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**Eco-innovative package design for fresh vegetable export case study of bell peppers from the royal project**

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**Abstract**

The consumer packages for export of bell peppers from the Royal Project were designed in accordance with packaging requirements gathered from marketing survey and style and dimension of the formerly developed transport packages. The concept of eco-package design was utilized in order to reduce packaging materials, stimulate reuse and promote recycling. In parallel, the concept of universal package design was applied to obtain the finish package style which is easy to fill, easy to hold, easy to open, easy to take out and finally easy to dispose. In addition, all of basic package functions e.g. containing, protection, information and sale promotion were maintained. The developed packages were die-cut boxes made from kraft paper (KP 230) with 195×100×84 mm outside projection dimension. Both structural and graphic designs clearly create natural look. Furthermore, with special design structure to minimize waste during manufacturing, saving of 64.3% packaging materials were achieved. Graphic design was simple with one color printing and the logo of the Royal Project Foundation was placed on clearly visible site to indicate the produce origin.

**Keywords:**

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## **Introduction**

Fresh vegetables marketed by the Royal Project Foundation have shown commercial potential in both domestic and foreign markets especially- bell peppers which made successful export to Singapore. In the near future, England has been set as one of the targeted exporting markets (Market Department, 2006). Therefore, development of consumer packages for exporting bell peppers were required to protect the inside produces and complied the packaging legislations particularly the Packaging and Packaging Waste Directive: Essential Requirements in England that are more strictly. Based on the requirements, packaging volume and weight must be minimum necessary for safety, hygiene and acceptability of the packaged product for the purchaser and end-user; suitable for recycling, composting or energy recovery, and suitable for re-use if re-use is intended or claimed; and any noxious or hazardous constituents of packaging must be minimized to reduce the impact on the environment when it is finally recycled, composted, incinerated or landfilled as well as the combined concentrations of lead, cadmium, mercury and hexavalent chromium must not exceed 100 ppm, except in plastic crates and pallets used in a closed loop system or in containers made from lead crystal or recycled glass (Envirowise and Incpen, 2008). In addition, the environmental concerns become one of the major factors regulating package design.

Development of eco-innovative packages for exporting the Royal Project's bell peppers based on principals of eco-package design and universal design to achieve all of the mentioned requirements were reviewed in this paper.

## **Materials and Methods**

1. The packaging requirements were identified based on the results from the study on packaging status of exporting fresh vegetable (Praditniyakul et.al, 2008).
2. The design concept and the appropriated outside dimension of the consumer boxes were developed according to the packaging requirements.
3. The structural design was developed with accordance to both design concept and packaging requirements. The 3D-mock up was made and tested to evaluate its basic functional properties by eyes. The best 3D-mock up was finally obtained from adjusting the limitations of the prior 3D-mock up and finished structural prototypes were made from kraft paper (KP 230)
4. The finished structural prototypes were evaluated to find out the percentage of decreasing in packaging materials by weight compared to the prior developed consumer boxes made from corrugated paper board (DP/310/CA105/KI125), flute E (Figure 1) Five box samples were conditioned at 28 °C and 65% relative humidity for 48 hours (ISO187) prior to weigh by four decimal balance. Weight reduction percentage was calculated based on packing size of 36 fruits.
5. The graphic designs were developed and the final prototypes were made.



**Figure 1** : The Prior developed corrugated paper board box.

## **Results and Discussion**

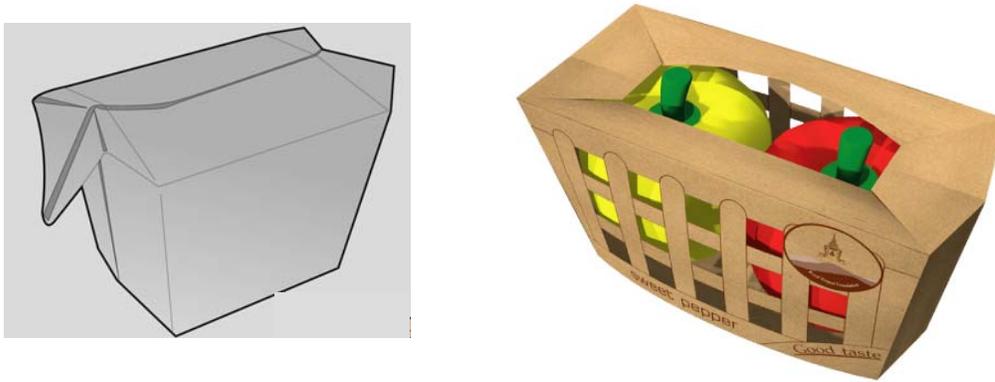
### *Packaging Requirements and design concept*

Based on status of packaging utilization and produce handling during transportation and storage from farm to Chiang Mai Airport, the packaging requirements and design concept were identified. The characteristics of the developed boxes should be as following:

- Having enough strength for long distance transportation.
- Convenience to pack and use.
- Fitting to inside dimension of prior developed transportation boxes (Tungsangprateep et.al, 2007).
- Packing size of two fruits which are suitable for single buying.
- Providing stacking ability.
- Possibility for commercial scale production.
- Minimizing packaging materials as well as packaging waste.
- Using environmental friendly packaging materials.
- Having simple graphic designs which give the images of nature, environmental friendly and premium quality produces from the Royal Project Foundation.

### *Structural and graphic designs*

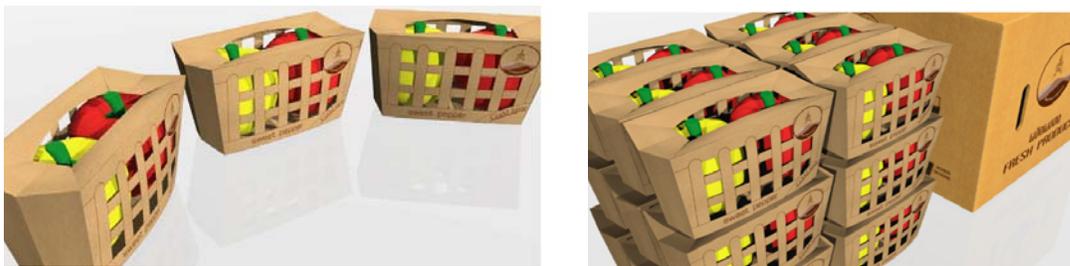
To achieve the developed packaging requirements and design concept, the principles of eco-package design and universal package design were applied. The initial sketched and finished designs are shown in Figure 2. The developed packages were made from kraft paper (KP230) and printed in single brown color. Two front panels were punched and printed to created simple wood fence style. The clearly visible logos of the Royal Project Foundation were placed on right top of the panels.



**Figure 2:** The sketched and finished developed boxes. *Reduction of packaging materials*  
The average weight was 19.6 grams for the developed kraft boxes and 82.3 grams for the prior developed corrugated boxes. Thus, 64.3% weight reduction was accomplished.

#### *The prototypes*

Figure 3 presents prototypes of consumer boxes for exporting bell peppers. Three layers of six boxes are able to fit into the prior developed transport boxes as shown.



**Figure 3:** Prototypes of the developed boxes.

#### **Summary**

The eco-innovative packages for exporting the Royal Project's bell peppers to Singapore and England markets were developed based on principals of eco-package design and universal design. With new design and folding method, the lighter weight kraft paper (KP230) was enable to be used as packaging materials replaced of commodity corrugated paper board resulted in 64.3% weight reduction, and optimum functional and attractive environmental feature with single color printing.

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