TECHNICAL PAPER

# AIRFREIGHT TRANSPORT OF FRESH FRUITS AND VEGETABLES - A REVIEW OF THE ENVIRONMENTAL IMPACT AND POLICY OPTIONS

International Trade Centre

Monograph

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Study focusing on the issue of "air miles " (the number of miles (kilometres) a product has to be transported from the farmer/grower to various stages of production until it reaches the supermarket and the plate of the consumer) - outlines main policy perspectives surrounding the use of airfreight in food supply chains; looks at methodologies that have been used to consider the environmental impacts associated with the food supply chain; focuses on the approaches used to investigate fresh produce production and transport; provides a literature review of farm to fork studies, as well as an analysis of the energy and emissions associated with the production, trade and consumption of fresh fruit and vegetables; investigates some policy options that may be used to reduce carbon emissions in the fresh fruit and vegetable supply chain; includes bibliography (p. 35-37).

Descriptors: **Fruit, Vegetables, Horticultural products, Supply Chain, Air Transport, Freight Forwarding, Environmental Management**.
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# Executive Summary

The increasing international trade in fresh fruit and vegetables has started to raise concerns about the distance that food travels and the emissions associated with its transport. The term food miles has been coined to capture the number of miles (kilometres) that food travels through a supply chain, from producer to consumer. The simple logic of food miles is the further that a food product has travelled, the more energy is consumed, the more greenhouse gases are produced, and the greater the impact on the environment. Food and air miles are simplistic concepts and not indicators of sustainability or environmental impact.

A leading UK organic certifier, the Soil Association recently proposed changes in the certification criteria for the labelling of airfreighted organic fruit and vegetables. The Soil Association was contemplating removing the eligibility of airfreighted produce to be labelled organic1. In response to this proposed change, the International Trade Centre commissioned Lincoln University's AERU to undertake a review of the literature around food miles and in particular studies that consider airfreight transport of fresh fruit and vegetables.

There is growing awareness and concern of climate change. The concepts of food miles and air miles have gained some attention and this has led to a variety of initiatives in the UK to implement carbon labelling and to improve the efficiency of the food supply chain. For example, the UK's Carbon Trust is underway with a carbon labelling initiative, Tesco's have recently announced by that they will invest £500 million to implement carbon labelling of products in their UK supermarkets, and Marks and Spencer are investing £200 million to reduce its carbon footprint over the next five years. This increasing concern appears to be influencing the call for Country of Origin Labelling (COOL) in the USA and the growing demand for locally produced food.

This raises a number of issues such as the validity of food air miles as a concept. Food/air miles only consider the transport component and ignore the full energy and emission associated with the production and consumption of the product. This also doesn't account for factors such as the total transportation of a product from production to consumption and the importance of that product in the shopping basket. Moreover, there is concern that this potential move by the Soil Association may be a disproportionate reaction to the issue of airfreight and in particular this may have an adverse impact on developing countries. For example, over one million African livelihoods are dependent on airfreighted fresh fruit and vegetable exports (Legge et al., 2006). Analysis of the carbon emissions for developed and developing nations show some stark contrasts. For example, Africa's emissions are 40 times lower per capita than the United Kingdom's.

The studies reviewed for this report include life cycle analysis (LCA), input-output, and hybrid approaches. However, no study offered a complete cradle to grave assessment. The studies varied in their scope tending to focus on production systems and/or transportation systems. Several of the studies investigated other aspects of the supply chain including supermarket to home transport, cooking and refrigeration, and waste disposal. The studies varied in terms of their unit of analysis, spanning EU, country and product level analyses.

Two Dutch studies calculated the greenhouse gas emissions associated with household consumption of fruit and vegetables. These studies estimated that fruit and vegetable consumption accounts for 9 to 10 per cent of household and per capita CO2e emissions per

[1] (May, 2007) Airfreight Green Paper: a basis for discussion. Should the Soil Association tackle the environmental impact of airfreight in its organic standards?

annum (Kramer, Moll, Nonhebel & Wilting, 1999; Nijdam, Wilting, Goedkoop & Madsen, 2005).

In a study of the relative transport contributions to UK food transport, cars were found to account for the largest number of food kilometres (48 per cent of total kilometres) although UK heavy goods vehicles (HGV) operating locally and in Europe were the largest emitters of carbon dioxide (57 per cent of total CO2 emissions) (AEA Technology, 2005). Airfreight accounted for only a small share of total carbon dioxide emissions (10 per cent). For the period 1992 to 2002 UK urban food kilometres increased by 27 per cent, HGV food tonne kilometres increased by 36 per cent, and airfreight increased by 140 per cent. These trends have led to a 12 per cent increase in the CO2 emissions associated with food.

A UK study focusing solely on the transportation of lettuce, apples and cherries found that UK and Spanish grown lettuces had the lowest average CO2 emissions (44-45kg CO2/tonne) (Mason, Simons, Peckham & Wakeman, 2002). Apples which on average travelled the furthest (8,767 km) emitted 2.4 times more CO2. Cherries which on average travelled 7,751 km emitted the largest amount of CO2, 80 times more CO2 than for the lettuce. The main factor influencing the higher CO2 emissions for the cherries was the proportion of the imports airfreighted from North America. In contrast the New Zealand sourced apples were sea freighted and therefore had lower CO2 emissions. An important observation made in this study was the expert advice that it would be climatically and economically challenging to increase the UK grown supply of cherries and lettuce. In the case of apples, this was possible for only limited varieties. Mason et al.'s observation about the limited opportunity for replacing imported produce is even more significant when the United Kingdom's low level of self-sufficiency in fruit (9 per cent) and vegetables (62 per cent) is considered (Garnett, 2006).

Although it is predicted that fresh fruit and vegetable consumption is likely to continue to rise, and that airfreight is expected to continue to grow, the relationship between these two trends is more complex. DEFRA (2007) suggest that there are several factors that will influence the proportion of fresh produce airfreighted including labelling, airfreight costs and consumer preferences. MacGregor and Vorley (2006) observe that there is no clear evidence linking airfreight expansion to fresh fruit and vegetable consumption.

Product based LCA studies offer some important perspectives on the relative contribution that airfreight transport makes to the total greenhouse gas emissions associated with fresh fruit and vegetables. Although airfreight is an important contributor to fresh produce CO2 emissions, several studies have found that heated greenhouse production systems, home cooking methods, and consumer shop to home transport choices can also be significant contributors to a product's CO2 emissions. For example, a consumer's shopping trip of more than 10 km to solely purchase one kilogram of fresh produce will generate more CO2 emissions than the airfreighting of one kilogram from Kenya (van Hauwermeiren, Coene, Engelen & Mathijs, 2007).

Several studies have been completed investigating the emissions and energy associated with the apple supply chains sourcing fruit locally and from further a field (e.g. EU and the Southern Hemisphere). Canals, Cowell, Sim and Besson (2007) did not find that clear support that a local (UK) supply would necessarily be superior to the alternative European or Southern Hemisphere supply scenario. The period of supply and therefore the relative storage period was as an important an element, as was the road transport of European sourced fruit. For example, UK sourced fruit had the lowest energy use during its supply to market in the months of January and October, and the highest in August where the energy use overlaps with apples sourced from the Southern Hemisphere.

Canals et al.'s findings are further supported by Saunders, Barber and Taylor's (2006) LCA study of UK and New Zealand apple and onion production systems. Interestingly this research shows that the CO2 emissions associated with the UK storage of locally produced onions is greater than from the sea freight of NZ onions shipped to the UK. In case of apples, the key driver of the greater CO2 emissions intensity of UK produce (271.8 kg CO2/Tonne) over NZ produce (185.0 kg CO2/Tonne) was the cold storage of the UK apples (85.8 kg CO2/Tonne).

Vringer and Blok (2000) compared the energy use associated with Dutch and Kenyan cut flower production. Airfreighted Kenyan roses transported to Europe were found to have a lower total energy footprint than the Dutch grown roses.

Several key themes emerged through the literature review. Few studies offer a complete farm to fork analysis and the studies varying scope and assumptions limit the comparisons that can be made between the studies. The distance travelled and in particular the transport mode used appears to have the greatest influence of CO2 emissions. However, consumer supermarket to home transport, heated greenhouse production, storage, and food preparation methods can also be significant contributors to total CO2 emissions.

The review highlights the growing concern regarding climate change and the carbon footprint associated with food production. The varying scope and assumptions of the existing studies makes it difficult to enable comparisons of the emissions and energy associated between different components of the supply chain. Although airfreight transport has the highest emission profile, when the whole of a product to a market is considered the emissions associated with air transport tend to be low. Most of the studies assume that the importing country could supply the market and reduce or replace imports. For many products this is unlikely to be the case and even where this may be possible this would be likely to lead to an intensification of production systems thereby raising energy and emissions intensity.

Most of the studies assume that alternative sources of supply could be found closer to the market. Within the EU it is clear that there are real limits to the expansion of fruit and vegetable production. Moreover, current EU initiatives such as the Single Farm Payment are likely to lead to less intensive production in the EU. When the low EU per capita fruit and vegetable consumption (typically below health guidelines) is considered in addition to the issue of EU farm production, it appears most likely that EU countries will typically continue to increase their proportion of imported produce.

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