From Al-Andalus to the Americas (13th–17th Centuries)

Destruction and Construction of Societies

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CHAPTER 9

Commercial Crop or Plantation System? Sugar Cane Production from the Mediterranean to the Atlantic

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Introduction

Al-Muʿtamid, king and lord of Seville, lives in his Abbadid court surrounded by luxury. His gardens are full of exotic plants, tended by the most experienced botanists. His household abounds in the most sophisticated spices and perfumes. One day, his wife Iʿtimād sees common women kneading clay with their feet to make bricks. She wishes to do so as well, and tells her husband. He, in order to please her, brings large quantities of sugar, ginger and perfumes to the palace courtyard, so she can knead the perfumed mud with her feet.[1]

In this piece, the poet al-Tiğānī tries to describe his mentor's court in its full splendour, adorning the tale with the scent of the most prized spices and the exquisite sweetness of sugar, sign of the utmost refinement. Because that is what sugar is: refinement, sophistication and luxury. This is so in 11th century Seville as well as in the heart of Islam, Mecca, where the use of sugar in the holy months of *ramaḍān*, *raǧab* and *šaʿbān* almost reaches the category of art. Human or fruit-shaped sugar figurines are sold in the shops throughout the city, heaped in colourful piles over the shop counters, catching the eye like flowers and encouraging the traveller to spend his last few coins.[2]

Sugar cane came to join other substances already in use for the satisfaction of the old craving for sweeteners. In pre-Islamic times, this taste was satiated with products such as honey – always a favourite in the West – *manna* and fruit. In fact, we know sugar to have played a secondary role in antiquity in comparison with other sweeteners, despite possessing some superb features such as a strong sweet flavour, the absence of secondary tastes and good qualities as a preservative. Sugar's position among sweeteners is related to its

1 Henri Pérès, *Esplendor de al-Andalus. La poesía andaluza en árabe clásico en el siglo XI. Sus aspectos generales, sus principales temas y su valor documental* (Paris: 1937; Madrid: Hiperión, 1983), 328. Citations refer to the Hiperión edition.

2 Ibn Jubayr, *Ibn Jobair. Voyages*, ed. and trans. M. Gaudefroy-Demombynes (Paris: Paul Geuthner, 1949), 5, 141–142.

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nature as a luxury product, even in the Eastern regions where it originates. It is likely that such a consideration springs from the complexity of processing. Of course, in the West sugar is a cultural loan, and consumption thus acquires a social dimension.[3] It is not strictly related to the satisfaction of basic needs. It is common for developing societies to incorporate new features – by cultural loan – which either create new needs or cover old needs in new, exotic and, therefore, useful ways for status competition.

What we mean to stress with this is that sugar is both an unnecessary and a replaceable good. The needs satisfied with sugar are not a priority in those societies where it is used, including those societies that also produce it.

It is therefore logical to presume that sugar production must have been initiated for reasons unrelated to the satisfaction of basic needs. Thus sugar production must be considered a commercial venture from the outset, aimed at profiting from its commercialisation as a luxury and not at the satisfaction of primary needs. Other products such as raisins, dried figs and almonds, albeit mostly falling into the category of market crops – perhaps even more so than sugar – also had a place in the regular diet of the peasant populations involved in their cultivation and processing.[4] This was not the case with sugar. For this reason, the only explanation for its adoption by medieval Mediterranean societies lies in a secure commercialisation.

This crop and the industrial processing which it implies were very costly. We shall not linger here to discuss this matter, which we believe to be sufficiently well known, but we shall stress that the satisfaction of the biological needs of this tropical plant in Mediterranean environments demanded exclusive use of valuable irrigated land; this land would therefore stay outside peasant agricultural systems, based on irrigation and high productivity rates and on the combination of subsistence crops. It also required costly, exclusive infrastructure and was labour intensive during the processing of the crop into sugar. It was particularly costly, however, since it did not contribute to maintain the social balance of the peasant society involved in its cultivation. This high cost and the absence of a social profit equivalent to the effort involved in its cultivation

3 In Maxime Rodinson's definition. Maxime Rodinson, "Les influences de la civilisation musulmane sur la civilisation européenne médiévale dans les domaines de la consomation et de la distraction: L'alimentation," in *Convegno Internazionale. Oriente e Occidente nel Medioevo: filosofia e scienze* (Roma: Accademia Nazionale dei Lincei, 1971), 479–499.

4 Antonio Malpica, "Il traffico commerciale nel mondo mediterraneo occidentale alla fine del Medioevo: Il regno di Granada," in *Atti del Convegno Internazionale di Storia Militare. Aspetti ed attualità del potere marittimo in Mediterraneo nei secoli XII–XVI* (Roma: Ufficio storico della marina militare, 1999), 351–381, esp. 352–353.

leave commercial gain as the only explanation for the adoption of the crop in the first place. From this point of view, its nature as a market crop from the outset seems beyond doubt.

As we have already stressed, commercial profit lies behind the adoption of this crop by societies such as the Andalusian. This implies a well defined strategic decision, outlined outside peasant parameters and which will occupy a marginal position in the agricultural system, both regarding areas of cultivation and of labour allocation, including the tending of the crop and its subsequent processing. This seems to be the case for the earliest stages of sugar cane production in the Middle Ages as well as for later phases, when the position of sugar in European markets is well established.

Sugar in the Medieval Mediterranean Context

The strategy involved in sugar cane production in the Islamic Mediterranean, organised in many regards beyond the parameters and internal dynamics of peasant society, becomes self evident when observed from a number of different angles. There is no shortage of direct evidence pointing towards the involvement of the highest social strata in this activity. The Sicilian case is well known. Until the mid 13th century, sugar for consumption in Ifriqīya was not only cultivated but also processed in Sicily under the direct control of the Fatimid caliphs.[5]

Sugar production in Syria and Palestine – among the first sugar producing regions in the Mediterranean, where sugar cane has been attested as early as the Ummayyad caliphate although its final consolidation did not take place until around the 10th century – is connected with palace environments, where rudimentary sugar processing infrastructures for the satisfaction of the needs of the royal house have been found. Although details of sugar production in this region throughout the 11th century are difficult to ascertain, it seems at least clear that production must have had the support of the state and of a minority elite capable of investing large amounts of capital.[6] The Egyptian case

5 ʿAbd Allāh Abū Bakr, *Kitāb Rīyāḍ an-nufūs fī Ṭabaqāt ʿulamāʾ Qayrawān wa Ifriqīyah*, trans. Michele Amari, Biblioteca Arabo-Sicula. Raccolta di testi arabici che toccano la Geografia, la Storia, la Biografia e la Bibliografia della Sicilia (Torino-Roma: F.A. Brockhaus, 1880), 1, 294–324, esp. 324.

6 Mohamed Ouerfelli, *Le sucre. Production, commercialisation et usages dans la Méditerranée médiévale* (Leiden: Brill, 2008), 31–37.

also offers abundant examples of the involvement of the Fatimid caliphs, high-ranking officials, merchants and important landowners from an early stage.[7]

But this is not everything. In al-Andalus, several *taifa* governants also exhibited an interest in experimenting and learning ways to adapt the plant, ever present in the court's gardens; in rural areas, however, the new plant did not thrive to the same extent, and never shrugged off the label of exoticism with which it had arrived. It was present in al-Muʿtamid's (1069–91) Abbadid court garden, probably under the supervision of the Sevillian Abū l-Khayr, one of the most reputed Andalusian agronomists and author of one of the most detailed and accurate descriptions of the plant and of its maintenance, which he based on personal experience.[8] Far from being an exceptional case, this may have been the norm in the *taifas*, dinasties always on the lookout for elements with which to legitimise their recently acquired sovereignty, but also of new economic resources with which to guarantee their survival.[9] Their own nature gave these kingdoms an extraordinary dynamism and drove them towards novel economic practices and projects that even they termed as exotic. These were promoted by the sovereigns themselves – for example, in the *taifa* of Almería ruled by al-Muʿtaṣim. According to al-ʿUḏrī this included exotic crops such as several varieties of banana and sugar cane.[10]

The fact is that – due to the high esteem which commercial circles were already showing for sugar – this product offered excellent profit perspectives.

The careful selection of areas for the cultivation of this crop, which appears to respond to very specific criteria, is a clear indicator of the commercial orientation of sugar production from an early stage. Cultivation had to be carried out in easily accessible fields, equipped with the right infrastructures to ensure the efficient commercialisation of the produce, as abundantly shown by those areas which enjoyed an early commercial success.

This is the case, for example, of the Sūs region in Morocco, whence according to al-Bakrī (1028–94) sugar was already being exported to other parts of the Maghreb in the 11th century.[11] This region already produced good quality sugar, highly appreciated in commercial circles, since according to different

7 Ouerfelli, *Le sucre*, 73 and ff.

8 Abū l-Khayr, *Kitāb al-filāḥa. Tratado de agricultura*, ed. and trans. Julia M. Carabaza (Madrid: Agencia Española de Cooperación Internacional, 1991).

9 Félix Retamero, "La formalización del poder en las monedas de los *mulūk* de Denia (siglo V H./XI D.C.)," *Al-Qantara XXVII* (2006): 417–445.

10 Al-ʿUḏrī, *Tarsīʿ al-Ajbār*, trans. Manuel Sánchez, "La cora de Ilbīra en los siglos X y XI, según al-ʿUḏrī, (1003–1085)," *Cuadernos de Historia del Islam* 7 (1975–76): 5–82, esp. 45.

11 Al-Bakrī, *Kitāb al-masālik wa l-mamālik*, ed. and trans. Mac Guckin De Slane, *Description de l'Afrique Septentrionale* (Argel: A. Jourdan, 1911–13), 2, 305 of the trans.

authors it could be found ranging far and wide. According to Abū Hamid al-Andalusī, sugar produced in Sūs was exported worldwide, while Maqqarī highlights its quality.[12] Instances of the infrastructures necessary for the full realisation of profits, aimed at channelling the product into international commercial circuits, have been attested. For example, a sugar market in the nearby Marrakech.[13]

Earlier, in the 10th and 11th centuries, in the eastern Mediterranean region of the Levant, the main areas for sugar cane cultivation were close to the sea shore, around cities such as Tripoli, Beirut, Tyre, Sidon and Acre.[14] In the Nile Valley, an essential commercial route and a preferential region for sugar cane production, the crop concentrated around Fustat, Faiyum and Upper Egypt.[15]

The commercial orientation of sugar production in the Mediterranean from an early stage is therefore clear. This is even more evident, if possible, in the Latin orbit, where sugar was mostly adopted in a second phase of growth throughout the Mediterranean; Venetian Cyprus, Norman Sicily, Valencia and the Portuguese Algarve are particularly relevant and well known examples, which emerged alongside other regions still under Islamic rule but where the new economic logic was already becoming dominant.[16]

This was also the case of Nasri Granada, which gave a new boost to sugar production in response to the demands posed by the main commercial factors in the late medieval west. This activity, again fundamentally and inescapably backed by local powers, drifted even further away from the parameters

12 Abū Hamid al-Andalusī, *'Adjā'ib el-makhloukāt*, trans. E. Fagnan, *Extraits inédits relatifs au Maghreb* (*Géographie et Histoire*) (Argel: Ancienne Maison Bastide-Joudan, 1924), 1, 27–40, esp. 27. Al-Maqqarī, *Naf al- ṭīb*, trans. Pascual Gayangos, *The history of the Mohammedan dynasties in Spain; extracted from the Nafhu-t-Tib min Ghosni-l-andalusi-r-rattib wa Tárikh Lisánu-d-Dín Ibn-l-Khattib, by Ahmed Ibn Mohammed al-Makkarí, a native of Telemsán* (New York: Johnson Reprint, 1964), 1, 87. Gayangos attributes the work to Ibn Sa'īd, *Kitāb al-mušraq fī hulī l-mašriq*. The work is not preserved and very little is known about its author (p. 387, footnote 6).

13 Ibn 'Idārī al-Marrākušī, *Al-Bayān al-Mugrib fi Ijtiṣār Ajbār muluk al-Andalus wa al-Magrib*, trans. Ambrosio Huici, *Colección de Crónicas árabes de la Reconquista* (Tetuán: Editorial Marroquí, 1954), 2, 78.

14 Ouerfelli, *Le sucre*, 31–37.

15 Ouerfelli, *Le sucre*, 71 and ff.

16 In Cyprus sugar cane cultivation thrived especially under the promotion of the Venetian Cornaro family, which enthusiastically adopted this crop for strictly commercial reasons. Doris Stockly, "Commerce et rivalité a Chypre. Le transport du sucre par les Vénitiens dans les années 1440, d'après quelques documents génois," in *Oriente e Occidente tra Medioevo ed Età Moderna. Studi in onore di Geo Pistarino*, ed. Laura Balletto (Genova: Brigati, 1997), 1133–1144.

followed by the peasant society which lay at the socio-economic foundations of these regions.[17] The few known references to sugar production from 14th century Granada insist on this association between cultivation and commercial infrastructures for exportation, openly revealing the commercial orientation that lay behind sugar production. We shall not fully reproduce here the well known texts by Al-ʿUmarī, Ibn al-Khaṭīb and al-Qalqašandī which stand as a clear evidence of this for Nasrid Granada, but we shall once again highlight that this was no local phenomenon.[18]

This mercantile-feudal impulse, as it has been defined by Malpica with reference to well known cases such as that of Valencia, and mainly because of the new stimulus introduced by commercially based capital, would herald the golden age in the medieval history of sugar.[19] From as early as the 13th, but especially from the 14th century, sugar became a major commercial success, with positive effects on production areas, both Latin and Islamic, which were now able – through the mediation of these commercial companies – to sell their products in the main European markets.

Although we shall not examine this issue in depth, we must mention that the immediate consequence of all this was an absolute increase in production and, foremost, the beginning of a trend towards the diversification of available sugar qualities, particularly of lower qualities aimed at a wider spectrum of the population and at less restricted consumption patterns. This phenomenon seems to be closely related with some production areas such as Granada or Sicily, which find their niche in the European market in the context of the trend

17 See a recent overview of the successive productive models involved in the first stages of sugar production in Antonio Malpica, "La caña de azúcar y la producción azucarera desde el mundo mediterráneo a las islas atlánticas. Una interpretación de 'modelos,'" in *Azúcar. Los ingenios en la colonización canaria* (*1487–1525*), ed. Ana Viña, Mariano Gambín and M. Dolores Chinea (Tenerife: MHA, 2008), 27–40.

18 Tunisia: Al-ʿUmarī, *Masālik el abṣār fī mamālik al-amṣār*, ed. Maurice Gaudefroy-Demombynes (Paris: Paul Geuthner, 1927), 36–37. Morocco: Ibn al-Khatīb, *Mīʿyār al-ijtiyār fī ḍikr al-maʿāhid wa-l-diyār*, ed. and trans. Mohammed K. Chabana (Rabat, 1977), 54–55; Al-Qalqašandī, *Ṣubḥ al-aʿša fī kitābāt al-inšā*, trans. Luis Seco de Lucena (Valencia: Anubar, 1975), 25.

19 Malpica, "La caña de azúcar," 34. This incentive could materialise in very different ways, from the increase in demand, with the subsequent increase in tax collection – for example in Granada – to direct investment in new ventures for sugar production. This could result in the creation of fully private concerns, a common case for example in Cyprus, or in partnerships with the feudal lords. Adela Fábregas, *Producción y comercio de azúcar en el Mediterráneo medieval. El ejemplo del reino de Granada* (Granada: Universidad de Granada, 2000); Jaume Castillo, "Els feudals i la introducció de la canyamel a la Safor del segle XV," *Afers* 32 (1999): 101–122.

towards increased diversification. These regions would also produce sugar of higher quality – although by no means comparable with the best Eastern sugars – but would have no qualms in supplying the market with much lower quality varieties, which the market easily absorbed. Sugar thus started to reach beyond the luxury circuits with had hitherto restricted its consumption. This would lay the groundwork for the future great explosion of the sugar industry.

This substantial step forward in the history of sugar, the decisive commercial impulse followed by a moderate increase in production and consumption, was not to go any further. And it could not go any further. That is why the comparison between the sugar sector in the Mediterranean during the Middle Ages and the spectacular explosion in sugar production in America is simply absurd. All comparisons will naturally reach the conclusion that, after the end of the Middle Ages, traditional sugar varieties were wiped out from the international markets by Atlantic and American varieties. And the equally natural conclusion will follow that these traditional varieties succumbed to the crisis produced by the emergence of the new ones. But how can we effectively relate medieval markets, even after the mercantile expansion – or even revolution – with the world market system supporting the American stage of sugar production?

Nasrid Granada Sugar in the Late Medieval Context

The case of Granada, especially well known to us despite the still considerable gaps in our knowledge, should be of help in illustrating our doubts. We have mentioned several times that, according to coeval authors, during its golden age in the 14th and 15th centuries, the sugar produced in Granada could flood the European markets. What amounts are we actually referring to when we talk about "flooding"? Let us try to be as precise as possible. The few available pieces of hard evidence allude to very small quantities; ridiculously so when compared with the mercantile-minded amounts of barely a century later, let alone current production figures. Although we only have precise production figures for 5 years during the Nasrid period, they are fully reliable since they source from the agricultural society in charge of exporting sugar from Granada.[20] Furthermore, the data correspond to the peak period of sugar production in Nasrid Granada. The figures are shown in Table 9.1.

20 Though not all sugar was the property of this agricultural society, a significant part of it was, and even the proportion that was not had to go through the society's control systems. At any rate, we believe that the sugar consignments bought by the society for direct

TABLE 9.1 *Value and volume of sugar production in Nasrid Granada*

	Value	Weight in arrobas	Weight in kg (based on Genoese arroba = 7,9 kg)	Weight in kg (based on Andalusi arroba = 7,2 kg)
1435	70,000 *besantes*	3168	25027	22809
1436	190,000 *besantes*	3078	24316	22161
1438	100,000 *besantes*			
1451	21,000 pounds (126,000 *besantes*)	2810	22199	20232
1454	72,000 *besantes*	1900	15010	13680

These figures tally with what we know about medieval sugar consumption according to the account of the *infante* Don Enrique. Concerned about the threat of collapse posed to the European markets by the growth of Madeiran sugar production, he recommends in 1469 not to exceed production quotas, set on 10,000 *arrobas* per year, which the markets are deemed capable of absorbing.[21] Not respecting these quotas caused an overproduction crisis and the general collapse of prices on the island, despite these being but the first steps of Madeiran sugar production, a timid announcement of what we shall see later in the early 16th century.[22] Already Madeira is operating at a completely different level: while 130 vases of Sicilian sugar are sold in the Valencian market in 1496, no less that 3,000 are imported from Madeira, despite Valencia being a traditional outlet for Sicilian sugar.[23]

commercialisation are highly representative of total production figures. See Adela Fábregas, "Vías de acceso del azúcar del reino de Granada al mercado europeo: la Sociedad de los Frutos (siglos XIV–XV)," in *Actas do II Seminario Internacional de História do Açúcar. Rotas e Mercados* (Funchal: Regiâo Autónoma da Maderia, 2002), 22–52; Idem, "Azúcar e italianos en el reino nazarí de Granada. Del éxito comercial a la intervención económica." *Cuadernos del CEMYR,* 22 (2014): 133–154.

21 In this case, we should talk about Madeiran *arrobas*, equivalent to 12.852 Kg and 14.852 from 1502. José Azevedo, *A Madeira e a construção do mundo atlántico* (*séculos XV–XVIII*) (Funchal: Secretaria Regional de Turismo e Cultura-CEHA, 1995), although we have collected this information from Antonio M. Macías, "Canarias, 1480–1550. Azúcares y crecimiento económico," in *Rotas e mercados*, 157–191, esp. p. 164, note 27.

22 Alberto Vieira, "A Madeira e o mercado do Açúcar. Séculos XV–XVI," in *Rotas e mercados*, 55–89, esp. 69–73.

23 Vieira, "A Madeira," 57.

The Canarian case is even more spectacular. From the first decade of the 16th century (1507–8), that is, barely ten years after the conquest of the archipelago, the production of Tenerife alone is of 69,090 Castilian *arrobas* (11.5 kg). The case of Gran Canaria is nothing short of incredible, with a production of 400,000 *arrobas* in 1502.[24]

The earliest production figures for Hispaniola reflect a reality which is already utterly out of proportion with European levels. An efficient *ingenio* can process around 8,000 *arrobas* in white sugar only per year, and the total production can reach 24,000 *arrobas* per year. A well furnished *trapiche* (sugar mill), although never reaching the level of an *ingenio*, could process 10,000 *arrobas* of sugar per year. At the prime of the sugar sector on the island in the mid 16th century, Hispaniola could export every year over 100,000 *arrobas* of sugar to Seville alone.[25]

Considering these data, is it possible to argue for the existence of spaces for competition? In fact, we do not perceive a productive crisis in the Mediterranean in connection with the new American factor, or at least we believe that the changes introduced in Europe should not be presented in such terms. The disappearance of Nasrid sugar from the international markets was not caused by a productive drop, but by an increase in local and regional demands which are now capable of absorbing the whole production. The truth is that the sugar industry in Granada never ceased growing, and certainly not after the Castilian conquest in the late 15th century. It is, however, a perfect illustration of the idea that we wish to suggest here: that Granada, the Mediterranean world at large, and the emerging Atlantic sector need to be considered at completely different levels. The sugar producing areas in the Mediterranean carried the weight of the initial increase in sugar production in the middle ages; this involved the development of a productive strategy which proved essential for the promotion of sugar as a commercially viable commodity, without which evolution could not have been carried any further and which would also widen consumption patterns, the final condition for commercial success. But from this stage the newly created needs could not be satisfied with the existing productive structure; sugar demanded a new productive system which would be difficult to apply in the Mediterranean.

24 Macías, "Canarias," 180, 182.

25 Genaro Rodríguez, "La economía azucarera de la Española en el siglo XVI," in *História e tecnologia do açúcar*, ed. Antonio Vieira (Funchal: Centro de Estudos de História do Atlántico, 2000), 117–160, esp. 143–145.

The Limited Expansion of Cultivated Areas

The difficulty of applying the new productive system is well understood and has been analysed by us elsewhere. At any rate, we believe that it is a topic worthy of further analysis, since many key points and details remain unknown. This will be our task henceforth. We will thus compare the main features of sugar production in Mediterranean regions with those which inherited, continued and overtook their productive model. A comprehensive insight into the situation and development in the sugar islands will be essential for a good understanding of the Mediterranean history of sugar. These new productive contexts, albeit clearly indebted to the Mediterranean experience, will exhibit their own features, which always point toward the supersession of the previous model and the constant search for new productive strategies. This has led some authors to label them as experimental areas.[26]

The first necessary step is to increase the areas dedicated to sugar cane production. The Mediterranean world could hardly assume such a reorganisation of the agricultural space, let alone do it at the required pace.

At this stage I must go into some factors already mentioned elsewhere (see the papers by Kirchner, and by Retamero and Martínez-Enamorado in this volume). Since they play a major role in my following arguments, however, I have no option but to make them explicit. In our best known example, Granada, the productive regime – a model of rural economy based on irrigation and with strong social implications – imposed important limitations and sugar cane could hardly do anything more than survive. Agrarian systems were closely determined by water management and intensive labour. The amount of land under cultivation was determined by the amount of water available from a river or spring. Once outlined, therefore, agricultural systems were difficult to alter, and their expansion involved significant technical challenges. On the other hand, the design of the perimeter of a given irrigation area responded to the needs of the community which exploited it. These areas were therefore assigned to a specific peasant community made up of small tenants and focused on subsistence agriculture – thus excluding monoculture – with very well defined tasks, multiple crops aimed at self-sufficiency and often a disperse property regime.

This kind of irrigation agriculture could assume the cultivation of sugar cane to a certain extent, which would otherwise find no niche in Mediterranean landscapes. In fact, sugar cane added commercial value to the crops, to

26 Alberto Vieira, "A Madeira, a expansão e história da tecnología do açúcar," in *História e Tecnologia do açúcar*, 7–27, esp. 8.

the point of becoming a bonus for exchange. The drawback is that the system did not allow for any concentration of production, as correctly pointed out by Antonio Malpica.[27] This agricultural regime opens up to the market as a consequence of high productivity and the specialised nature of production, but exchange is never allowed to become the basis of the economic system.[28] Additionally, peasant social dynamics would ensure that no substantial modifications were introduced to labour mechanisms. All these circumstances explain the limited importance given to sugar cane from the beginning. Therefore the restrictions to the cultivation of sugar cane – the development of which requires that certain specific conditions were met – in al-Andalus were not only responding to landscape features. The description of some of the areas where sugar cane was in cultivation will help us to better understand this issue.

Al-Nuwayrī recommended in the 13th century the use of flood basins in Egypt for sugar cane, while Ibn Ḥawqal referred to the surroundings of Palermo as an intensively cultivated agricultural area, crisscrossed by middle-sized fluvial courses, large enough to feed and power watermills. The lands near the shoreline are described as territory full of water plants also cultivated with sugar cane.[29]

The description of these small deltas could perfectly match that of some of our well known Andalusian sugar cane producing areas. Indeed, from the earliest cultivation of sugar cane in al-Andalus, marshland became a preferential location. The Sevillian marshes, where according to al-Rāzī the plains are covered by water even during the summer, were already described in the 10th century as a rich landscape, good for crops, game, pasture and sugar cane.[30]

27 Malpica, "La caña de azúcar," 36.

28 Andrew M. Watson, "A case of non-diffusion: The Non-adoption by muslim Spain of the open-field system of Christian Europe. Causes and Consequences," in *Relazioni economiche tra Europa e mondo islámico secc. XIII–XVIII. Atti della Trentottesima Settimana di Studi, 1–5 maggio 2006*, ed. Simoneta Cavaciocchi (Firenze: Fondazione Istituto Internazionale di studi economici "F. Datini," 2007), 241–265.

29 On Egypt, Mounira Chapoutot-Remadi, "L'agriculture dans l'empire mamluk au Moyen-Age d'après al-Nuwayrī," *Les cahiers de Tunisie* 85–86 (1974): 23–45, esp. 25. On Palermo, Ibn Ḥawqal, *Kitāb al-masālik*, trans. Michele Amari, Biblioteca Arabo-Sicula. Raccolta di testi arabici che toscano la Geografia, la Storia, la Biografia e la Bibliografia Della Sicilia (Torino and Roma: Loescher, 1880–1), 11–27.

30 Al-Rāzī, *Ajbār mulūk al-andalus*, multilingual edition by Diego Catalán and María S. de Andrés, *Crónica del moro Rasis. Versión del ajbār mulūk al-andalus de Aḥmad ibn Muḥammad ibn Mūsà al-Rāzī, 889–955; romanzada para el rey don Dionís de Portugal hacia 1300 por Mahomad, alarife y Gil Pérez, clérigo de don Perianes Porçel* (Madrid: Gredos, 1974), 94.

And shortly afterwards by al-ʿUḏrī in much more detail, describing the area known as al-Marayn as a place rich in water, with very fertile pastures that did not dry even during the summer. These conditions are extremely favourable to stockbreeding, which benefits from abundant pastures, and to certain crops such as sugar cane, which was particularly abundant in coastal areas.[31] Also, the delta of the River Guadalfeo, on Granada's coast, one of the most successful and long lasting sugar cane cultivation areas in the Iberian Peninsula, is subject to seasonal floods resulting in marshland. Al-Rāzī also highlighted the area's wealth of trees, cumin and sugar cane.[32]

This recommendation to choose humid and flood areas for the cultivation of sugar cane obviously responds to ecological criteria, but it is also true that these areas are rarely part, at least to a significant degree, of agricultural systems, being marginal areas around river basins. Their soil subtract is often sandy, of low agricultural quality and therefore unfit for traditional crops. In short, they are marginal areas with regard to agricultural irrigation spaces. Their main feature is permanent access to abundant water, which is essential for the survival and quality of sugar cane, covering the water needs of a demanding plant without interfering with the irrigated areas which play such a central role in the Islamic agricultural model.[33]

Sugar cane remains today, and certainly was in al-Andalus, which is the best known area for its production in the Mediterranean, a marginal crop awkwardly related to traditional peasant agricultural systems. It was always a labour intensive crop with a clearly secondary role, as reflected in the size and location of the fields dedicated to it. It leapt from the palatine gardens to the fields, but certainly not to occupy a position of privilege. In a few cases, sugar cane was cultivated in suburban areas in which new dynamics had begun to displace traditional peasant models.[34] It was also cultivated in lands which were the property of the Nasrid sultan, for example in the Vega de Salobreña, irrigated by the River Guadalfeo. These are the only sugar cane producing areas the ownership of

31 Al-ʿUḏrī, *Tarsīʿ al-Ajbār*, trans. Manuel Sánchez, *Fragmentos geográfico-históricos referentes a las coras de Elvira y Sevilla en la obra de Ahmad b. ʿUmar al ʿUḏrī (1003–1085). Estudio preliminar, traducción y notas*" (unpublished dissertation, Universidad de Granada, 1969), 118. A later translation was published in Rafael Valencia, "La cora de Sevilla en el Tarsīʿ al-Ajbār de Ahmad b. ʿUmar al ʿUḏrī,'" *Andalucía Islámica* IV–V (1983–86): 107–143, esp. 117.

32 Al-Rāzī, *Ajbār mulūk al-andalus*, 28.

33 Miquel Barceló, "El diseño de espacios irrigados en al-Andalus: un enunciado de principios generales," in *Actas del I Coloquio de Historia y medio físico. El agua en zonas áridas. Arqueología e historia* (Almería: Instituto de Estudios Almerienses, 1989), 1, XV–XL.

34 Antonio Malpica, *Turillas, alquería del alfoz sexitano.* (*Edición del Apeo de Turillas de 1505*) (Granada: Universidad de Granada-Diputación Provincial de Granada, 1984).

which are known, and the most illustrative example of mass production in the history of Andalusian sugar. Until very recently, the only known case was that recorded by Ibn al-Khaṭīb, but more examples have since come to light in the nearby city of Almuñécar.[35] Our knowledge of the lands belonging to the king or to the royal house on the coast of Granada increases day by day, and it is presumed that many of these properties were cultivated with sugar cane.[36]

It seems increasingly likely that the Nasri state itself was actively involved in this sort of commercially focused agricultural venture. Often, lease terms would be agreed with farmers for the exploitation of these lands under strict conditions and the compulsory and exclusive cultivation of sugar cane.[37] The highest levels of society would therefore be involved in the exploitation of sugar cane through the lease of lands for its production.[38] When the evolution of the sector imposed an increase in the area under sugar cane cultivation, new spaces had to be found in alternative locations in order not do dislocate the dominant agrarian structure and the social building attached to it. This expansion thus often occupied suburban areas where the peasant substratum had already been superseded.[39]

35 Ibn al-Khaṭīb, *Mi'yār al-ijtiyār*. 120–121. Antonio Malpica, "Las 'tierras del rey' y las ordenanzas de la acequia del río Verde en Almuñécar," in *Castilla y el mundo feudal. Homenaje al profesor Julio Valdeón*, ed. Isabel del Val and Pascual Martínez (Valladolid: Junta de Castilla y León-Universidad de Valladolid, 2009), 2, 167–178.

36 José E. López de Coca, "Granada y la ruta de Poniente: el tráfico de frutos secos (siglos XIV y XV)," in *Navegación marítima del Mediterráneo al Atlántico*, ed. Antonio Malpica (Granada: Universidad de Granada, 2001), 149–177, esp. 175–177; Antonio Malpica, "Sobre el mundo agrícola nazarí. La alquería de Escóznar en el siglo XIV," in *Poder y sociedad en la Baja Edad Media hispánica. Estudios en homenaje al profesor Luis Vicente Díaz Martín*, ed. Carlos Reglero (Valladolid: Universidad de Valladolid, 2002), 1007–1024. Emilio Molina, "El Mustajlas Andalusí (I) (s. VIII–XI)," *Revista del Centro de Estudios Históricos de Granada y su Reino* 14–14 (1999–2000): 99–189; Emilio Molina, "Más sobre el Mustajlas nazari," in *Estudios árabes dedicados D. Luis Seco de Lucena* (*en el XXV aniversario de su muerte*) (Granada: Universidad de Granada, 1999), 107–118.

37 The production of sugar cane was regulated by the so called *musāqā* exploitation regime, or "irrigation contract." This is a lease of the exploitation rights of a plot of land planted with fruit trees and/or stem plants (cereal, sugar cane, etc. with the exclusion of vegetables) in exchange for a share (half, third, fifth, etc.) of the crop. Vincent Lagardère, "Les contrats de culture de la canne à sucre à Almuñécar et Salobreña aux XIII et XIV siècles," in *Paisajes del azúcar. Actas del V Seminario Internacional sobre la caña de azúcar*, ed. Antonio Malpica (Granada: Diputación Provincial de Granada, 1995), 69–79.

38 Lagardère, "Les contrats," 69–79.

39 Malpica, *Turillas, alquería del alfoz sexitano*.

After the Castilian conquest, the new lords proved willing to assume the necessary investments for the adaptation of production to the new developments occurring in the sector, and efforts were made to impose new regimes, closer to monoculture, more competitive with regard to the Atlantic-American phenomenon, but success was nevertheless limited.[40] The scale of production realised by the new plantation system was impossible to reach.

These changes did, however, involve substantial alterations to the region's traditional agricultural regime. This was the source of conflicts such as that between Juan de Ulloa and Marco Squarzafigo and Miguel el Hanini, owners of an *ingenio* (sugar refinery) in Lojuela, Almuñécar, who argued about the need to expand the sugar cane production areas by occupying cereal fields. This would involve the rearrangement of the hydraulic system throughout the whole basin and a reorganisation of the labour structure in order to cover the new needs.[41] A similar problem is encountered in Algeciras (present province of Cádiz) where Francisco Piñar's wish to introduce sugar cane in Río de la Miel against the wholehearted opposition of the locals ended with the opening of a lawsuit in 1516.[42]

Indeed, not even the Madeiran case shows particularly revolutionary features regarding the property structure when compared with the Mediterranean systems, at least at first sight. In fact, and despite these outward similarities, the reality of both examples is completely different.

Madeira would be the destination of important population contingents from Portugal, as a part of the colonisation policy promoted by the Portuguese crown. The agricultural policy was based on the creation of small rural exploitations managed according to traditional agrarian regimes. By 1520 the exploitation of sugar cane was based around small properties, at least in part of the island. The area around Funchal would account for 33% of total sugar cane production, with 27% around Calheta and 20% around both Ribeira Brava and Ponta Delgada.[43] However, the social reality suggested by these farms, whose owners are known, was very different from the picture offered by traditional peasant systems. The evidence obviously records small and medium farmers, but also cobblers, barbers, carpenters, merchants, civil servants, officials, etc.

40 This was achieved by amalgamating previously uncultivated areas and the mini-plots which stood as the basis of the previous Andalusian system.

41 Malpica, "Las 'tierras del rey'."

42 Antonio Malpica, "Medio físico y territorio: el ejemplo de la caña de azúcar a finales de la Edad Media," in *Paisajes del azúcar*, 11–40, esp. 34–36.

43 José Pereira da Costa and Fernando Jasmins-Pereira, *Livros de contas da ilha da Madeira (1504–1537). Registo da produção de açúcar*, (Funchal: Regiâo Autónoma da Madeira, 1989).

who see agriculture as secondary occupation with which to supplement their income.[44] On the other hand, the trend over time points towards the concentration of property in a few privileged hands, which did not amount to more than 1% of the total population.[45]

Regarding total area under sugar cane cultivation, the situation also changes substantially over time, and between 1450 and 1506 sugar cane becomes the predominant crop on the island.[46] Sugar cane becomes therefore a priority crop from a very early stage, and even though production largely remains in the hands of small farmers, these soon focus a significant part of their effort to the production of sugar cane.

In the Canaries the progression is even easier to trace. Land allotment for new settlers responded mainly to merits during the conquest, and therefore some members of the higher orders soon received large properties. Additionally, the shortage of water resources in the Canaries in comparison to Madeira made the allocation of rights over water a priority even with regard to the allotment of land itself.[47] These lords were given preference in the distribution of the best soils around the river basins, where irrigation systems can be easily arranged, to promote the development of highly productive agricultural environments. Sugar cane held a foremost position in these systems from the beginning.[48] These lords would dominate most of the islands' sugar cane production, not only because they were allotted the best available lands for this sort of crop, but also because the exploitation of sugar required of an initial capital investment for the construction of the *ingenios* – essential for the crop's profitability – which only they could afford. The minimum extension of land granted to anyone willing to cultivate sugar cane was of thirty *fanegas*.[49] Francisco Palomar, Genoese merchant residing in Valencia, bought in 1494 from Alonso de Lugo – governor in Tenerife – lands and a sugar *ingenio* in Agaete,

44 Virginia Rau and Jorge de Macedo, *O açúcar na Madeira nos fins do século XV: problemas de produçáo e comércio*, (Funchal: Junta Geral do Distrito Autónomo do Funchal, 1962), 22.

45 Alberto Vieira, "Sugar islands. The sugar economy of Madeira and Canaries, 1450–1650," in *Tropical Babylons. Sugar and the making of the Atlantic world, 1450–1680*, ed. Stuart B. Schwartz (Chapel Hill: University of North Carolina Press, 2004), 42–84, esp. 45.

46 Vieira, "Sugar islands," 47.

47 Thomas Glick, *Los antecedentes en el Viejo Mundo del sistema de irrigación de San Antonio, Texas* (Granada: Universidad de Granada, 2010).

48 Macías, "Canarias," 182.

49 Eduardo Aznar and Ana Viña, "El azúcar en Canarias," in (*1450–1550*). *Actas del I Seminario Internacional* (Motril: Casa de la Palma, 1989), 173–188, esp. 178. Manuel Lobo, "El ingenio en Canarias," in *História e tecnologia do açúcar*, 105–115. Macías, "Canarias," 157–191.

including 90 *fanegas* of land, three buildings (*ingenio*, boiler room and draining house) and a nearby bread mill.[50]

In this way, although land was initially distributed to give priority to small exploitation units, Madeira and especially the Canaries soon witnessed a radical change in the property distribution of lands under sugar cane cultivation. The trend was to develop early prototypes of the plantation system, later to be fully realised in America, the key feature of which was monoculture. The predominance of extensive sugar cane production in Gran Canaria – made sustainable by the economic structure promoted by the Castilian crown in the archipelago, in which the economies of the different islands complemented one another –[51] was to become characteristic of the Atlantic islands and was the key for the qualitative leap involved in the full incorporation of sugar cane to the mechanisms of a pre-capitalist market economy, and the subsequent abandonment of traditional productive regimes, the external appearances of which were still, however, preserved. The occupation of the best lands by a dominant crop and the increasing size of the properties so engaged stand as signs of a hitherto unrealised flexibility in agricultural systems.

Changes in the Processing Facilities

The second condition for the adaptation of sugar processing to the new challenges posed by the international market is connected with processing infrastructures: *aduanas*, *trapiches* and *ingenios*. In this regard, developments in America were to introduce a completely new situation. Let us briefly consider the nature of an early sugar *ingenio* in America. The large amounts of sugar cane to be processed demanded optimised procedures, and strict operational guidelines for the synchronisation and coordination of all operations involved were imposed. This explains the inextricable relationship created between sugar cane plantations and sugar processing plants – always located side by side – the coordination of which can only be guaranteed by a single management. This proximity also means that both units were operated by the same work force, the control of which became a priority, explaining the resort to slave labour, which we shall cover below.

50 Archivo de la real Chancillería de Granada, cab. 512, leg. 2476, pieza 7; Archivo General de Simancas, RGS, 1496–II, fol 1.

51 Manuel Lobo, "La navegación entre las Islas Canarias en la Edad Moderna," in *Islas y sistemas de navegación durante las edades media y moderna*, ed. Adela Fábregas (Granada: Alhulia, 2010), 91–115.

The evidence available for the sort of *aduana* in operation during the Nasrid period sharply contrasts with this picture, but is perfectly consistent with what we know about their productive scale. While they reflect the importance of sugar cane cultivation in the region, they also lack the kind of structure or organisation capable of coping with a large volume of production. These were small structures for the processing of discrete production volumes which sometimes hardly extended beyond the domestic scale.[52] As we have outlined above, sugar cane – and other market crops – played a secondary role in the predominant agricultural system, in spite of their commercial profitability. The humble processing structures, therefore, faithfully reflect the limited volume of production.

We know, for example, that because of their small size, *trapiches* and *aduanas* were often called "houses;" the written descriptions locate them at the centre of settlements, and say that they were equipped with animal drawn mills. The Faqih Basti's property in Motril (Granada) is said to have had two grinding stones.[53] Another in Lojuela (Almuñécar, Granada), owned by Juan Castellanos, had only one boiler to boil and purge the juice. This made boiling potentially problematic, and for this reason Luis Fernández requested, as late as 1522, a second boiler as a condition of taking up the position of master boiler, purger and whitener.[54]

Material remains, most commonly dating to the Castilian period, confirm these impressions. In 2005 Antonio Malpica published the earliest remains of the only sugar aduana known to date on the coast of Granada. The structure, located within the precinct of the Castillo de San Miguel (Almuñécar), dates to the early 16th century. It is relatively small in size, and its mode of operation is still largely unknown, due to the partial nature of the excavations.[55]

The evidence also points towards there being a relatively small number of plants during the Nasrid period. To date, later Castilian documents have helped to identify four sugar *aduanas* in the Guadalfeo-Río Verde area, without doubt the most important region of Nasrid sugar production. The expansion of sugar cane production immediately after the Castilian conquest was accompanied

52 Antonio Malpica and Adela Fábregas, "La producción de azúcar en ámbito doméstico en el reino de Granada," in *O Acúcar e o Quotidiano. Actas do III Seminario Internacional de História do Açúcar* (Funchal: Centro de Estudos de História do Atlántico, 2004), 29–49.

53 Archivo Histórico Nacional, Diversos (Títulos y Familias), leg. 1794.

54 Archivo de Protocolos Notariales de Granada, Francisco Muñoz, fols. 586r–587r.

55 Antonio Malpica, "Aportaciones de la Arqueología a la Historia del Azúcar: el caso de la costa de Granada (Motril y Almuñécar)," in *Preços, medidas e fiscalidade. Actas do IV Seminario Internacional de História do Açúcar.* (Funchal: Centro de Estudos de História do Açúcar, 2006), 385–400.

by an equivalent increase in the number of sugar processing plants. Thus by the late 16th century the number of sugar processing concerns located between Salobreña (with three plants, two within the town itself and another one in the *alquería* of Lobres) and Motril (up to seven have been identified beyond doubt) had grown to 12, which is a considerable number for what is a relatively small area. This is indicative of an enlarged production and the inability of existing structures to cope with it, although we must not believe this increase to be of a spectacular kind. In fact, the new *aduanas* do not seem to incorporate significant structural changes. For example, the illustrative case of the *aduana* in Lojuela (Almuñécar) is known to have been operating with a single grinding stone as late as 1521.[56] In another example, one of the *aduanas* in Motril still had such limited capacity in 1553 for the reception and grinding of sugar cane and for the storage of unused moulds, that its owner complained about the lack of space to carry out even the necessary daily tasks of grinding.[57]

This, however, does not mean that processing facilities were readily affordable for small, family based exploitations, mostly enjoyed under a regime of tenancy for absentee landlords. Both the old and the new owners belonged to the highest levels of the social order. Nevertheless, processing plants remained limited in size and productivity, justifying the lack of significant investment. In view of their modest nature, the new lords would instead try to increase profits by cornering the existing framework of production, and so gearing the second re-structuring of Granada's productive architecture, immediately after the Castilian conquest.[58] On the other hand, the last stage of refining can take place outside the *aduana*, even in domestic environments.[59] This is the third major difference with the American model, which is characterised by the strict organisation and rationalisation of production necessary for the processing of vast quantities of sugar cane.

We know, however, of other *ingenios* which were far better prepared for the new production regimes. The sugar plant of La Palma, in Motril, was already a much more complicated business, a more substantial architectural complex in

56 Archivo de Protocolos Notariales de Granada, Francisco Muñoz, fols. 31r–32r.

57 "domes [are] so low and small that they are not sufficient to grind the sugar cane arriving every day." Archivo de la Alhambra, Leg. 167, pieza 18, fol. 71r.

58 Archivo Municipal de Vélez-Málaga, IV–4. Edited in José E. López de Coca, "Nuevo episodio en la historia del azúcar de caña. Las ordenanzas de Almuñécar (siglos XV–XVI)," in *En la España Medieval. La ciudad Hispánica* (*siglos XIII–XVI* 10 (1987): 459–488, re-edited in López de Coca, *El reino de Granada en la época de los reyes Católicos. Repoblación, comercio, frontera* (Granada: Universidad de Granada, 1989), 1, 205–239.

59 Juan Martínez, "Notas sobre el refinado del azúcar de caña entre los moriscos granadinos. Estudio léxico," *Revista de Dialectología y Tradiciones Populares* 20 (1964): 271–288; Malpica and Fábregas, "La producción de azúcar."

which the entire process could be carried out.[60] It had a spectacular pressing room, including at least four large beam presses, a milling room, not preserved, a boiling room, in the basement of the main building, and detached buildings for purging and refining. The most significant feature, however, is the rationalisation and organisation of space according to the working procedure, which allows for the process to be carried out uninterrupted. Nevertheless, although the building is dated to the late 16th or early 17th centuries, some innovations such as the hammer press, fully adopted by this stage in other sugar producing latitudes and necessary for the maximisation of results in terms of time and production, were still to be incorporated.

In Madeira, domestic environments also seem to play an important role in the processing of sugar during the early stages. There is a considerable presence of hand presses (*alçapremas*) along with more substantial structures. The latter did not normally belong to those in possession of the sugar cane fields, and they were not necessarily located near to said fields.[61]

In Canarias the situation is substantially different from the beginning. The colonisation policies aimed at making the island economically viable from the earliest possible moment encouraged land allotments in which sugar cane field and *ingenio* could grow side by side. As we have mentioned above, from the late 15th century the best lands were reserved for those willing to commit themselves to the construction of an *ingenio*, necessarily involving a substantial scale of production. The sector is therefore cornered by the Canary "sacarocracy."[62] This experience confirmed that the optimisation and maximisation of production demanded a neat rationalisation of all steps involved in sugar production, from the agricultural phases to the processing stages.

This does not completely eliminate the small property, and multiple sugar cane fields with an extension of just over 2 hectares existed. The processing of their crops was carried out in external *ingenios*. Unfortunately, to date the only evidence available about the larger *ingenios*, capable of processing between 4,000 and 5,000 *arrobas* per year, comes from the written record.[63] For this reason, we still lack detailed accounts of their internal structure and organisation.

60 Antonio Malpica, "Arqueología y azúcar. Estudio de un conjunto preindustrial azucarero en el Reino de Granada: La Palma (Motril)," in *La caña de azúcar en el Mediterráneo. Actas del II Seminario Internacional sobre la caña de azúcar* (Sevilla: Junta de Andalucía, 1991), 123–153.

61 Alberto Vieira, "O açúcar na Madeira: produção e comércio nos séculos XV a XVII," in *Producción y comercio del azúcar de caña en época preindustrial. Actas del III Seminario Internacional sobre la caña de azúcar* (Granada: Diputación Provincial de Granada, 1993), 29–70, esp. 36.

62 Macías, "Canarias."

63 Macías, "Canarias," 45.

It is hoped that archaeological studies such as the one carried out in the Canarian *ingenio* of Agaete, dating to the early 16th century, will help to clarify the matter.

On the other hand, we must not believe that the situation that we have portrayed as characteristic in Granada reflects the whole Mediterranean picture of sugar production during the medieval period, being merely a result of the discrete volume of sugar cane to be processed. In this sense, there is clear evidence of substantial, and industrially organised, sugar processing plants in the Mediterranean from the 13th century, for example the fully equipped sugar cane processing factory (called *maʿsir*) described by the Egyptian Al-Nuwayrī.[64] Other sugar *ingenios* which have been subject to archaeological enquiry, for example in Cyprus and Palestine, show a compact and precisely designed layout.[65]

New Productive Regime and Labour

The last determining factor is far more significant, to the point of being considered by many the real drive behind the ultimate leap forward in sugar production: the massive use of slave labour. Slave labour and the strict organisation of working processes thus form a close dichotomy at the foundations of the new productive regime. We have thought best not to go into detail on how sugar cane is processed. It is important to stress, however, that it involves intensive and highly specialised procedures. For this reason, highly qualified technicians, in charge of such delicate stages as boiling and purging, worked alongside less qualified workers.[66] This was so for all stages involved in the process, from those requiring a careful touch to those demanding expediency.

64 It was divided into several rooms with different functions: the *dār al-qaṣab*, *bayt al-nuab*, identified as "washing room," rooms for grinding, equipped with grinding stones (*ḥaǧar*) and water-powered gears (*dawlā*, pl. *dawālīb*), the boiling room (*maṭbaj*), the fusion room (*bayt al-ṣabb*) and the refining room (*bayt al-dafn*). Chapoutot-Remadi, "L'agriculture," 34.

65 Marie-Louise Von Wartburg and Franz G. Maier, "Excavations at Kouklia (Palaepaphos). 15th Preliminary Report: Seasons 1987 and 1988," *Archäelogischer Anzaiger* (1988): 177–188; M. Louise Von Wartburg, "Design and tehcnology of medieval refineries of the sugar cane in Cyprus. A case of study in industrial archaeology," in *Paisajes del azúcar*, 81–116.

66 These specialists are already recorded in detail as early as the 8th century, alongside others such as feelers – who used their touch to decide when the canes were ripe – cutters, peelers, pilers, bearers, choppers, grinders and moulders. Jean Sauvaget, "Sur un papyrus arabe de la Bibliothèque Egyptienne," *Annales de l'Institut d'Études Orientales* VII (1948): 29–38.

The history of sugar is conditioned by the need for a numerous and exclusive work force, at least for the more delicate stages. In any case, the new dimension that sugar acquired during the Atlantic and American stage only became a full reality after production volumes soared, which did not occur until the old agricultural regimes had been superseded. As is well known, massive slavery was absent from late medieval agriculture. The tasks involved in sugar cane production, therefore, fell mainly on local peasants, despite some views which see the Mediterranean stage as the first chapter in the dichotomy between sugar and slavery, an idea which has now been discarded.[67] Slavery was absent from Cyprus, where the system rested on peasants exploiting sugar cane fields under lease and on the imposition of *corveés* on certain local groups (*Parici*, *Paroikoi* and *Perperiarii*) and also from Valencia where, despite the fact that sugar cane production stayed from the beginning outside the margins of the traditional peasant regimes, the agricultural tasks involved were performed by the local peasants, encouraged or coerced into this in a variety of ways.[68] Slaves, at least in any significant numbers, also seem to be absent from processing plants.[69]

67 These approaches point to the Abbadid Zanŷ and, of course, Cyprus, the strongest case for the supporters of this theory. Alexandre Popovic, *La révolte des esclaves en Iraq au IIIe/IXe siècle* (Paris: P. Geuthner, 1976), 64–65. Jean Richard, "Une economie coloniale? Chypre et ses Ressources Agricoles au Moyen Age," *Bizantinische Forschungen* 5 (1977): 331–352. Sidney M. Greenfield, "Cyprus and the beginnings of modern sugar cane plantations and plantation slavery," in *La caña de azúcar en el Mediterráneo*, 23–42, esp. 37.

68 Studies on slavery in Valencia do not mention the involvement of slave labour in sugar production, at least in significant quantities. Debra Blumenthal, *Enemies and Familiars: Slavery and Mastery in Fifteenth-Century Valencia* (Ithaca and London: Cornell University Press, 2009). On the other hand, Luis P. Martínez clearly establishes that "The production of sugar in Valencia neither rests on slave labour nor in feudal corveés, because the work of the local peasants, instead of being forced, was paid." Luis P. Martínez, "Feudalisme, capital mercantil i desenvolupament agrari a la Valencia del segle XV. El plet de la canyamel," *Afers* 32 (1999): 123–149. Equally, Francisco J. Marzal, *La esclavitud en Valencia durante la Baja Edad Media* (*1375–1425*) (Valencia: Universitat de València, 2006), p. 789, note 223, supports this idea, given the lack of contrary evidence. The suspicious case involving the purchase of 13 slaves from Almería by a group of partners which include Francesc Siurana, also a partner in a sugar-producing company, is hardly relevant. However, the possibility of slaves being occasionally employed in sugar production should not be discarded. Jacqueline Guiral-Hadziiossif, "Diffusion et production de la canne à sucre (XIII–XVIe siècles)," *Anuario de Estudios Medievales* 24 (1994): 225–245; Pau Viciano, "Capital mercantil i drets feudals en la difusió de la canya de sucre al País Valencià. La sensoria d'Oliva a l'inici del segle XV," *Afers* 32 (1999): 151–166.

69 According to the data available for the *trapiches* located in Gandia and the Ràfol de Valldigna for the years 1434 and 1554 respectively. Ferran Garcia-Oliver, "Les companyies del trapig," *Afers* 32 (1999): 167–194.

Meanwhile, the intervention of the grand mercantile and financial capital had boosted the re-emergence of the Sicilian production in the 15th century.[70] Although the sector showed important innovations with respect to the typical Mediterranean regime, it seems not to have made use of slave labour.[71] Work in Sicily was carried out by small peasants exploiting sugar cane fields under lease and by small landowners selling their crops, sometimes in advance. Processing plants would be manned by hired hands from nearby communities.[72]

In Morocco, sugar cane cultivation also rested on peasant labour. Once again, the communities located around productive centres carried the weight of sugar production.[73] In fact, regarding the province of Sūs, most work in sugar cane producing areas seems to have been in the hands of the Maṣmūda Berbers.[74]

In Granada, ownership of sugar cane fields was always outside traditional peasant groups, but the evidence does not support direct exploitation by these landowners nor, most especially, the employment of slave labour. Exploitation would be carried out by small tenant farmers who were probably also hired for processing the canes. Although hired labour seems not to be limited to the most specialised tasks involved in the process, these were indeed undertaken by itinerant highly skilled hired technicians operating in the area.

Even after American sugar plantations had demonstrated the profitability of slave labour, in Granada the harder and most intensive tasks involved in the process, such as planting, sowing or grinding, were still carried out by hired *Moriscos*.[75] We must not forget that in Castile, and consequently in Granada, slave labour still had a fundamentally urban nature.[76] In fact, some attempts to implement the slave-based formula in Castile, for example in Algeciras, were strongly opposed by the local population.[77] Local communities confronted

70 Henry Bresc, *Un monde méditerranéen. Économie et societé en Sicile, 1300–1450,* (Roma: École Française de Rome, 1986), 248.

71 Henry Bresc, "La canne à sucre dans la Sicile médiéval," in *La caña de azúcar en el Mediterráneo*, 117–171, and Antonino Morreale, "'Stigli,' 'machine' e 'mastrìe' nell'industria siciliana delo zucchero (secc. XV–XVII)," in *História e tecnologia do açúcar*, 29–58.

72 Bresc, "La canne à sucre," 48–49.

73 Luis del Mármol Carvajal, *L'Afrique de Marmol*, trans. Nicolas Perrot (Paris: Thomas Jolly, 1667), vol. II, book 3, Chap. XXIII, 31–32.

74 Mármol, *L'Afrique de Marmol*, vol. II, book 3, Chap. XX, pp. 28–29.

75 López de Coca, "Nuevo episodio."

76 Raúl González, *La esclavitud en Málaga a fines de la Edad Media* (Jaén: Universidad de Jaén, 2006); Alfonso Franco, *La esclavitud en Andalucía, 1450–1550* (Granada: Universidad de Granada, 1992).

77 Archivo de la real Chancillería de Granada, cab. 503, leg. 558, pieza 3.

these efforts to adapt traditional systems to the demands posed by new needs because of the threat these presented to their own survival as communities. The imposition of working regimes based on slave labour eliminates the possibility of hired work and of the leasing of lands which, should these new regimes succeed, would be directly exploited by their otherwise absentee owners whose main income, on the other hand, must have had other sources. Finally, these new regimes would also deprive local communities of acquired rights over the use of public lands, which would end up in private hands for their exclusive exploitation.

Indeed, only an agricultural system exclusively oriented towards the market and the detachment of the agrarian regime from the social structure deprives peasants of their autonomy.[78] Restriction of the labourers' mobility, or their de-contextualisation through forced migration and the supersession of their rights as a social group stand as *sine qua non* premises for the imposition of such a system. Geographical displacement will bring cultural rootlessness, in what Moreno-Fraginals defines as a deculturation process resulting in the disappearance of the individual's identity, and thus generating a society made up of: "aggregated instead of interacting individuals, whose action is coerced exclusively towards production."[79] Obviously, this sort of transformation cannot be imposed on peasant populations featuring a robust degree of social cohesion and strongly attached to the territory. These population groups show a strong attachment to their own territorial system, well established cultural and social habits and acquired rights; in short, a number of features which strongly oppose the application of such a deep process of disassociation from their own labour.

The new working regimes described would not even be fully applied in Madeira or the Canaries, where the emergence of the first capitalist ventures was to take place. Arguments in favour of the predominant use of slave labour in Madeira have also been severely questioned, among other things because the larger slave groups for which there is evidence, in Funchal and Ponta do Sol according to Alberto Vieira, do not seem to coincide with the main sugar cane producing areas, which in the 15th and 16th centuries were located around Partes do Fundo.[80] Slaves were clearly involved in sugar cane production, but

78 Alfredo Margarido, "Du commerce à l'écologie capitaliste," *Studia* 47 (1989): 291–309.

79 Manuel Moreno-Fraginals, "Aportes culturales y deculturación," in *La historia como arma y otros estudios sobre esclavos, ingenios y plantaciones*, ed. Manuel Moreno-Fraginals (Barcelona: Editorial Crítica, 1983), 24–49, esp. 36.

80 Virginia Rau and Jorge de Macedo, *O açúcar na Madeira*. Sidney M. Greenfield, "Sugar cane in the Atlantic Islands," in *La caña de azúcar en tiempos de los grandes descubrimien-*

as part of a mixed system in which their work was not predominant. This is the case, for example, in the Canaries, where the system was somewhat more advanced than in Madeira. The presence of hired labour during the most important steps of the process, both in the field and in the processing plant, remains very significant.[81] The participation of slaves appears to be more frequent in the first stages of sugar processing (milling, grinding, etc.), but this does not exclude the presence of hired hands. At any rate, the idea that we wish to convey is that in such a system slave labour plays nothing but a secondary, supporting role.

These areas, however, were to add a new element which would ultimately prove to be crucial. They are new, uninhabited lands, free from any social or cultural premise – or where what culture there was had been wiped out. This makes them perfect fields for experimentation, and they were probably used as such. Although the development of the new formula was not fully realised, all the new factors to be combined in America were indeed being fine tuned.

The island of São Tomé was discovered in the late 15th century. It was completely deserted, and in this case the opportunity for experimentation was much better used than in previous instances. The difficulties involved in the colonisation of such a distant territory turned into the greatest opportunity for experimentation with the new formula. Additionally, the Portuguese crown began to favour predatory policies instead of the policy of agricultural colonisation carried out in colonies closer to home, and this attracted merchants interested in quick gains through trade – slaves, spices and dyes – rather than farmers. The consequence was that the consuetudinary social norms on which agrarian societies rest were altogether lacking, and without peasants imposing their own ancestral system over the crops, a new regime could at last be started from scratch. Merchants, which to date had merely played a partial role in sugar production, became the sole actors. Besides excessive humidity, which will ultimately affect the quality of the sugar, the island presents ideal conditions for the generalisation of the crop, which ripens in a mere 5 to 6 months all year round and, most importantly, without having to share the available space with

tos, 59–82. Charles Verlinden, "Dal Mediterraneo all'Atlantico," in *Contributi per la storia economica* (Prato: Fondazione Istituto Internazionale di studi economici "F. Datini," 1975), 29–51. Alberto Vieira, "Agua, trabalho e açúcar. O caso da Madeira nos séculos XVI e XVII," in *Agua, trabajo y azúcar. Actas del VI Seminario Internacional sobre la caña de azúcar.* (Granada: Diputación Provincial de Granada, 1996), 101–146, esp. 120.

81 Manuel Lobo, "Azúcar y trabajo en Canarias," in *Agua, trabajo y azúcar*, 223–237, esp. 228–229.

subsistence crops with which to feed a peasant population. Only one factor is lacking: labour.

Since the previous exploitation systems – hired labour and land leases – were not available, the only option left for the production of sugar cane would be slave labour – those in possession of the sugar cane fields would also control the slave trade with Europe. Prisoners captured in war or *razzias* were no longer available in sufficient numbers as slaves, and the market had to be supplied with African captives.[82] Slave trade started around 1450, but the Portuguese monopoly was only verified in 1479. Slaves were shipped straight to the crown from factories located in Mauritania, the Gulf of Guinea and north-west Africa.[83] In addition to the activities sponsored by the crown, privately organised expeditions soon entered the business. These would carry the most weight in the spectacular growth of Portuguese slave trade between 1490 and 1510.[84] This growth coincided with a particularly intense phase of activity for the merchants based on São Tomé, which received 4,307 slaves only in 1516, and 7,000 the following year.[85] Many of these, as many as 12,000 according to Garfield, remained on the island and were put to work in sugar cane plantations. In Castro-Henriques' words, here they finally learned how to produce plantation slaves, breaking their social rules, behaviour and freedom.[86]

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82 Isabel Castro-Henriques, "L'invention sociale de São Tomé et Principe au XVIe siècle," in *Les assises du pouvoir. Temps médiévaux, territoires africains*, ed. Jean Devisse (Saint-Denis: Presses Universitaires de Vicennes, 1994), 199–211.

83 Ivana Elbl, "The volume of the early atlantic slave trade, 1450–1521," *The Journal of African History* 38 (1997): 31–75. See also António Mendes, "Portugal, Morocco and Guinea: reconfiguration of the North Atlantic at the end of the Middle Ages," in this volume.

84 Elbl, "The volume," 59.

85 Elbl, "The volume," 72.

86 Castro-Henriques, "L'invention sociale de São Tomé," 203.

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