

Private Standards, Handling and Hygiene in Fruit Export Supply Chains: A Preliminary Evaluation of the Economic Impact of Parallel Standards

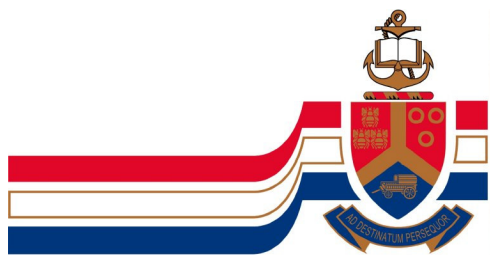
H.Vermeulen^a, D. Jordaan^a, L. Korsten^b & J. Kirsten^a

^a *Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria, South Africa*

^b *Department of Microbiology and Plant Pathology, University of Pretoria, Pretoria, South Africa*

Working paper : 2006-01

Department of Agricultural Economics, Extension and Rural Development
Faculty of Natural and Agricultural Sciences
University of Pretoria
Pretoria
0002
South Africa



University of Pretoria

Private Standards, Handling and Hygiene in Fruit Export Supply Chains: A Preliminary Evaluation of the Economic Impact of Parallel Standards

H. Vermeulen^a, D. Jordaan^a, L. Korsten^b & J. Kirsten^a

^a *Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria, South Africa*

^b *Department of Microbiology and Plant Pathology, University of Pretoria, Pretoria, South Africa*

Abstract

With the emergence of private food safety and quality standards in developed countries fruit exporting countries in the developing world face increasing constraints to access markets in the rich industrialised countries in the North. Producers in the South have no alternative as to make the necessary investments on farms and in pack houses to comply with the requirements of these food quality and safety standards. The export of fresh fruit is an important component of South African agricultural exports, with citrus fruit exported to markets such as Europe being of particular importance. This paper reports selected results from a large research project into the impact of private standard compliance on the quality of the fruit and the returns to farmers. The research process involved a multi-disciplinary analysis of Agricultural Economics and Microbiology / Plant pathology as we analysed the dynamics of the citrus export supply chain from the farms in South Africa to the end consumer in Europe. Sampled fruit containers were followed through the whole supply chain which allowed us to provide an exposé of the behaviour of the different actors in the citrus supply chain and obtain some evidence of poor handling and hygiene standards by means of a comparison of the experimental observations with various relevant components of the EurepGAP control points and compliance criteria for fruit and vegetables. Observations suggest that these standards are adequately applied to the production and handling of fruit at the farm and pack house levels while on the other hand the subsequent stages (mainly after the importing harbour in Europe) of the fruit supply chain are seemingly not subjected to the same strict requirements laid out for producers, leading to fruit quality deterioration and financial losses for producers. This constitutes clear parallel standards in terms of fruit safety and quality standards between upstream and downstream sections of the supply chain and questions thus the purpose of the standards and the financial return for producers making large investments to comply with these privately introduced standards.

1. Introduction

The emergence of private food safety and quality standards mainly in developed countries is now a well-established fact (*cf.* Henson and Reardon, 2005). These standards operate alongside regulatory systems but in terms of market access and access to the shelves of the leading supermarkets in the rich countries, it become almost mandatory. With these standards becoming a global phenomenon, countries in the developing world (the South) faces increasing constraints in exporting their food products to markets in Europe and the USA. In order to ensure continued access to these important export markets, producers in the South had no alternative as to make the necessary investments to comply with the requirements of

certain food quality and safety standards such as the Euro-Retail Produce Working Group Good Agricultural Practices (EurepGAP) standard and the standard of the British Retail Consortium (BRC).

The exports of fresh fruit is an important component of South African agricultural exports contributing on average 27% to total agricultural exports with citrus fruit dominating with a 11% share of agricultural export earnings during the 2002-2004 period. The citrus export chain is dominated by large commercial producers who sell their produce mainly to European markets (25% of exports from 1999 to 2004) and the United Kingdom (29% of exports from 1999 to 2004) (PPECB, 2004).

It is against this background that a large research project was undertaken in order to determine whether the investment by citrus producers to comply with the different private standards provided them with a competitive edge and improved returns. Has it really contributed to better quality fruit, reduced losses, higher prices, higher net returns and continued access to markets? In the process we are combining an analysis of the dynamics of the citrus export supply chain and an exposé of the behaviour of the different actors in the chain with some evidence of poor handling and hygiene standards in Europe to highlight the impact of private standard compliance on the quality of the fruit.

The importance of this research should also be seen in light of the fact that producers are normally held responsible for fruit quality and safety up to the point of sale and carries the risk for most of the supply chain without being able to influence the behaviour of the actors in the chain and also having no formal control over the handling of fruit beyond the farm gate. Fruit quality typically deteriorates throughout the chain due to interruptions in the cold chain and negligent handling.

The objective of this paper is to evaluate the existence of parallel standards in the citrus export supply chain. Parallel standards in this context is defined as a discrepancy between the food quality and safety standards enforced at farm level and in the pack house in the exporting country, versus the food quality and safety standards applied and enforced in the rest of the supply chain. The evaluation of the impact of parallel standards was based on preliminary evidence and was used as a basis to suggest a set of critical policy issues towards a thriving South African citrus sector.

The paper is organized as follows. The next section provides an overview of the structure and standards of the South African citrus chain. The third section covers an overview of the research methodology and section four presents the observations from the on-going project, which investigates the organisation of citrus export from South Africa to Europe. Finally, the economic implications of these observations are analysed which informed a set of policy issues towards a thriving citrus sector.

2. Current export standards and practices in the South African citrus supply chain

South African citrus producers serve a variety of markets in order to accommodate fruit heterogeneity. The markets differ in terms of requirements for fruit quality, volumes to be supplied, production practices and accreditation. Each market has a unique governance structure, with corresponding responsibility structures and returns to quality. Farm-gate selling to the informal market for example involves small quantities, lower and variable quality and irregular supply volumes. Quality is assessed by the consumer based on visual aspects, while production conditions are not an important consideration. On the other hand marketing through the domestic fresh produce markets involves larger volumes, long-term relationships with market agents, the enforcement of quality standards, grading standards as well as an increase in the importance of supply frequency and volumes. The most challenging national market outlets for citrus fruit are food processors and supermarkets. These markets require larger and consistent volumes, certification for good agricultural practices and adherence to specific product quality and safety standards. This is similar to those standards required by the supermarkets and importers in the major export markets.

As mentioned earlier, citrus fruit is an important agricultural export commodity of South Africa with an 11% share of agricultural export earnings during the 2002-2004 period. In order to access the export market, citrus producers have to be registered with the National Department of Agriculture (DoA) and the Perishable Product Export Control Board (PPECB). The DoA issues a production unit code (PUC) and a phytosanitary certificate to each producer when in compliance with international agreements. PPECB has a statutory responsibility to ensure that standards in the export chain is maintained and applied based on product and market

requirements set out by the DoA (PPECB, 2004).

In addition the South African citrus export sector is also affected by two categories of private food safety standards applied by importers in many developed countries. Standards related to Good Agricultural Practices (GAP) are applied to fruit production, handling and all processes up to the point where the produce leaves the farm. A prominent international GAP standard is the EurepGAP standard of the Euro-Retailer Produce Working Group, recognised as a minimum standard by most European Union countries and numerous food retailers in Europe (PPECB, 2004). Fruit handling, packaging and distribution after the farm gate are governed by other private standards, such as Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP) and the protocol developed by the British Retail Consortium (BRC) entitled the BRC Global Standards. It is important to note that some major role-players in Europe developed additional own post-farmgate requirements, highlighting the need for protocol harmonisation among role-players in this regard. The estimated number of certifications to voluntary food quality and safety standards in South African agricultural and food industries on 30 March 2005, are shown in Table 1.

Table 1: Total number of voluntary food safety standard certifications in South African agriculture and food industries, as on 30 March 2005

Standards Accredited	Number of Accredited Role-Players in SA Agricultural and Food Industries¹
Eurepgap	2125
Nature's Choice	589
HACCP	231
BRC	34

¹ Sources: Compiled by Prof Lise Korsten (Department Microbiology and Plant Pathology, University of Pretoria) based on personal communication with certification bodies (SGS, ProCert, PPECB, BCS, GCS, Cmi Africa, National Britannia Bekker Wessels, Ecocert), as well as Internet resources (www.Procert.ch; www.certification.sabs.co.za; www.afrisico.net)

According to preliminary results from a study by Breedt (2005) South African fruit farmers and pack houses engage in significant additional investments in order to comply with the requirements of food safety and quality standards, for access to the European supermarkets. On a typical litchi and mango export farm (without an on-farm pack house) the investment in terms of capital costs, extra managerial and training costs amounted to around R130 000 per farm, while the annual inspection and accreditation fees typically amount to around R6 000. The annual inspection and accreditation fees could rise to about R35 000 in the case of a farm with an on-farm pack house. In addition to adhering to food quality and safety standards citrus

producers need production of adequate volume, quality and specified cultivars, which requires entrepreneurial capacities and advanced business- and farming skills. These substantial investments and additional skills are obviously out of reach for many smaller growers.

A large proportion of South Africa's top quality fruit is selected for export by agents who coordinate transport, repacking and marketing to supermarkets in Europe. On the farms from where these export fruits are sourced product deterioration and losses are reduced by means of various treatments and actions in the pre-harvest, harvesting and post-harvest stages such as storage and transportation. However, these export supply chains are normally longer, involving more intermediaries and more intensive fruit handling resulting in a longer time lapse from harvesting to consumption. Normally fruit that was sorted and bulk-packaged at the farm level pack house is often subject to another process of resorting and repackaging at the supermarket distribution / repack facility in the export market in order to reduce quality variability that developed in the fruit within the supply chain between the farm gate and the supermarket. This could lead to breaking the cold chain, more produce handling and chances of contamination and losses.

3. Methodology

This paper reports results from a larger more comprehensive inter-disciplinary study, which combines Agricultural Economics and Microbiology to identify issues and problems in the citrus export chain. In order to do so we physically followed several consignments of citrus exports from the orchards in South Africa, via the pack house and the South African harbour to their final destinations (harbour cold storage facility, retail distribution centre, repacking facility and supermarket) in Rotterdam (Netherlands), Antwerpen (Belgium), Hamburg (Germany) and Stockholm (Sweden) where we sampled the fruit, and reviewed the sanitary conditions as well as the compliance with the private standards in these various end destinations. In the process we were able to monitor the behaviour of the different agents in the chain and assess the economic implications of their actions. An overview of the citrus supply chains relevant to the investigation is shown in Figure 1.

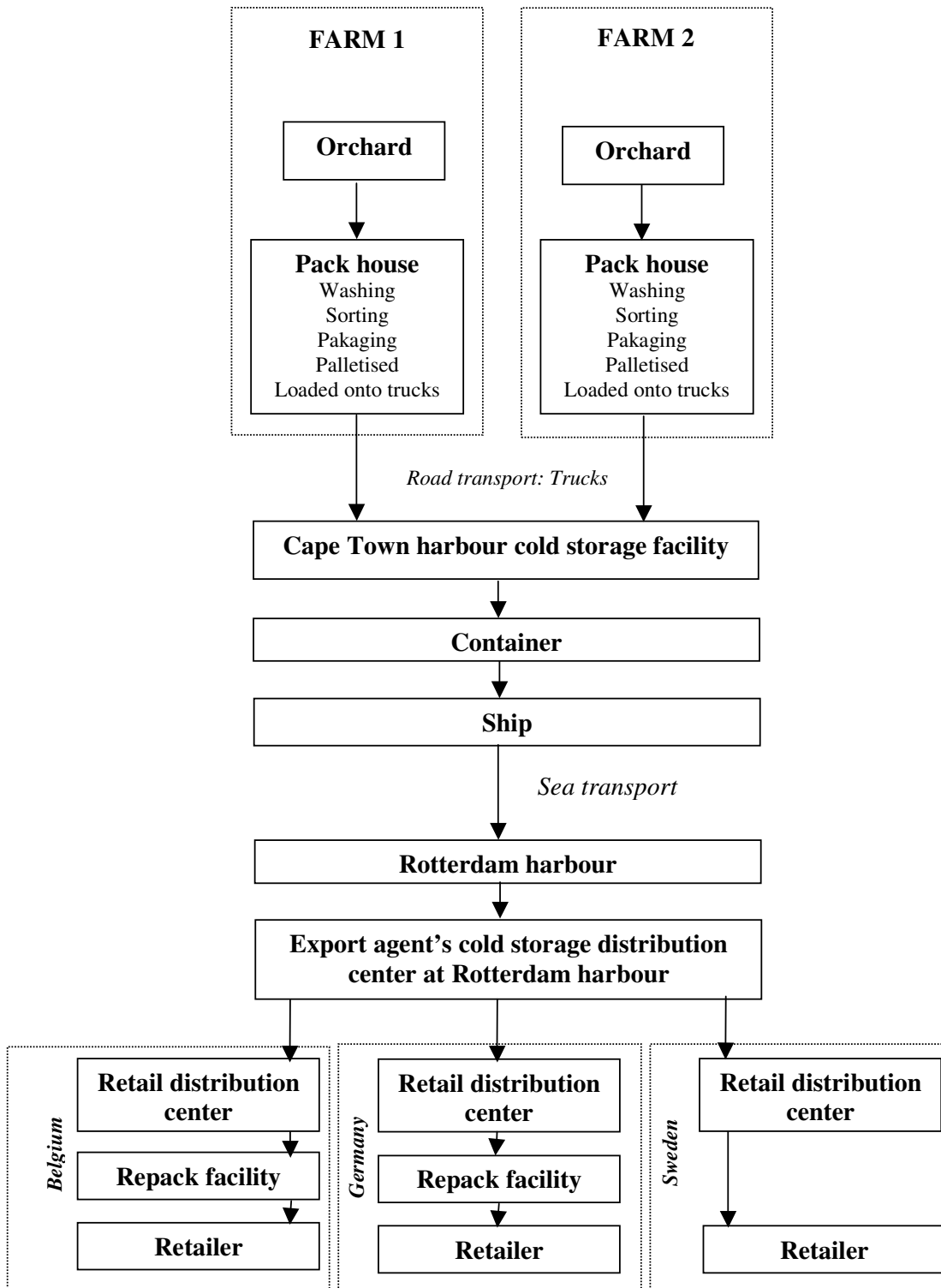


Figure 1: Overview of the experimental citrus supply chains

From a microbiological perspective the research endeavoured to develop a microbiological profile of the fruit and the fruit environment (e.g. packaging material, floors, walls, air,

working surfaces) from the farm to the final consumer. These findings were then combined with economic analysis which include: (a) the functioning of the chains (the flow of product, information and money); (b) the processes within the supply chain and the behaviour of the different actors (especially regarding fruit handling) impacting on fruit quality; (c) issues like liability, risk, ownership; (d) financial gains at various stages in the supply chain (up to the payment of farmers after completion of the supply chain); and (e) quantity and value of losses incurred within the selected supply chain.

We report here some of the preliminary results of the investigation based on observations of produce handling and hygiene practices within the supply chain. The results presented in this paper focus largely on a comparison of the experimental observations with various relevant components of the EurepGAP control points and compliance criteria for fruit and vegetables (EurepGAP, 2004a), in order to investigate the possibility of parallel standards in the supply chain. There are three types of control points within the EurepGAP standard that producers need to undertake to obtain EurepGAP recognition: “Major musts”, “Minor musts” and “Recommendations” (EurepGAP, 2004b). For “Major musts” 100% compliance is required, while 95% compliance is required for “Minor musts”. No minimum compliance percentage is established for “Recommendations”. These types of control points were used to identify the most critical discrepancies between the standards required by South African producers in terms of EurepGAP and the European supply chain role players such as repackers, transporters and retailers, by focusing on observations relevant to “Major musts” and “Minor musts” control points.

4. Key Observations from the citrus export chain

4.1 Comparing the observed standards in Europe with EurepGAP requirements

Within this section the observations from the citrus supply chains in the European market were compared to the relevant components of the EurepGAP control points and compliance criteria for fruit and vegetables. The following components of EurepGAP were selected as being applicable to both farmers and potentially to the role-players in the rest of the chain (such as cold storage / distribution facilities):

- Traceability

- Record keeping and internal self-inspection
- Site history in terms of risk assessment
- Site management (recording systems and visual identification or reference systems)
- Hygiene
- Facility management requirements
- Waste and pollution management, recycling and re-use
- Worker health, safety and welfare

It is important to note that the comparisons made within this section are based on initial results obtained through visual observations within the various facilities within Europe during the experimental supply chain visit.

4.1.1 Traceability and reference systems

Within the EurepGAP protocol traceability is a “Major must”, while a visual identification or reference systems in the facility is a “Minor must”. In terms of traceability the EurepGAP registered product must be traceable back to and traceable from the registered farm where it has been grown. Observations revealed indications of traceability systems in terms of record-keeping practices, designated fruit storage areas in buildings and labels on citrus fruit boxes. However, two scenarios were observed that could have detrimental effects on traceability within the supply chain. Even though electronic traceability systems are available throughout the export chain, traceability is often lost towards the end of the chain due to informal repacking practices at the retail end where you often find a total mixing of fruit per region and country of origin resulting in cross contamination and potential consignment rejections.

The first scenario involves the potential loss of traceability systems in cases where fruit are repacked. This process is often required in the latter stages of the supply chain to repack fruit from bulk packaging material to retailer specifications requirements. Re-packing is also often done by export agents in cases of product deterioration, in order to remove fruit of inadequate quality. However, the repacking procedures are a cause for concern from a traceability point of view. It quite often leads to the destruction of the traceability system. For example, fruit from different batches and different countries (with different quality and safety standards) happened to be mixed during the repacking procedure and the traceability link between

repacked fruit and the original bulk packaging is lost. Repacking involving the mixing of fruit from different suppliers was observed at all the repacking facilities.

The second scenario involves the sale of loose fruit by many European retailers (including the three retailers visited). Thus, consumers can touch individual fruit prior to purchasing as part of their purchasing decision process, introducing a potential contamination source for the fruit on the shelves. Furthermore consumers could theoretically move fruit between display baskets. This could also lead to a mixing of fruit per region and country of origin resulting in cross contamination and potential consignment rejections.

Future investigations will have to be conducted to determine the nature and adequacy of the traceability systems of European supply chain role-players, in order to facilitate comparisons with the standards of EurepGAP accredited farmers.

4.1.2 Hygiene

A summary of important produce handling hygiene requirements specified in the EurepGAP Control Points and Compliance Criteria that could be relevant to other supply chain role-players in Europe is shown in Table 2.

Table 2: A summary of the produce handling hygiene requirements of EurepGAP and the available experimental observations

Requirement¹:	Level:	Negative observations?
Hygiene risk analysis (performed, documented, annually updated)	Minor must	No
Hygiene procedure implementation (including aspects related to containers, equipment, transportation, physical-, chemical- and microbiological contaminants)	Minor must	No
Workers must have access to clean toilets and hand washing facilities, in the vicinity of their work	Minor must	No
Evidence that workers have received verbal and documented understandable instructions in the relevant aspects of produce handling hygiene, including personal cleanliness (hand washing, wearing of jewellery, fingernail length, etc.), clothing cleanliness and personal behaviour (no smoking, spitting, eating, chewing, perfumes, etc.)	Major must	No
Evidence that workers are complying with the hygiene instructions	Minor must	Yes, in: Port terminal (n=1) 1 distribution centre (n=3) 1 repacker (n=2)

¹(Adapted from the EurepGAP Checklist: Fruit and Vegetables, Version 2.1, EUREPGAP (2004a))

In terms of hygiene aspects, a number of inadequacies were observed in the chain. Physical contamination and rotten fruit were observed in all the cold storage distribution facilities, as evident from the example in Figure 2 below. No evidence of chemical contaminants was observed. Some floor cleaning actions (sweeping and washing) were observed during the visits, but the cleaning actions generally only dealt with the passageways and did not involve cleaning between the shelves (where rotten fruit sometimes accumulated). These observations raised questions regarding the risk assessment basis of the hygiene programs in the various facilities.



Figure 2: Physical contamination (pallet splinters) and an example of microbial contamination (rotten orange) on the floor of a distribution cold storage facility in Europe

A number of observations revealed that, in some instances, the workers did not engage in proper hygiene behaviour. In one of the facilities, workers continued working and touching fruit, after a tea break (within which they smoked and ate outside the building) without washing their hands. None of the facilities' workers wore protective hygiene clothing (such as gloves, coats, hair nets) and some workers smoked while handling fruit.

Equipment hygiene is particularly important in the context of fruit repacking facilities, where fruit comes into contact with repacking equipment. The equipment hygiene conditions within the repacking facility that was visited in Europe were not up to standard (Figure 3).

The last set of hygiene observations in this discussion relates to produce transportation hygiene and whether containers are used for fresh produce exclusively. Ten sea freight containers arriving at the harbour distribution centre were investigated by means of visual

observations and microbiological sampling. The visual observations revealed that eight of the containers were relatively clean. However, two of the investigated containers were damaged, dirty, wet and rusty and one of the containers contained a definite foul chemical odour even though it looked clean. An example of these containers is shown in Figure 4.



Figure 3: Visible dirt on the final sections of the repacking equipment used for the repacking of the experimental fruit



Figure 4: Moisture, rust and pallet splinters on a container floor

4.1.3 Facility management requirements

A summary of important facility management requirements specified in the EurepGAP Control Points and Compliance Criteria that could be relevant to other supply chain role-players in Europe is shown in Table 3.

Table 3: A summary of the produce handling hygiene requirements of EurepGAP and the available experimental observations

Requirement¹:	Level:	Negative observations?
Cleaning and maintenance of produce handling facilities to prevent contamination	Minor must	Yes, in: 2 containers (n=10) Port terminal (n=1) 3 distribution centres (n=3) 2 repackers (n=2)
Cleaning and maintenance of produce handling equipment to prevent contamination	Minor must	Yes, in: 2 repackers (n=2)
Storage of rejected produce and waste material in designated areas	Recommendation	No
Storage areas for rejected produce and waste material in designated areas: routinely cleaned and disinfected	Recommendation	Yes,
Food industry application approval for cleaning Agents, Lubricants etc. that may come into contact with produce, and adherence to dose rates	Minor must	Yes, in: Port terminal (n=1) 3 distribution centres (n=3) 2 repackers (n=2) 3 retailers (n=3)
Use of breakage safe lamps or lamps with a protective cap	Minor must	Yes, in: Port terminal (n=1)
Restricted access of domestic animals to the facilities	Minor must	No
Adequate pest control measures in produce handling and produce storage sites to minimize ingress and avoid infestation	Minor must	No

¹(Adapted from the EurepGAP Checklist: Fruit and Vegetables, Version 2.1, EUREPGAP (2004a))

Examples of inadequate facility management practices were observed within the supply chains in Europe. The negative observations related to cleaning and maintenance of produce handling facilities and equipment has already been discussed within the section on hygiene issues. In terms of the management of rejected produce and waste material most facilities have designated areas for waste disposal. However, inadequacies were observed in terms of the routine cleaning and disinfecting of these areas in terms of waste accumulation and dirty waste containers (Figure 5). In one of the facilities a waste container was observed that was emptied, but not cleaned and disinfected as evident from the rotten orange remaining on the bottom of the waste container. The broken glass of a fluorescent light on the floor of one of the facilities indicated a discrepancy in terms of the use of breakage safe lamps or lamps with protective caps.



Figure 5: Inadequate waste container cleaning and disinfecting

4.2 Behaviour of supply chain actors and incentive structures

Within the supply chain followed, there seemed to be a misalignment in terms of the current incentives driving the behaviour of the role-players and the behaviour necessary for sustaining the added value of fruit in terms of quality and safety. An example of this misalignment relates to the behaviour of forklift drivers at the cold storage centre on the harbour. General harbour costs are extremely costly for role-players utilizing harbour facilities (such as vessels, containers and trucks). Consequently human behaviour is driven by harbour cost minimization through maximising time efficiency. The main driver of their behaviour is not the maintenance of fruit quality. Thus, the forklift operators on the harbour typically engage in quick fruit handling with potential positive and negative implications. On the positive side it could improve the maintenance of the cold chain from the ship to the cold storage facility on the harbour. On the other hand it may impact negatively on fruit quality due to careless fruit handling in terms of broken pallets, damaged boxes and bruised fruit. However, in some of the retail distribution centres the forklift operators also worked fast, but without pallet and produce damage. This might be a function of training or different incentive structures. It is important to note that the forklift drivers at the ports are often temporary workers, in contrast with those at distribution centres.

There is thus a need to investigate the nature of the current incentives driving the behaviour of the supply chain role-players in order to make recommendations regarding the alignment of

incentives to ensure sustained added value of fruit in terms of quality and safety throughout the chain.

5. Conclusion and recommendations

A number of voluntary standards have been introduced by European retailers to ensure that quality and safety of food products imported into the European market are not compromised. These quality and safety standards are a response to the demands of European consumers for high quality, safe agricultural produce. These systems generally entail a series of sector specific certification standards primarily designed to ensure the safety of food. It also includes production systems at farm level that respect worker health, -safety and -welfare, and in certain cases includes environmental and animal welfare issues (EurepGAP, 2004a). This paper raises a key policy question regarding the nature, purpose, integrity and consequences of these quality and safety standards. Fruit that is produced along the guidelines required by these voluntary standards conforms to the minimum quality and safety requirements. This implies that specific intrinsic value is embedded in the fruit through the adherence to the guidelines of these standards. The question is whether the intrinsic value is transmitted through the supply chain from production to the point of sale, if it is assumed that final consumers demand fruit with the intrinsic value as described above.

Preliminary indications are that there exists a discrepancy between the standards enforced before and after the farm gate in citrus supply chains. Observations suggest that these standards are strictly applied to the production and handling of fruit (especially on farm and pack house levels), implying that the transmission of the intrinsic value is seemingly well organised to the point in this case of the South African port. On the other hand the observations revealed that consequent stages of the fruit supply chain are seemingly not subjected to the same strict requirements laid out for producers, leading to fruit quality deterioration and financial losses for producers. This constitutes clear parallel standards in terms of fruit safety and quality standards between upstream and downstream sections of the supply chain. The results presented in this paper were also observed in the supply chain investigations conducted in previous production seasons (Korsten, 2005). This discrepancy results in a decline of the quality and safety of the fruit and a potential breach in the value created by the quality and safety standards in the chain. The lack of transparency within the

supply chain in terms of price, required standards to comply with and due diligence is a matter of concern and requires urgent attention for all role players in the supply chain.

It is hypothesized that only through coordination with producers, packing facilities, shippers, importers, repacking facilities and retailers can the supply chain produce and deliver the desired end product in terms of quality and safety dimensions. However, little coordination seems to take place to ensure that this intrinsic value reaches Europe intact and ultimately reaches final consumers – for whom much of the intrinsic value is created in South African orchards and packing facilities strictly governed by the quality and safety standards. The economic impact of the ineffective structures to facilitate the transmission of intrinsic value, as described, is a loss of value for the whole fruit supply chain and especially for primary producers who are required to invest in costly and very specific assets to comply with the safety and quality standards merely to gain market access and without guarantee that the returns will justify the investment in the specific assets. Furthermore, the risk borne by the producers is relatively disproportionate to their compensation in comparison to the other supply chain role-players. The primary policy issue is therefore the establishment of structures within the fruit supply chain – especially on the downstream end of the supply chain to ensure improved transmission of value.

Given the seeming lack of structures to effectively transmit the intrinsic value of fruit produced according to strict quality and safety standards – especially at the latter stages of the fruit supply chain, raises some questions regarding the true purpose of these quality and safety standards. Against the background that fruit is globally in over supply and in an effort to secure the cream of global fruit production for the discerning European market European importers and retailers are compelled to introduce mechanisms to provide a framework for securing the best quality fruit globally available. It could therefore be hypothesized that the quality and safety standards required by European retailers function more as a selection mechanism and is, from a retailer's point of view, an ideal and legitimate mechanism to procure only the highest quality fruit available on the globe.

An additional dimension of this hypothesis is whether current fruit quality and safety standards are truly based on European consumer needs, or whether these standards are determined in isolation by retailers without taking the actual needs of consumers into account? A misalignment between consumers' actual requirements for fruit quality and safety,

and the requirements enforced by the supermarkets within the supply chain would lend weight to the hypothesis that private standards function more as a selection mechanism more so than as a mechanism to ensure prescribed quality and safety levels for fruit.

If the safety and quality standards that are imposed on producers are unwarranted the economic impact thereof would be that producers would have made unnecessary investments and are currently incurring unnecessary running expenses. If this was the case the search and monitoring transaction costs that European retailers and/or importers would have had to incur to source the highest quality fruit globally is transferred to producers. Producers would therefore be “paying” for the retailer’s quality management in the procurement system. The primary policy issue is therefore that food safety and quality standards should be fair and transparent in their purpose and that the implementation of these standards should not leave the more vulnerable parties within the supply chain worse off in terms of financial losses or levels of risk that these parties are required to bear.

In terms of the current misalignment of incentives driving the behaviour of the role-players a need was identified to develop incentive structures throughout the supply chain that will lead to the behaviour necessary for sustaining the added value of fruit in terms of quality and safety.

6. References

- BREEDT, L. (2005). Capital investments on citrus export farms in South Africa. Unpublished mimeo, University of Pretoria, October 2005.
- EUREPGAP (2004a). *EurepGAP Checklist: Fruit and Vegetables*. Version 2.1, October 2004. Germany: EurepGAP c/o. FoodPLUS GmbH. Available on the World Wide Web at <http://www.eurep.org> .
- EUREPGAP (2004b). *General Regulations: Fruit and Vegetables*. Version 2.1, October 2004. Germany: EurepGAP c/o. FoodPLUS GmbH. Available on the World Wide Web at <http://www.eurep.org> .
- HENSON, S. & REARDON, T. (2005). Private agri-food standards: Implications for food policy and the agri-food system. *Food Policy*, Volume 30, Issue 3, June 2005, Pages 241-253.
- KORSTEN, L. (2005) Personal communication, Department of Microbiology and Plant Pathology, University of Pretoria, South Africa.
- PPECB (2004). *PPECB Export Directory*. Second edition. Published by the Perishable Products Export Control Board in association with Malachite Communications. Pp.2-8 to 2-9, 3-5.