Characterization of Postharvest Handling Chains of Cut Ornamentals at Exporter Sites in the Western and North Western Provinces of Sri Lanka

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ABSTRACT

The export-oriented floriculture industry in Sri Lanka earns foreign exchange and generates employment. However, the failure to meet expected quality standards in cut ornamentals is an obstacle to expand this profitable industry. Insufficient quality management or improper actions at different stages of handling cause a quality loss of products. In Sri Lanka, no formal study has been conducted to identify the handling chains involved in export-oriented cut flower and foliage production. Therefore, a survey was conducted using a sample of exporters in Western and North Western Provinces to identify the handling chains involved and associated postharvest problems in export of cut ornamentals. Data were collected using a structured questionnaire and interviews. Sub-standard quality of supplies from outside growers, inappropriate packaging and transport methods, failure to maintain cold chain throughout, damages caused by extensive security checks at various points have caused quality loss of produce. Moreover, non-adoption of postharvest treatments to improve water status of cut stems and foliage could have a negative impact on their end-user shelf life. Results of this study recognize areas for quality improvement in handling chains at exporter sites. Competition with other countries, competition among local companies, high cost of production and lack of technology were the major marketing problems faced by the exporters. Further research will estimate the end-user life of different cut ornament products after simulated export.

KEYWORDS: Cut flowers, Cut foliage, Floriculture exports, Handling chains, Postharvest quality

INTRODUCTION

Floriculture is a science and practice of growing, harvesting, storing, designing and marketing of cut flowers, potted flowering plants, foliage plants, bedding and garden plants, cut cultivated greens and propagative materials (Anon, 2010). Export floriculture sector in Sri Lanka earns foreign exchange and contributes to employment generation in the country (Anon, 2012). In year 2011, Sri Lanka earned US$ 14.8 Mn worth of foreign exchange by exporting floricultural products. It indicates an average growth of 9% over the year 2010 (Anon, 2011). The country's diverse agro-climatic conditions can accommodate a range of tropical, sub-tropical and temperate species of ornamentals. This, along with the availability of skilled and educated workforce, gives promise for the expansion of the industry (Niranjan and Gunasena, 2011). Sri Lanka's major exportable floriculture product categories are ornamental foliage plants, cut decorative leaves, cut flowers, aquarium plants, landscaping plants and tissue cultured plants. Currently 106 exporters of floricultural products have been registered under the Export Development Board (Anon, 2012).

Cut flowers and cut decorative foliage accounted for around 50% of the total floriculture export earnings in Sri Lanka in 2010. However, Sri Lanka's share in the world market is 0.1% (Anon, 2011). The major market for Sri Lankan floriculture products is Europe which was the destination for 62% of total floricultural exports in year 2009. Other major import markets are Japan, South Korea, and Middle Eastern countries (Dhanasekara, 2002).

One obstacle for expansion of cut flower and foliage exports from Sri Lanka is the failure to meet expected quality standards required by the importing countries (Anon, 2012). Exporters receive products from different supply channels (Anon, 2012). Insufficient quality management or improper actions at different stages of handling cause a quality loss of products (Van Doorn and Tijskens, 1991). Produce that is visually still acceptable when sold may, however, have a short vase life, which will result in an additional (unknown) loss of consumer satisfaction. Postharvest quality and vase life of cut ornamentals could be maintained throughout the distribution process by adopting correct handling practices, including proper postharvest treatments. A study

conducted in Dutch cut flower industry revealed that physical parameters such as the temperature of handling environment, ethylene concentration, lead times (i.e. time a product needs to pass through an operation), and the knowledge level and managerial performance with respect to product quality have contributed to significant loss of vase life downstream in the channel (Hoogerwerf et al., 1994).

In Sri Lanka, no formal study has been conducted to identify the handling chains involved in export-oriented cut flower and foliage production. Therefore, this study was conducted with a view to understand the handling chains involved in export of cut ornamentals and associated postharvest problems along the chain. The objective is to recognize areas for quality improvements in order to enhance the postharvest performance of cut ornamentals exported from Sri Lanka.

MATERIALS AND METHODS
Sampling and Data Collection

Western and North Western Provinces, due to their favorable logistics, have become the major location for export floriculture firms. Therefore, a survey was conducted using a sample of 33 export companies registered under the Sri Lanka Export Development Board. The study was conducted from January to May 2013.

Data were collected using a pre-tested structured questionnaire and face to face interviews. The information collected include but not limited to: main products and their origin, quality of supplies, pre-treatments, postharvest handling practices, species-specific postharvest problems, financial and marketing aspects, sanitation and consumer satisfaction.

Data Analysis

Data were analyzed using STATA (StataCrop, USA) program.

RESULTS
Product Types

According to the results, out of the total range of products, 60% of cut decorative leaves, 32% of unrooted cut stems with leaves and 8% of rooted stems of products were exported to the international market. Cut flowers were rarely exported since the products were not up to the international quality standards and the high cost of production involved.
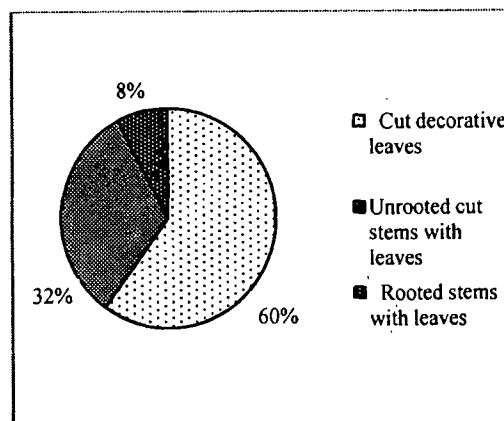

Figure 1. Products type distribution among the exporters

Out of the total production 89% was exported to the international market while only 11% was sold in the domestic market.
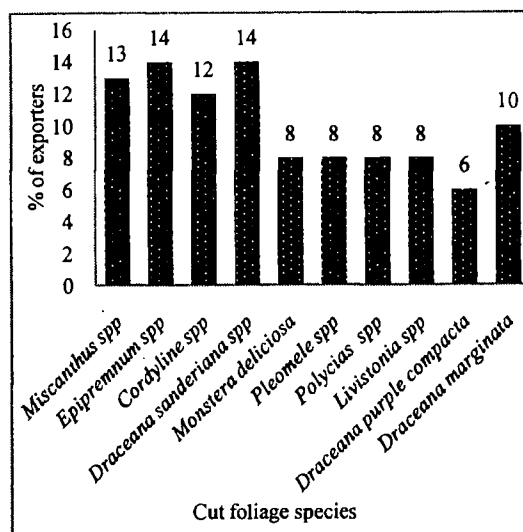

Figure 2. Distribution of cut foliage species among the exporters

The majority of the respondents (14%) exported Epipremnum spp. and Dracaena sanderiana followed by Miscanthus spp. (13%) and Cordyline spp(12%) (Figure 2).

Sources of Supply

Exporters had different systems of obtaining products. According to the results, 81% of exporters obtained products from outside growers and 100% of products were not in excellent quality. (Miscanthusspp, Epipremnum spp, Chrysalidocarpus leutescens and Caryotaurens). Among the outside growers 83% of growers cultivated plants in open fields without providing artificial shade like net houses or poly tunnels. Other 16% of growers used net houses for the cultivation.

Majority of the outside growers (92%) used soil without adding any other potting media. Eight percent of growers used potting media with coir dust and compost added to the soil. Harvested cut foliage and stems were delivered to the export companies without giving any special chemical treatments.

About 98% of outside growers delivered their harvest by public transport (e.g. by bus) or by private transport systems such as motor-bikes and small trucks without any special arrangements to maintain the cold chain. Only 2% of growers used refrigerated transport systems particularly for *Codiaeum* spp. *Aglaonema* spp., *Calathea* spp. and *Philodendron* spp.

Majority of the outside growers (81%) did not use proper packaging to deliver harvest to the exporters. They packed cut foliage as tight bundles. Only 19% of outside growers used a proper packaging system consisting of plastic containers.

Products received at the export companies were screened through a quality controlling system before being purchased. Products below the export quality standard have been rejected at this point.

Table 1.Frequency of rejecting the supplies provided by outside growers at the exporter sites.

Rejection % /Month	% of exporters
Less than 5	26
5	9
10	8
15	8
20	33
30	13
35	3

As shown in Table 1, the rejection percentage at 26% of exporters was below 5%. However, about 33% of exporters had rejected 20% of outside supplies per month. Major reasons for rejection were identified as products not in the right stage, improper colour, wilting problems, pest and disease problems and mechanical damages during transport.

Approximately 78% of the exporters obtained products from their own nurseries. Because some exporters obtained products both from outside growers and owned nurseries, the total percentage of exporters exceed 100%. Eighty two percent of exporters stated that the products obtained from owned nurseries were' excellent' in quality while 18% mentioned that they were good in quality. Most of the exporters (96%) used net houses /

shade houseas the growing environment for plants while 4% of exporters used open field. Among the exporters, 99% used normal soil + compost +coir dust as the growth medium and 1% used soil alone as the growing medium.

Harvesting and Postharvest Handling Practices

Harvesting

Cut foliage should be harvested during a cool part of the day so that their metabolic rate is low and removal of field heat is less difficult (Joyce and Faragher, 2012). In most of the nurseries (93%), harvesting was not done at specified times of the day. It was because the focus was on time of dispatch of the order to meet the customer requirement. However, in 7% of nurseries harvesting was done in the morning. Cut foliage was harvested manually using simple tools like secateurs or knives. A majority (50%) of exporters used water + chemical agent (Chlorox) to disinfect harvesting tools. A disinfectant agent + water were used by 21%, a chemical agent + disinfectant agent + water was used by 20% while only 9% used water alone for this purpose.

Grading

Cut foliage were trimmed, graded and sorted according to customers' requirements, to eliminate diseases incidence, physical damages and insect attacks. Expected quality standards varied with different cut foliage species.

Pre-treatments

Pre-treatments are applied to cut ornamentals before exporting with the objective of maximizing postharvest longevity. (Joyce and Faragher, 2012). However, 79% of exporters did not use any pre-treatments to extend postharvest life. Only 21% exporters used treatments to control pests and diseases.

Maintaining Cool Chain

According to the results; 67% of exporters used pre-cooling systems, which consisted of walk-in cold rooms, before dispatch. However, 33% of exporters did not use a pre-cooling system. The reason was the close proximity of their nurseries and packing houses to the airport.

The time of pre-cooling was different among the exporters. Sixty eight percent of exporters pre-cooled the produce after grading, 35% did after packaging, 7% did during packaging and 4% did immediately after harvesting (Table 2).

Table 2.Time of pre-cooling

Time of cooling	% of exporters
Immediately after harvest	4
After grading/sorting	68
During grading/sorting	0
During packaging	7
After packaging	35

In addition, the temperature used in cold storage varied among exporters. About 56% of exporters stored their products at 15°C, while 28% and 16% stored at 20°C and 10°C, respectively.

Nature of Packing

Majority of the exporters (77%) used dry packing system and 22% of exporters used wet packing, i.e. wet cotton wool soaked in water. All exporters used corrugated cardboard boxes as the primary package.
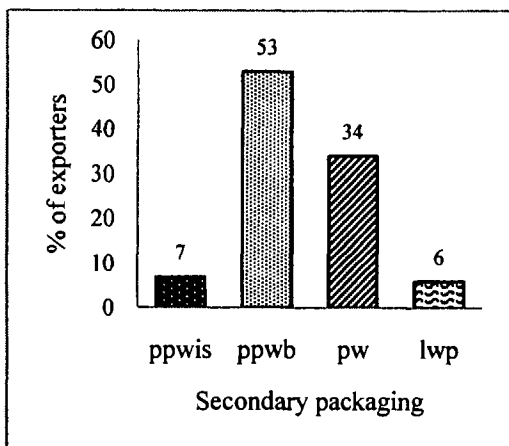
Note: ppwis-Paper and polythene wraps for individual stems; ppwb-Paper and polythene wraps for bunches; pw-Paper wraps; lwp-Lining with paper

Figure 3. Distribution of secondary packaging among the exporters

Out of total respondents 53% of the exporters used paper with polythene wraps for individual bunch. Thirty three percent of exporters used only paper wraps while 7% used paper with polythene wraps for individual stems. Six percent of exporters used a lining with polythene in pack boxes (Figure 3).

The results revealed that 73% of exporters delivered their products to the airport using normal temperature transport systems while only 27% used refrigerated trucks. All

the exporters delivered their products to importing countries under cool condition by air.

Postharvest Problems

Damages have taken place due to over cooling during cold storage. Yellow patches, wilting, and black color margin in leaves were the most common symptoms. High microbial growth could be observed due to the packaging as a result of improper handling of workers.

Quarantine Regulations

Quarantine regulations differ from country to country and European market require high quality standards than the other markets (Anon, 2012). All floriculture shipments should accompany a phytosanitary certificate issued by the Department of Agriculture. In addition, the Clearance Certificate from Forestry Department, CITES certificate by the Department of Wild Life Conservation, and Country of Origin/GSP Certification were also needed.

DISCUSSION

All export companies considered in this study had their own nurseries. Nonetheless, many exporters source products from small and medium scale outside growers. It is mainly due to the inability to fulfill the total requirement from owned nurseries. However, exporters revealed that the products from outside growers rarely match the required quality standards. The possible reasons could include substandard cultivation practices, such as the use of soil without adding compost and coir dust and open field conditions. Harvesting methods such as harvesting of foliage which are not in the correct maturity stage, inappropriate packaging systems such as compact bundling of foliage in poor quality containers could also contribute to increase the rejection level.

As a solution, large scale exporters can provide technical training programs for their suppliers to obtain good quality products from them. Further, cash advances and other extension services can also be provided in collaboration with government organizations.

Rejections and complaints have been received from foreign buyers frequently. Major reasons for this were revealed as over-cooling or heating damages, low quality packaging materials, long internal transport, and damages during transport, wilting problems and low quality products. It is important to identify the best range and duration of cool storage for different species to

avoid low temperature injury. Wilting problems at the end-user could be caused by poor water status of the cut stems. Postharvest pulse treatments with surfactants (wetting agents) and preservatives, applied before dispatch can improve the water status of cut stems. Quality of products degrades due to inappropriate handling practices by the workers. Frequent supervision and providing necessary skills to the workers would minimize that problem.

According to the exporters interviewed in the present study, the major problems they face are: competition with other countries, competition among local companies, high cost of production, lack of advanced production and postharvest technology and extensive security checks. With increasing competition among local exporters due to new entries, they often move to unfair business practices such as under cutting (competitor finds out the price offered to a foreign buyer, and makes an offer at a cheaper price). China is the most recent emerging competitive country in Asia providing a large amount of quality cut foliage products to the market.

Since the costs of planting materials and other required inputs are high, the initial investments needed for the export production of foliage is comparatively high. Extensive security checks in roads and airports cause damages to products and packaging material which ultimately results in high level of rejections at destinations.

CONCLUSIONS
Modern, reliable and cost effective postharvest handling techniques would be are needed for production of high quality cut ornamentals in Sri Lanka.

ACKNOWLEDGEMENTS

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