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Designer Grapes: The Socio-Technical Construction of the Seedless Table Grapes. A Case Study of Quality Control

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Abstract

This article focuses on agro-food production in Murcia, Spain, and analyses the socio-technical production processes of the seedless table grape. In the agro-food industry, a focus on quality has driven an unstoppable process of biotechnological innovation, which is also evident in the object of this study. Before these technological innovations, taste, colour and calibre as specific qualities of the grape were not considered a determinable characteristic. They had only emerged in the context of certain productive, technological and institutional conditions of possibility and the establishment of particular relationships between the agents implicated in its cultivation. By using Callon's contribution to Actor Network Theory, the article examines how the different qualities of the seedless table grape are constructed through quality control procedures that try to stabilise the relationship between human (labour) and non-human (technology, insects, fungi, water, sun) actors.

Introduction

The agricultural industry has undergone an enormous transformation over the last few decades. The globalisation of the agro-food system has given rise to the emergence of new intensive agricultural enclaves on every continent. The expansion of the agricultural industry in these geographic regions is closely linked to a new international division of work within the framework of the restructuring of the global economy. The result of this reconfiguration is the development of a global system of fresh fruit and vegetable production/consumption in which numerous countries participate across various continents. In this system, developed countries are the principal consumers and under-developed countries the main producers (Busch and Bain 2004; Wolf and Bonanno 2014; McMichael 2009). This division is generally configured on a north-south axis, an orientation that is also apparent in the E.U. where the agro-food producing regions of the Mediterranean have become known as the 'garden of Europe' (Gertel and Sippel 2014; Pedreno 2014, Corrado *et al.* 2017).

Additionally, internal stratification, or a clear hierarchical structure, of the chain supply is visible in the different forms of governance, which have been studied in the literature on Global Value Chains (GVC) (Gereffi *et al.* 2005) and

Global Production Networks (GPN) (Coe *et al.* 2008). In this context, we can talk of the existence of a global agro-food production chain that is heavily stratified both geographically and internally.

Within this literature, there is a growing interest in quality control systems in agri- cultural production processes. On the one hand, the quality control of production processes and products has been decisive in the development of technological innovation in the global agro-food industry, and which has resulted in the creation and implementation of numerous quality management systems (Busch 2010). On the other hand, quality control has transformed the governance models of the global chain, becoming a specific socio-technological form of governance (Ponte *et al.* 2011). Some experts have tended to overemphasise quality as a strategy of big retailers to attract consumers (Ransom *et al.* 2013). This ignores the fact that there are many agents taking part in the quality standardisation processes: local producers, local institutions, workers, etc. (Bain 2010). However, although this literature has recently tried to analyse the role of a greater number of agents, it has not taken into account the influence of non-human agents. Actor Network Theory may be useful for such a task. Hence, building on lines of research line developed among others by Faier (2011), Berndt and Boeckler (2011), Van de Port and Mol (2015), Legun (2015) and Freidberg (2009),¹ this article tries to investigate the way that quality standardisation processes have transformed agricultural production in its entirety by seeking to control both human and non-human entities. To do so, the article centres on the case of seedless table grape production in Murcia, Spain, one of the most important agro- food producing territories in Europe. The implementation of a series of public and private quality certification systems over the last number of years makes the production of the seedless table grape a paradigmatic case in question. In this context, the article focuses on how the production processes construct the different qualities of grapes (taste, colour and calibre).

The main objective of the article is to show how taste, colour and calibre are qualities that emerge through the constant reproduction of a complex network of relationships between the human and non-human agents involved in the production and distribution of this type of grape. The analysis is based on data obtained from a wide- range of interviews with the principal human agents in the agro-food sector of the region.

The following section of the article provides a brief overview of Actor-Network Theory (ANT) and some useful theoretical considerations when undertaking an analysis of the diverse configurations and governance systems of global commodity chains (GCC). Subsequently, we present the Murcian case-study and then the analysis of how the different qualities of the seedless table grape are constructed by applying some of ANT's analytic tools, and more in particular Callon's concept of framing and overflowing.

Governing human and non-human agents

Since the 1980s, the gradual configuration of a globally integrated market has brought with it a series of challenges for states, companies, workers and consumers. Faced with this new and highly stratified economic space, all of these economic agents have been forced to reposition themselves by developing new strategies and forging new relationships within the chain. At the same time we have witnessed a profound restructuring of production, distribution and consumption across the globe and a redefinition of public and private forms of governance.

The wide geographic spread of these newly configured economic systems has pre-sented transcontinental companies with a number of problems. Principal among these is the coordination of diverse productive units while trying to ensure product quality and price control in open and volatile global markets. On the other hand, states that wish to promote economic development and integration to global net-works have had to contend with the need to develop and apply appropriate legislation for a phenomenon that transverse national borders.

Over the last 30 years or more, a number of different approaches to the question of global supply chain governance have emerged (Bair 2005, 2009; Robinson and Rainbird 2013). Of greatest interest to this article is the observation of which actors are considered significant and therefore included in the different conceptualisations of governance that appear in the literature. Analysis of the GCCs and the global value chains (GVC) focuses on the complex relationships between each of the companies involved throughout the chain: from the extraction phase until point of sale and even recycling. This approach investigates the changing control strategies that the leading companies employ over the rest of the chain, as well as the coordination systems that they put in place to govern such a complex framework of companies (Gereffi *et al.* 2005).

The need to take into consideration how multiple local territories are integrated into supply chains has been stressed by authors who focus on global production net-works (GPN) (Coe *et al.* 2008; Coe and Hess 2013). This territorial focus means that a wider more inclusive definition of participating agents is required. One that reaches beyond the leading companies and main supply chain actors to include local institutions (local authorities, universities, etc.), suppliers, subcontractors, growers, and the workforce, as each of these is, ultimately, integrated into the supply chain. Under this conceptualisation, supply chain governance has to coordinate and adapt to multiple regulations from public institutions, as well as the interests of local productive agents and companies' competition strategies (Selwyn 2010, 2013; Talbot 2009, 2011).

Finally, the application of quality standards has also brought about an important change in the approach to governance. The global production chains have introduced systems to manage, certify and control quality, such as social and environmental certification and best practice codes. Indeed, at present there is a complex mix of public and private regulations on quality and food security that are becoming increasingly important (Konefal *et al.* 2005).

As mentioned earlier, Ponte *et al.* (2011) posit that quality standards have become a specific form of governance within the global production chain. Following them, business governance through quality consists of a form of indirect control that is based on the establishment of quality systems that producers, suppliers, subcontractors and workers must meet. In addition, Ponte and Gibbon (2005) have studied the process of standardisation of products, production and communication and recording procedures involved in these quality systems, as well as the ways in which actors are involved in the decision-making processes that define quality.

The agro-food sector has been integrating different quality systems since the 1990s. Towards the end of 1990s, the supermarket chains, in collaboration with some local suppliers and producers, created the EurepGAP standard, which subsequently became the Global G.A.P. standard (Global Good Agricultural Practices). The main aim of these standards was to create a common framework to regulate global operations (Bain 2010). One of the consequences of this change was the incorporation of a large number of actors specialised in quality management in each phase of production.

Despite the trend towards the incorporation of ever more actors, big retailers are still considered as the leaders in the regulation and implementation of quality systems thanks to their powerful position. So when other agents are analysed, they are usually considered as passive and subordinated (Konefal *et al.* 2005). However, without ignoring the different power positions, management of quality requires a more active role of local agents. Although there are studies that have paid close attention to a greater number of actors (Bain 2010), this article uses ANT to include non-human agents in the analysis of the network of actors linked to the quality systems. This is because the interactions between human agents tend to mobilise the qualities of non-human agents in a direction that allows them to reach some kind of agreement. Thus, the basis and conditions of those agreements between human agents would depend on their ability to stabilise the behaviour of the qualities of non-human agents; behaviour that is not always predictable.

The role that these entities occupy in all sectors of activity is clear, but it is especially important in agriculture, where living matter (seeds, fungi, crops, etc.) is a critical component of production. The 'manufacture' of the 'perfect' fruit or vegetable has become an obsession for the industry, which is most evident in way that product quality has been defined in the most minuscule detail (calibre, colour, texture, smell, taste, etc.) made possible by innovations in technology, biology and production. Hand in hand with this goes a preoccupation with the organisational mechanisms that permit such a manipulation or governance of the chain. In summary, the governance of the behaviour of fungi, insects, water, the sun, hail, flowering patterns and fruit maturity rates are all at the heart of a complex network of actors whose 'stabilisation' is critical to the acquisition of the best possible quality.

In this context, the observation and control of the behaviour of the relationship between human and non-human actors takes on a special importance and is an ambit where ANT can make a particularly interesting contribution.

Actor network theory (ANT)

Looking specifically at interactions between human and non-human actors, ANT theorists used the concept of a 'black box' to explain processes and relationships that had become 'invisible' due to their success or even mundanity (Latour 1987, 2005; Callon 1986). In his analysis of markets (Callon and Muniesa 2005; Callon 2007), Callon pointed to a dual process of framing/overflowing through which he tried to render visible a range of interactions and processes that take part in the configuration of markets.

Framing occurs in three phases. In the first phase, stable and commercially viable commodities are translated by means of attributing them with specific and singular qualities while also excluding other associations in order to permit transposition from one context to another (from the selling context to the buying context). Secondly, framing requires the development of tools and devices (inscriptions) that make it possible for the emergence of calculative agents (researchers, producers, auditors, quality control managers, packaging workers, day labourers, buyers), that can place an objective value on the goods. Thirdly, through the development of such calculative socio-technical devices, agents can hierarchise their preferences, or the values attributed to goods, and engage in a process of negotiation and defence of interests, or agreement on prices.

Callon's conceptualisation of framing presupposes the selection and delimitation of an ensemble of human and non-human actors, within which roles and relationships are defined so as to account for all possible market dynamics. In other words, the system enables and constrains relationships between actors, forcing them to behave in a particular way in an effort to be efficient and account for any externalities. However, Callon does not propose that such framing results in an optimal re-allocation of resources and of power, where all variables are controlled. Neither does he hold that powerful agents act without opposition. Quite to the contrary, the complexity of reality and the network of associations that exist beyond the frame, which are not controllable, result in unforeseen and often contradictory sources of resistance. Callon considers framing to be a fragile and contested process that is not easily amenable to control and which is incomplete and open to leakage. This inherent uncertainty results in what he refers to as 'overflow' (Callon 2007).

The dual concept of framing and overflowing can help us to examine how agricultural production processes are oriented towards the creation and stabilisation of associations and alliances between human and non-human actors. Particularly, this dual concept can shed some light on the way in which different local actors, such as large and small breeders, workers,

technicians, breeders, etc. drive agricultural production processes towards the creation and stabilisation of associations and alliances between human and non-human actors in order to reach the quality standard. A participation that is not subordinate but active to the extent that the creation of a quality grape requires not just interaction with other actors but they must plan and design interactions with elements such as water, air, soil, insects, fungi, etc., all of which determine the taste, size and calibre of the grape.

In the next section we will employ this dual concept to analyse the development of the taste, colour and calibre of the seedless table grape in the Region of Murcia.

Background to the study and research methodology

Part of the global agro-food system, the Region of Murcia is one of the most important intensive agriculture enclaves in Southern Europe (Figure 1). In 2015, agriculture



Source: Digitised map of the Region of Murcia. Report on the Table Grape, ICEX, 2011.

Figure 1: *The main grape producing areas in the Region of Murcia*

Source: Digitised map of the Region of Murcia. Report on the Table Grape, ICEX 2011.

accounted for 4.3 per cent of regional GDP, compared to a national average of 2.3 per cent. In terms of labour force, in the second quarter of 2016, 83,700 people were employed in agriculture, 14.7 per cent of the region's total, much higher than the national average of 4.2 per cent (INE 2015, 2016). Its importance to the region is further emphasised by the fact that it is the only productive sector of the economy that has increased its workforce since the commencement of the current economic crisis. In general, it is a growing sector of the local economy that has been driven by technological innovation, industrialisation, the consolidation of large businesses and an ever increasing focus on export.

The growth of the fruit and vegetable sector in Murcia received a huge boost in 1986 when Spain became a member of the European Union and gained access to its vast market (Pedreno 2005). Since then, a large part of

agro-food production goes to export. In 2012, 70 per cent of fruit and vegetable production was exported, of which 93 per cent went to the European market (MESS 2012, pp. 15–16). This export orientation has meant that the scale of production has had to increase significantly. In turn, this necessitated access to resources such as capital, water, land and labour to carry out technological, organisational and commercial restructuring. On the one hand, such development and expansion brought significant change to the structure and composition of local businesses, shifting from a traditional smallholder based economy to one dominated by medium and large sized companies that have a focus on industrial scale production (Camarero *et al.* 2002; Segura *et al.* 2002).

On the other hand, this intensification in technological and productive investment has been organised around the application of quality certifications. Quality seems to have had a strong impact on the organisation of production processes and on labour relations. But quality has been implemented through devices that have modified the relationships between agents and made visible many non-human agents. For the study of this redefinition of the relations between the agents, we have employed to the non-participant observation and personal interviews. Observation helped us to get an idea of the way in which new varieties are created, the functioning of irrigation systems, protection structures (meshes, plastics), the management of pests and fungi, and how the vine is pruned. The interviews allowed us to analyse how actors mobilise their resources and interact to define and achieve common goals. During the fieldwork, which was carried out in various phases between October 2012 and March 2015, 56 semi-structured interviews were done with workers, production managers, company managers, representatives of employers' associations, smallholders, representatives of research centres and officials from the agricultural department of the local and regional authorities. We used a purposive qualitative sample to select participants whose occupational and institutional profile was most relevant to the research (see Table 1 online). The number of interviews carried out in each category was based on data saturation (Alonso 1998; Flick 2014). For the purpose of this article, the interview extracts that we present are only from the interviewees with people linked to quality management processes: quality control workers, small producers, general managers and quality managers of large agricultural firms, technicians in research centres working on new varieties, technicians from local authorities, and representatives of unions and growers' associations.

Results and analysis

The introduction of quality systems in the grape sector has been one of the most efficient devices in the governance of the global production chain of the grape. One of the key outcomes of this process has been the development of the superior quality seedless table grape. In this section we

use the analytic tools framing/overflowing (Callon 2007) to examine how the seedless table grape was developed. Specifically, framing refers to tasks related to the standardisation of processes and qualities of non-human entities than human agents seek to control, while overflowing concerns those uncertainties that threaten to move those entities beyond predefined quality standards.

Fruits are always in a process of mutation. Producers and researchers try to control or stabilise this process in order to keep the qualities of the fruit within the limits of the standards set by supermarkets. This means that companies develop ways of governing the production chain that includes not just control of human actors but also of objects. To put it another way, companies try to achieve the best possible quality by means of manipulating the relationships between human and non-human agents. In this sense, the implementation of quality certificates is a means of exercising control over the behaviour and mutability of non-human agents (fruit, fungi, insects, the sun, water, hail) so that certain standards (framing) can be achieved and maintained. The process of standardising agricultural production is in part achieved through the development of records and checklists. These records mean that the process of standardisation is under constant supervision and subject to continuous auditing by a complex network of agents employed to manage quality certification. This profound redesign of production processes and activities means that every operation, in each phase of production, along with all of the fruit's qualities, can be recorded and subsequently audited. In effect, product quality is defined, configured and governed.

In this quality control process, all the actors, including the grape, fungi, water, etc., are in play. The achievement of the perfect product (according to predefined standards) requires the permanent rearrangement of the delicate balance between human and non-human actors. In this sense, we cannot think of the qualities of the grape as a given, but as a result of the management of a complex assemblage of relations. In the following section we apply two principal operations in the framing of the construction of the flavour of the seedless table grape: the attribution of qualities and the creation of socio-technical devices.

The attribution of qualities to the seedless table grape

Attributing very specific qualities to the grape is a framing operation designed to make the product stable and commercially viable. The quality of the grape is determined by its taste, calibre (size and shape) and colour. The seedless variety, which comes in red and white, has a sweeter taste, larger size, rounder shape, and more homogenous and bright colour. It is also more resistant to deterioration than the seeded variety. These characteristics, or quality standards, have guided producers in their efforts to grow new varieties and in the introduction of new production methods.

Demand for quality comes from a number of sources. Although

consumers have an important impact, the main drivers are the supermarkets that use quality certification to oblige producers to achieve predefined standards.

Practically 90 per cent of clients require you to have the Global G.A.P. certificate. If the auditor comes and you have one, and let's say, I don't know, let's say there's a non-compliance so important that he has to take it off you, well imagine what that year would be like... we'd lose half, more than half of our clients. (Production manager, large company A)

In the supermarkets, if they tighten the contracts a bit more... They fix the quantity and price and quality, the calibre, taste, colour, type of packaging. It includes the reasons for rejecting the product and any penalties. For example, if they are stained, bruised, split, non-compliant calibre, unsuitable labels, rotten products... In general they'll only take 2 per cent of products in bad condition, [...]. (Commercial manager, large company C)

However, demand for quality also comes from producers' own innovative initiatives to reach higher standards in both the product and packaging.

You can develop a variety in five or six years. How does it work? Well, we develop the hybrids, we do the selections, and the members, all the producers, come here twice a year to see what we've done, we have two days of open-house to show them everything we have, but they also come individually at other times. (Director, ITUM)

... the process goes as follows: the breeder offers you something or you do research, maybe through the press, research articles, colleagues, or even other companies. You see what varieties are being offered in each program. Normally the genetic improvement programmes are done in the outdoors, which means that they go to special farm, it could be Italy or California, to show all their varieties, you have a look at them, you ask how [they've been developed], most importantly, you decide if you like them, if they're a fit with your company, what your customers are looking for, etc., then you have to move it all to your own area. Normally, you come to an agreement with them, you ask them for plant material, quarantine raisins, you plant in your fields and you wait, 3, 4, 5 years until you can assess the grapes properly, to make sure you don't have any problems, like splitting, stains, low yield, etc. (Production manager, large company A)

One of main problems is keeping the grape's qualities stable, or predictable, as it moves through the production process and supply chain. In the laboratory they have to obtain a flavour that can be reproduced during the cultivation process. In the fields, the grape should be treated in such a way as to allow the materialisation of the flavour contained in the variety's genetic makeup. It should also be harvested at the optimum point of maturity, and packaging should be achieved without any physical deterioration. Too much or too little water, too much light, excess temperature, the appearance of fungi or insects, the absence of workers at harvest or during packaging, or a sudden hail storm are just some of the overflows that can threaten the grape's qualities. In the process of moving the grape from the laboratory to the field, from there to packaging, and finally to the supermarket shelf, it is necessary to establish and neutralise (or frame) any connection with an external agent that might affect the standardisation process and push the grape's quality beyond the predefined limits of acceptability.

The development of socio-technical devices

The development of the quality standard for the seedless table grape is also

linked to the second type of framing operation identified by Callon: the creation of socio- technical devices that permit the involvement of agents who possess the technical and production knowledge to achieve the desired quality. The main socio-technical devices employed in the production process include: the development of new varieties by the Table Grape Technological Institute (ITUM); new cultivation and crop protection techniques; drip irrigation systems; pest and fungi treatments in the field; and packaging systems. The other main device is the use of quality checklists that allow supermarkets and their agents to control quality from a distance; mostly through annual inspections carried out by external auditors. In the following sections we describe each of these socio-technical framing devices, which are entangled with the different types of overflow.

Varietal development. Firstly, the search for a seedless table grape with an excellent flavour is closely related to research into varietal development driven by local producers. Such research has resulted in a manifold increase in the number of new varieties and, simultaneously, a decrease in autochthonous breeds. Consumer preferences and the companies that run the large-scale distribution chains guide such research. Until the middle of the 1990s, the main table grape in the Region of Murcia was a seeded variety called Napoleon. Since then, cultivators have developed numerous seedless varieties, but the most common breeds are Crimson, Red Globe, Superior, and Autumn Royal.

Twenty-five years ago they introduced a new seedless variety on a large scale for the first time [in Murcia]. It was the Superior (Sugraoane) variety... That was the start of the expansion of the seedless grape, going from nothing to 1,000ha of the 6,500 dedicated to grape production in Murcia at that time. Later, other free varieties that weren't [copyright] protected arrived, like Crimson Seedless and Autumn Royal, two apyrene [seedless] breeds ... and they planted another 1,000ha, more or less, of Red Globe. (Director of the Table Grape Research Institute, ITUM)

Currently, as some of the interviewees pointed out, almost 70 per cent of grape production in the region is of the seedless variety, though this is a very recent development. Conflicts related to the property rights of these new varieties is one of the overflow that has hindered a broader expansion of the sector.

The Table Grape Research Institute (ITUM), which carries out most of the research into new high quality seedless varieties, is a public-private entity that was setup in 2002 by a conglomerate of large and medium sized producers in the region, in partnership with the University of Murcia. It was established to create varieties that could compete with other breeding centres in California, Chile and South Africa. Through a series of programmes to improve genetic composition, the institute experimented with a number of seedless varieties. Before offering them to producers, the new breeds are cultivated at a special site for experimenting and to test for the new breed's ability to acclimatise to local conditions. These genetic improvement programmes are not just focused on the qualities of grapes, but also on the reduction of costs at each stage of production. Here the

overflow comes from unexpected behaviours of the experimental varieties when they first grown in a natural less controlled environment which can result in the creation of flavours, colour or sizes that do not fit with the quality standards.

Crop protection systems. The qualities of grapes are also related to new techniques that producers have developed for protecting the crop. To guarantee quality, producers have installed expensive metallic structures that can be covered with fine mesh netting or plastic. Such structures protect the vines from hail and allow temperature regulation and the control of fruit maturity throughout each stage of the season, all of which are crucial to ensuring an optimum flavour. As such, we can consider these structures to be technical devices that try to control overflows caused by non-human agents (hail, inappropriate temperatures, etc.), that could destroy the plant and all the grapes.

A key factor in the cultivation of the table grapes is an apparatus, which for me is very important, and which I've, possibly... been developing since I started to work with the table grape, which is the structure and placement of the plastics... There are two times in the season when we use plastic, we cover the early [season] varieties to accelerate maturity, and then from August on we cover the later varieties so that the rain doesn't affect them. (Production manager, large company B)
... well the mesh netting is very important for hail. But we also put plastic, or plastic fibres. There are two ways of using it, firstly, in the early varieties to increase the flowering temperature, so that the fruit is bigger, to get a more even cluster of berries of the same calibre and not to have small berries, the flowering temperature is very important for that and also so they don't get wet at that stage. And then later to help extend the growing period. (Production manager, large company A)

Drip irrigation. The introduction of drip irrigation systems is another vital cog in the cultivation of a high quality seedless table grape. Although this system also means a relative saving on water, which is important in Murcia due to shortage and cost, the real advantage is that it allows producers to control which plants receive water and how much.

[...] here the big change came about when, well more than fifteen years ago, fifteen or twenty years, with drip irrigation... drip irrigation saves water but also improves efficiency tremendously... Then, later, there are a series of collateral benefits, such as the work required [to maintain the vine]. Especially in fruit and vines, drip irrigation doesn't need working of the land. (Local Authority Agricultural Area Officer)

Water management is decisive for improving the productivity of the vines and to acquire a sweet flavour and homogenous colour. What causes overflow here is excess or insufficient irrigation of the plants; too much water can improve productivity, but worsen taste. In this sense, producers are always trying to carefully balance the need for quantity and quality.

... what you can't do is expect that one tree is going to give you 200 kilos, because that means that you'd have to give it a lot of fertiliser and a lot of water... and the fertiliser and water are at odds with the flavour. I mean, a tree needs a certain amount of fertiliser and a certain amount of water, so what you'd be doing is fatten the fruit artificially, I mean, if the tree sees that it has a lot of nitrates and a lot of water, what does it say? 'Well, as I don't need this food I'm going to fatten the fruit', but how?

Well, by injecting water into the fruit and the substances that create flavour get diluted. So, you have a really big grape or orange but it has no taste. Nowadays, for example, with the grapes, I'm seeing that the varieties that they tend to develop, in spite of, clearly, there isn't a cultivator who wants a variety that doesn't produce a certain yield, he wants it to give at least a certain amount of kilos, but the taste is also very important. (Commercial manager, large company C)

In participation with the Polytechnic University of Cartagena some of the large producers have co-financed research projects whose objective is to find ways to reduce water consumption, while increasing production and maintaining quality.

What we are doing is investing in R&D. For example, we have a project co-financed by the University of Cartagena. On the farm we have in Cieza we're trying to reduce water usage to improve colour, while also improving production. We have about two years of results and the truth is it's looking quite good. (Production manager, large company A)

Without doubt, in this case, the devices are attempting to reduce the threat of various types of overflows, such as water shortage and inefficient irrigation systems.

Fungi and pest control techniques. The fourth type of socio-technical device employed to reduce overflows and to stabilise the qualities of grapes are methods to control insect plagues and fungi, which is the clearest manifestation that the grape as a natural entity is in a constant process of biological mutation. In Murcia, the table grape is very sensitive to two types of fungus, powdery and mildew, and an insect known locally as the spinner moth (European grapevine moth), which can cause overflows through irreparable damage to the grape. To avoid insect propagation cultivators use phytosanitary treatments that have the lowest level and quantity of substances possible. The Healthy Grape Project, which was launched by one of the largest producers in the area,² provides guidelines for the application of such phytosanitary treatments. Producers must also abide by the strict indications of the quality certification standards, which are based on European regulations for food safety. These regulations specify the active materials that can be used in phytosanitary, in what quantity and to what extent (ICEX 2011, p. 16).

Due to limitations placed on phytosanitary use, producers have trialled the use of more natural techniques that eliminate the need for chemicals. Natural approaches to pest control seek to avoid the introduction of pollutants through the use of mating disruption techniques. By placing pheromone (the naturally occurring substance that the female emits to attract males) emitters on the vines the male insect is incapable of finding the female, whose eggs do not get fertilised.

They place pheromone emitters on the vines. The pheromones are the substance that the female releases to attract the male. So, if we can have emitters on the vine when the male enters, well he goes crazy, I mean, he's incapable of finding the female. If he doesn't find the female, she places unfertilised eggs on the vine. That's how the plague is controlled, it's a clean way to do it, there are no secondary effects, it's really clean... (Local Authority Agricultural Area Officer)

Through this technique the producers use a non-human agent (pheromone) to neutralise the negative effect of the propagation of other non-human agents (insects) on the vine. In doing so, the natural mutability of the grape is controlled and maintained within the desired quality standards.

Pruning the vine. Obtaining a quality grape also depends on the way that it is pruned, specifically cane and spur pruning. Cane pruning is done at various times during the season, of which the most important is the winter prune and the prune at the start of the season when new growth has started. Spur pruning refers to the removal of unwanted shoots and clusters from the vine and cordon. Pruning ensures that the phytosanitary treatments are easier to apply in the interior of the foliage, as well as maximising the entrance of light and the circulation of air, which helps to regulate colour, flavour and the size of the grape.

During the pruning process there are two additional sources of overflow: inadequate or substandard work or lack of available labour. The difficulty of mechanising this type of work means that grape quality depends on skills that come from practice and experience. In this sense, the focus on quality control through socio-technical devices shifts to questions of labour management.

The key to achieving an adequate pruning, and a quality grape, is the organisation of a flexible and specialised workforce. In Murcia, producers use temporary work agencies, companies that hire workers and make them available to third parties on a temporary basis. In Spain, the legal basis of temporary work agencies was established in 1994³ within the framework of a set of institutional reforms that have permitted producing companies to deepen their strategy of workforce flexibilisation (Ortiz 2013). As can be seen from Table 2, in the Region of Murcia, temporary worker agencies have become widespread and an important means of recruiting day labourers. Effectively, these companies have come to displace the role of two pre-existing agents in the labour market, that of the *enganchador*⁴ (informal recruiter), and the *furgonetero* (recruiter/transporter) (Gadea *et al.* 2017).

Table 2: *Contracts in agricultural occupations and contracts in temporary employment agencies by nationality, Region of Murcia, 2006–2014 (% of all contracts)*

<u>Contracts in agricultural occupations</u>	<u>Contracts through employment agencies in agricultural occupations</u>
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	Spanish nationals	Foreign nationals	Spanish nationals	Foreign nationals
2006	12.5	87.5	3.0	97.0
2007	11.7	88.3	3.0	97.0
2008	12.2	87.8	3.3	96.7
2009	18.5	81.5	6.7	93.3
2010	16.0	84.0	6.1	93.9
2011	16.0	84.0	6.2	93.8
2012	18.2	81.8	8.8	91.2
2013	21.1	78.9	12.0	88.0
2014	22.3	77.7	13.6	86.4

Source: Observatorio del SEFCARM Available online at www.sefcarm.es.

Checklists. The final socio-technical device related to quality standards is the use of checklists that permit the recording and auditing of the entire production process. Subsequently, inspectors use these checklists when certifying holdings. Additionally, cultivators use the checklists as a way to self-assess production. In the agro-food business the most important and widely used quality certification is the Global G.A.P. This certificate attempts to establish a one-stop best practice model for all agro-food production at a global level.⁵ The Global G.A.P. checklist for fruit and vegetable production is organised into three parts and contains almost three hundred points of control, which must be individually verified (see Table 3 online for an adapted and abridged version). Inspectors verify the degree of compliance with the checklist by examining registers of production activity, which the producer is obliged to maintain. Direct observations of the production process and/or product are only carried out as a complementary form of assessment.

Therefore, the checklist can be considered the principal socio-technical device that contributes to the establishment of quality control processes in grape production. The checklists act to describe in precise terms how to produce high quality grapes and how each agent should behave throughout the entire process. Furthermore, the checklists function as a point of reference and medium of communication for a whole range of participating actors: personnel directly involved in quality control in the producing company (quality control managers and packaging line workers); external assessors helping the producer prepare for annual quality audits; external inspectors carrying out the annual Global G.A.P. quality control audit, etc.

Discussion and conclusion

This detailed description of the production process of the seedless table grape shows how its different qualities depend on the stabilisation of a complex range of relationships between human and non-human agents. Or, to put it another way, the flavour, colour or size that the consumer experiences is not materially and genetically predetermined, but emerges

from a complex network of socio-technical relationships through the control (framing) of certain productive, technological, institutional and climatological conditions, amongst others. The governance of this process is focused on the creation and stabilisation of the conditions of the relationship between human and non-human actors and from which the qualities of seedless table grapes come out.

Framing requires the creation and definition of connections or relationships between agents, but it also necessitates that connections that disrupt stability and create overflows be neutralised or undone. The development of new varieties of seedless grapes in the Region of Murcia involves the participation of a wide range of human actors, such as the researchers from the University of Murcia, managers from the regional authority, agricultural officers from the local municipal authorities, producers, workers, and auditors. Non-human agents are also critical to the production process and include mesh netting, irrigation systems, water, light, pheromones, heat, phytosanitary, and checklists.

The production of the seedless table grape in Murcia has created a close relationship between researchers, producers, workers, auditors and new relationships with the physical components of agricultural production. Through the use of socio-technical devices, such as quality control systems and certification, each of these relationships is controlled and stabilised (framed) to the maximum degree so as to avoid unforeseen impacts or overflows. The work that is carried out in the field is dependent on the work carried out previously in the laboratory, and vice versa. Similarly, pruning permits that light and air can circulate to maximum effect, the use of phytosanitary on the vine reduces damage by spinner moths, mildew and powdery. Irrigation depends on the availability and supply of water from the local and regional agriculture and water authorities. Water is a vehicle through which the nutrients that create flavour are delivered to the vines, and must also be controlled so that the vine and grape matures at a rate that is conducive to achieving the right balance between flavour and yield. Physical structures, such as mesh netting, also contribute to production by controlling temperature at the start and end of the season, as well as protecting the vines from the elements. Temporary worker agencies control the workforce so that labour is available at precisely the right time to carry out the vital tasks of pruning and harvesting. Precise procedures make sure that workers observe hygiene protocols and that equipment and packaging is clean and pollutant free.

Each of these interdependent processes and agents are framed in such a way as to maximise productivity and quality and by consequence the development of the qualities of the grape that the consumer experiences. In summary, the most significant observation of the research is that the flavour, colour or size of the seedless table grape are not characteristics that pre-exist, rather, they are mutable, emergent and produced from a complex assemblage of human and non-human agents (producers, researchers, water, insects, workers, auditors, the sun) throughout the entire process of

cultivation and even beforehand.

Notes

- ¹ Faier (2011) studies the cultivation of a type of Japanese mushroom. She focuses on how the quality of mushrooms depends on the control of human and non-human agents such as changing weather patterns, forest use practices, geopolitics, and the spread of pine wilt disease. Berndt and Boeckler (2011) studied the conservation of quality standards of tomatoes produced in border territories using the framing/overflowing concepts. They concluded that the management of borders are one of the main elements to frame and control overflows. Freidberg (2009) analyses the historical quest for fresh products in six industries: beef, eggs, fruit, vegetables, milk, and fish. She focuses on the role of the development of refrigeration, of the establishing of international cold chain and of cold storage. Legun (2015) focuses on the creation of new varieties of apples in order to analyse the role that biology plays in shaping the social management of the economy. Also using ANT concepts, Van de Port and Mol (2015) analyse how different socio-material practices constitute different forms of eating that create different forms of body pleasures. Hence, they turn to consumption practices as the area in which qualities of food are embodied through the act of eating.
- ² For more information see: <http://www.presspeople.com/nota/proyecto-uva-saludable-murcia-presentara-evento> Accessed 15 October 2016.
- ³ Law 14/1994 (1 June) that regulates temporary employment agencies.
- ⁴ The *enganchador* is an informal recruitment intermediary used to hire day labourers. Under this system, terms of engagement are purely verbal. In Murcia, there is a long tradition of using the *enganchador* in the rural labour market for the citric and fruit harvest, in particular in the municipalities located in the interior of the region.
- ⁵ For more details see: <http://www.globalgap.org/es/> Accessed 15 October 2016.

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Supporting information

- Table 1. Profile of interviews carried out during the fieldwork
- Table 3. Simplified Global G.A.P. checklist

Table 1. Profile of interviews carried out during the fieldwork

Field and packaging	E3 Workers, “permanent contracts”, autochthonous, large companies, previously
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plant workers (based on gender, age, nationality and education)	<p>employed in construction (discussion group)</p> <p>E4 Young women, temporary workers, packaging and storage, large company, Abarán (collective interview)</p> <p>E5 Worker, female, large company</p> <p>E9 Retired worker, female, aged 85, Abarán</p> <p>E10 Workers, females, packaging and storage unit, large company (collective interview)</p> <p>E18 Worker, temporary full-time, female, 57 years old, large company in the Abarán area</p> <p>E19 Worker, retired, female, aged 59, large company</p> <p>E21 Temporary worker, female, immigrant, Alcantarilla</p> <p>E22 Temporary worker, female, autochthonous, Fortuna</p> <p>E27 Temporary worker, female, immigrant</p> <p>E31 Field worker, male, previously employed in construction</p> <p>E32 Worker, retired, male, straw and agricultural sector</p> <p>E41 Field workers, Blanca (collective interview)</p> <p>E42 Field workers, Blanca (collective interview)</p> <p>E43 Workers, immigrants, Blanca (collective interview)</p>
Union representatives	<p>E1 Union representative, female, General Workers Union (UGT), agricultural sector</p> <p>E7 Worker in a cooperative, female, union delegate in UGT</p> <p>E8 Worker, female, union delegate in UGT</p> <p>E28 Union delegate, female, Workers Commission (CC.OO.)</p> <p>E52 Union representative, male, responsible for agricultural sector (CC.OO.)</p>
Small and medium sized producers	<p>E13 Small to medium sized producer, Blanca</p> <p>E20 Small producer, day labourer, founder of a local cooperative</p> <p>E29 Owner/worker, vineyard</p> <p>E33 Small to medium sized producer, mixed activity (agricultural/non-agricultural), Cieza</p> <p>E36 Small producer, member of a cooperative</p> <p>E37 Small fruit producer, day labourer</p> <p>E55 Small table grape producer</p>
Managers, large companies	<p>E15 Ex-President of a large cooperative A</p> <p>*E34 Ex-Mayor of Abarán, founder of a large horticultural company</p> <p>*E35 Ex-President of a large cooperative A, ex-manager of large cooperative B, ex-councillor in Abarán</p> <p>E47 Managing director of a large local company A</p> <p>E48 Managing director of a large local company B</p> <p>E49 Logistics manager in a large local company C</p>
Representatives of growers'	<p>E2 Commercial representative of the Union of Small Producers and Farmers (UPA)</p>

associations	E11 President of UPA E16 Representative of APOEXPA E24 Representative of FECOAM E30 Treasurer of cooperative A (del Valle de Abarán) E39 Representative PROEXPORT Acción Social
Company managers (quality, commercial development, human resources, etc.)	E25 Commercial manager in large company C E38 Quality manager in a cooperative B (SAT in El Fenezar) E40 Worker responsible for quality, cooperative C (Coop Blanca)
Managers in Local Authorities and State Bodies	E23 Agricultural Office Manager, Cieza E44 Employment and Training Manager, Archena E45 Employment and Training Manager, Cieza E46 Corporate Social Responsibility Manager, Murcian Regional Government
Managers and other personnel in external companies (Technological institutes, labour intermediaries, suppliers, etc.)	E6 Employee in a recruitment agency for temporary workers in packaging plants, female E12 Manager of the agrifood sector in UGT, male, Cieza E14 Director of the Table Grape Technological Institute (ITUM) E17 Manager in a temporary workers agency E26 Foreman, wine arbor assembler E54 Manager in a temporary workers agency
Mayors, politicians	*E34 Ex-Mayor of Abarán, founder of a large horticultural company *E35 Ex-President of a large cooperative A, ex-manager of large cooperative B, ex-councillor in Abarán
Representatives of civil associations/ NGOs	E53 Manager in a charitable organization (Cáritas), Cieza E56 Manager in an immigrants association

Table 3. Simplified Global G.A.P. checklist

<p>Module 1. Characteristics of agricultural holdings</p> <ol style="list-style-type: none"> History and management of the agricultural holding Record keeping and internal self-assessment Workers health, safety and welfare Subcontractors Waste and Pollution Management, Recycling and 	<p>Module 3. Fruits and vegetables.</p> <ol style="list-style-type: none"> Soil Management Use of Substrates Pre-Harvest Check Harvesting <ol style="list-style-type: none"> Hygiene Protocol for Harvesting
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Re-use

6. Environment and Conservation

7. Complaints

8. Recall/ withdrawal procedure

9. Food Defense

10. Global G.A.P. status

11. Logo use

12. Traceability and segregation

Module 2. Crops base

1. Traceability

2. Propagation Material. Varieties used.

2.1. Quality and Health

2.2. Chemical Treatments and seed dressings

2.3. Genetically Modified Organisms

3. History and Management of the Site

4. Soil Management (soil types, cultivation techniques, etc.)

5. Fertilization

5.1. Nutrient requirement

5.2. Advice on Quantity and Type of Fertilizer

5.3. Records on Fertilizer Application (plot, type, date, quantity, etc.)

5.4. Fertilizer Storage (separately, in covered area, in dry zone, etc.)

5.5. Organic Fertilizer

5.6. Nutrient Content

6. Irrigation/ Fertigation

6.1. Predicting Irrigation Requirements

6.2. Irrigation / Fertigation Method

6.3. Quality and Provenance of Irrigation Water

7. Integrated Pest Management (forms of observation, prevention and intervention)

8. Phytosanitary/ Plant Protection Products

4.2. Worker Hygiene Training

4.3. Vehicle Hygiene

4.4. Final produce Packed at Point of Harvest (machines used, storage of the product packed on the farm, etc ...)

5. Produce Handling

5.1. Personal Hygiene (employee hygiene training, appropriate clothing for employees, etc.)

5.2. Sanitary Facilities

5.3. Packing and Storage Areas

5.4. Quality Control

5.5. Pest Control

5.6. Post-Harvest washing

5.7. Post-Harvest Treatments (labelling, type of treatment, date, product quantity, name of the operator who performed the task, etc.)

Additional module. Quality Management System Standards

1. Legality, administration and structure

1.1. Legality. Compliance with legislation

1.2. Producers and farms. (Contacts, managers, contracts, area of cultivation, etc ...)

1.3. Register for Multiple Farms

1.4. Producer's Internal Record Keeping of the Holding

2. Management and Organization

2.1. Structure

2.2. Training and Development of Personnel

3. Document Control (protocols, records, etc ...)

4. Compliant Management

5. Internal Auditing of the Quality Management System (training of

<p>8.1. Control over Quantities and Type of Plant Protection Products</p> <p>8.2. Pre-harvest Safety Dates</p> <p>8.3. Management of Surplus Mixtures of Phytosanitary Products</p> <p>8.4. Analysis of the Residues of Phytosanitary Products</p> <p>8.5. Storage of plant protection products (zone, temperature, lighting of the place, separated, etc ...)</p> <p>8.6. Manipulation of Phytosanitary Products (medical examination of personnel responsible for handling, training, etc.)</p> <p>8.7. Empty Phytosanitary Product Containers</p> <p>9. Equipment</p>	<p>auditors, frequency of audits,</p> <p>6. Internal Inspections</p> <p>7. Non-compliance, Corrective Actions, Sanctions</p> <p>8. Traceability and Segregation of the Product</p> <p>9. Withdrawal of Products</p> <p>10. Subcontractors (control protocols, registers, etc.)</p> <p>11. Producer Registration</p>
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Source: Abridged and adapted from the Global G.A.P. Checklist, available at <http://www.globalgap.org/es/for-producers/crops/FV/> [15th October, 2016]