of Madeira is influenced by dynamic factors of atmospheric circulation, general geographic factors, such as latitude and oceanic location and by its orography, the altitude and the exposure of the plots that give rise to the formation of microclimates, the soils of basaltic origin, generally clayey, acidic, with some organic matter, the abundance of water resulting from lush vegetation that extends throughout the island, all of these making up the main conditions that have allowed the installation and development of sugar cane and that strongly mark the production of this crop, which is the main raw material with a decisive influence on the unique characteristics of “Madeira Rum”.

In terms of rainfall, this averages annually between 3,000 mm at high altitudes, and 500 mm on the south coast next to the sea. About 75% of total annual rainfall occurs in autumn and winter, as a rule. In spring it rains just over 20% and in summer less than 5% of annual rainfall. Precipitation increases as the altitude rises, this effect is more accentuated on the south coast.
The trend for distribution of sugar cane cultivation among the island's different microclimates is not a matter of chance and links natural factors to human factors, highlighting the places where man found the optimal conditions for this crop to express its best qualities.

Sugar Cane Cycle

The phases of the sugar cane cycle can be summarised as follows:

Planting: the stalks are placed in setts under a variable, moist layer of soil, to facilitate their “germination”.

Germination: the buds that are accumulated on the cane give rise to stems (called primaries). At the same time, some rootlets emerge in the vicinity of the “eyes”, which will be responsible for feeding the young plants.

Tillering: since the internodes at the base of the new shoots are very close, a series of subterranean sprouts is formed which, in contact with the humidity of the earth, may give rise to new, now secondary stems; and, from these, others (tertiary) may be formed, and so on, until a “clump” is obtained which, depending on the species/variety and the climatic conditions prevailing in the area, may contain a variable number of stems (usually between 10 and 40).

Development of normal roots: as already said, the roots that emerge from the plantation stake have an ephemeral life, since they are joined to the new “clump” through a stake that will quickly rot and disappear. The other roots (of the stems), born from the new shoots and internodes of the young stems, which develop after the former, will have to be in sufficient quantity to supply the needs of the new clump and of all the vegetative material that comes next. All of this depends on the environmental conditions of the location.

Rapid growth: the terminal vegetative sprout of each stem born, will give rise to a succession of nodes (which contain an "eye") and internodes (which can reach a variable length, depending on the varieties, edaphoclimatic conditions and handling care given to the crop). The leaves born in each node will grow and later age, while the roots will branch and increase in length, ensuring good support for the canes and a good supply of water and nutrients.

Flowering: after a certain point, the terminal sprout of the stalk can evolve into a floral bud, giving rise to an inflorescence. Latitude and decreasing day length seem to have an influence on this phenomenon. However, there are many varieties that seem to have little tendency to bloom, which is the case with the vast majority of those grown in Madeira.

Ripening and harvesting: when flowering occurs, it always precedes technological ripening. This basically corresponds to an accumulation of sucrose in the stems, with a consequent decrease in the content of water, acids and glucose. Once the upper part of the canes ("cob") and its leaves have been eliminated, all the rest of the stem (which should be cut as clear as possible) is used to extract the juice, which will originate the Madeira Rum.

Offshoots: the "clump" comprises the entire underground part of the previously cut stems, the young shoots that are about to burst and the entire set of roots. From the latent sprouts it contains, new stems are born that have, in turn, new "eyes", which may (or may not) develop, giving rise to new roots. The roots of the old root system will quickly cease to function, being replaced by those of the new system that is now developing. The aerial part of the plant will continue to grow as normal. repeating the cycle until the next maturation and cutting/harvesting, until the agricultural yield becomes reduced, requiring a new planting by cuttings.
The life span of a plantation is variable. According to some sources consulted, it can be from 12 to 15 years. However, according to the experience of the cultivation in Madeira, the harvest only starts to decrease after 20-25 years of life. This may be related to the more careful care that is provided in the cultivation by the regional producers, allowing the useful life of the cane fields to be increased.

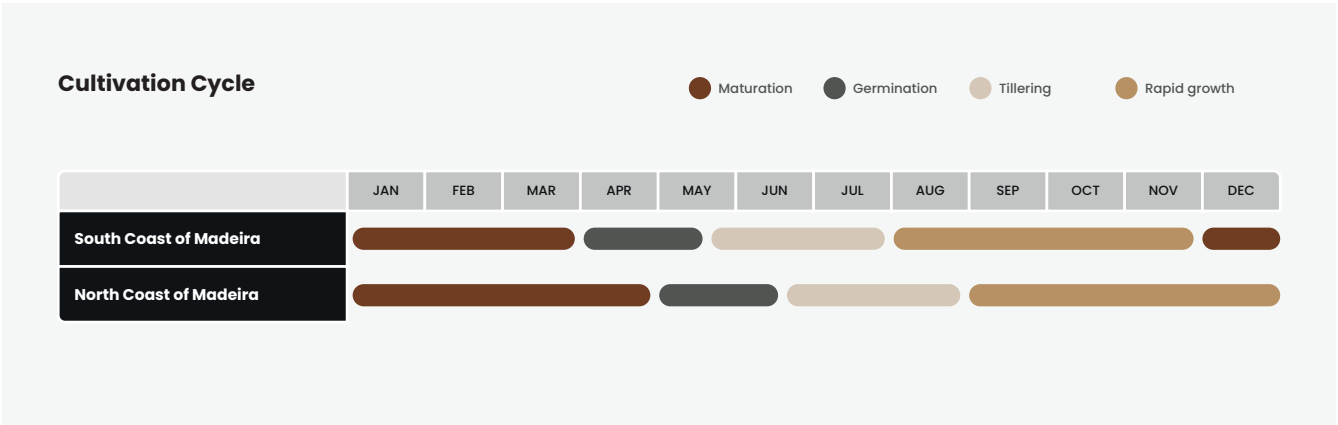
Particularities of sugar cane cultivation in Madeira

The cultivation is done quite differently from that of the other producing areas. It is done on smallholdings, with a very low degree of mechanisation. Due to this, the attention paid to the crop is more careful, and this provides higher productivity, which can reach 120 ton/ha.

The crop needs to be abundantly watered in the first stages of development of its annual cycle, corresponding to a lower rainfall.

In phytosanitary terms, there is only one pest to register: the "Broca"/"Bicho da cana" (Sesamia nonagrioides), whose attacks may be responsible for production losses that can be as much as 40%.

The harvest is undoubtedly the most painful and labour-consuming work. For this operation, it is necessary to first defoliate the cane and remove the "cob" (terminal, more tender and watery part of the cane). The harvest starts in mid-March, and extends into May, depending on several factors.



Sugar cane productivity in Madeira can vary from 40-50 ton/ha in very old cane fields and/or where the usual cultivation practices necessary for the crop are not fully complied with, to values exceeding 120 ton/ha in more recent cane fields, where all the fundamental conditions for such an output are fulfilled.

Sugar cane varieties in the production of Madeira Rum

Sugar cane is a plant that belongs to the genus Saccharum L.. There are at least six species of the genus, cana-saccharin or cultivated sugar cane being a multispecific hybrid, with the designation Saccharum spp.
The selection of the varieties of sugar cane used in the production of Madeira Rum takes into account several factors, including characteristics related to maturation, sugar content, requirements related to the type of soil, resistance to diseases and wind. Even so, productivity varies a lot, ranging from 40 ton/ha in old cane fields to 120 ton/ha in more recently installed cane fields.

The varieties used in the production of Madeira Rum are as follows:

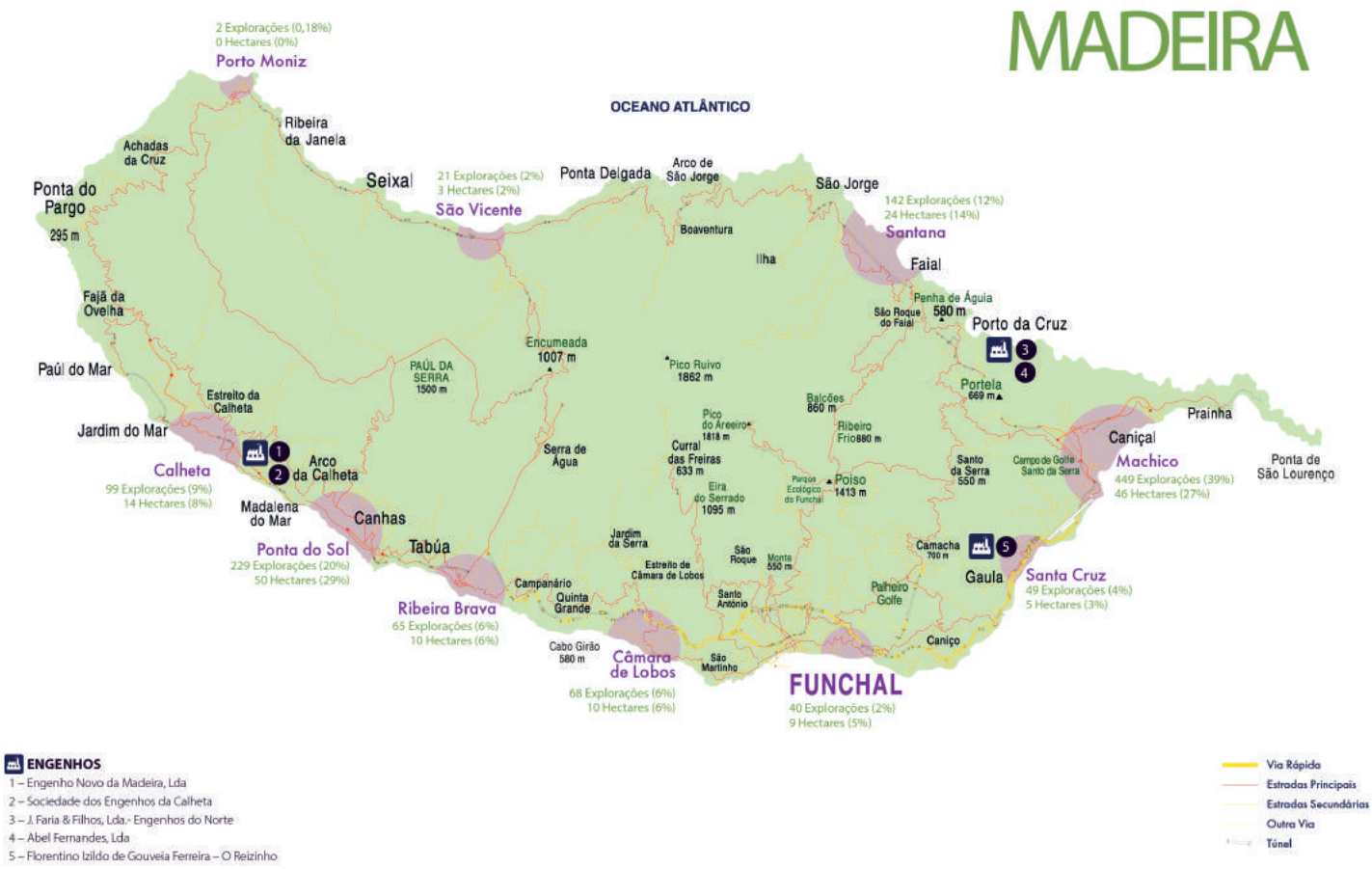
POJ 2725: very vigorous cane, which adapts well to a wide variety of soils, capable of yielding a good tonnage, even in poorer and drier soils. Its stalks, with a normal diameter of about 3.0 cm and about 3.0-3.5 m in height, have a purple colour (hence its popular name, "purple cane"), are very rich in sugar and not very fibrous, and therefore have a good industrial performance. Its “tillering” is quite intense, which contributes to obtaining high productivity.

NCO 310: cane that adapts well to a wide variety of soils. The tonnage that is obtained from its cultivation is, as in the previous case, excellent, even in soils of lesser quality. Its stems have a slightly larger diameter than the previous variety (they can reach 4.0 cm), have a maximum height also greater than that of POJ 2725 (reaching 4.0 m), are whitish green in colour, very juicy, high in sugars and low in fibre. Its tillering is not as intense as that of POJ 2725, which is why its productivity is very similar to that.

Yuba/Canica: this is a thin cane, with less heavy stalks, with a vigorous root (it can reach the deepest layers of the soil), therefore resistant to drought. It matures later and the harvesting is more difficult. Its juice is usually of good quality. Its cultivation in Madeira still persists, due to its adaptation to less watered soils, as well as the quality of its juice (“guarapa”), which give the resulting Rum a more characteristic aroma and a superior flavour quality.

Distribution

The areas of greatest regional sugar cane importance are the municipalities of Calheta, Machico (especially the Porto da Cruz area) and Ponta do Sol, followed by Ribeira Brava and other municipalities on the south coast of Madeira. Due to its lesser ability to adapt to the conditions, there is far less sugar cane on the north coast, although it is grown in Faial and S. Vicente, in the municipality of Santana.



Distribution of sugar cane production by municipality in Madeira and location of the Mills (producers) of Madeira Rum