

Dissertation Title	Supply Chain and Quality Management of Leafy Vegetables: A Case Study of Cabbage
Dissertation Credits	48
Candidate	Mr. Somsak Kramchote
Dissertation Advisor	Assoc. Prof. Dr. Sirichai Kanlayanarat
Dissertation Co-advisor	Assoc. Prof. Dr. Varit Srilaong
Program	Doctor of Philosophy
Field of Study	Postharvest Technology
Division	Postharvest Technology
Faculty	School of Bioresources and Technology
Academic Year	2013

ABSTRACT

Supply chains for cabbage produced in Phetchabun province (traditional chain) and the Royal Project Foundation (good practice chain), Chiang Mai Province, Thailand, were compared. The traditional chain involved growers and collectors in Phetchabun province and wholesalers and retailers in Bangkok. To assess the upstream supply chain stage, production analysis following the Supply Chain Operation Reference (SCOR) model was performed. Results reveal that all growers were not engaged in contract farming. However, 22% of the growers followed the guidelines of good agricultural practices (GAP). Besides that, GAP certified farms yielded about 7.7 tons/rai higher than that in non-GAP farms (6.2 tons/rai). Additionally, the cost of production in GAP certified farms was about 8,862 Baht/rai, less than that in non-GAP farms (11,458 Baht/rai). On the other hand, the good practice supply chain of cabbage under the Royal Project involved growers, packinghouse, distributors and retailers. 100% of these growers followed the GAP guidelines. However, cabbage yielded about 3.7 tons/rai and had a production cost of about 9,430 Baht/rai.

Initial observation showed that cultivation and distribution of cabbage to the consumers face serious problems because of preharvest and postharvest loss due to improper cultivation practices. The preharvest and postharvest losses of cabbage in the supply chains in both traditional and good practice chains were studied. The total postharvest loss of cabbage in the supply chains was estimated to be about 37% in the traditional chain and 19% in the good practice chain. Growers in both chains incurred the highest loss (15% in traditional, 8% in good practice) mainly due to insect pests during the

preharvest period. Despite high loss and low farmgate price (3.5 Baht/kg in traditional chains and 5.4 Baht/kg in good practice chains, the latter being lower since it is for cabbages with intact wrapper leaves), growers obtained high income (89.2% return on investment or ROI for traditional chain and 96% ROI for good practice chain). Additionally, from the collector to retailer level, loss differed with supply chains. In traditional chains, collectors incurred the least loss (6%) but sold cabbages to wholesalers at only about 1.5 Baht/kg higher than farmgate price, earning 22.3% ROI as a result. Similarly, the wholesale and retail prices were 2 and 10 Baht/kg higher than the collector's price (22.1 and 20% ROI). Wholesalers incurred the highest loss of 10% while retailers incurred a 6% loss due to physical damage and wilting. In the good practice chain, packinghouse incurred a 3% loss due to physical damage while the distribution center incurred a 5% loss due to physical damage and wilting; the retailer also lost 3% due to wilting. From packinghouse to retailers, the price of cabbage was about 10, 15 and 35 Baht/kg respectively. Additionally, packinghouse, distributor and retailers had profitability of 52.6, 39.3 and 75.7% ROI, respectively.

Understanding of consumers' needs is important for cabbage growers for producing cabbage to meet the market or consumer requirements. Consumer preferences for cabbage quality have been studied in Bangkok. Sanitation (4.00 ± 0.08), freshness (3.91 ± 0.09), chemical residue (3.52 ± 0.08), compactness (3.48 ± 0.14), price (3.38 ± 0.09), defects (3.25 ± 0.10) as well as size (3.05 ± 0.05) of cabbage head were the most important factors in purchasing decisions for consumers.

Additionally, the nutritional qualities of cabbage were determined in order to promote the cabbage quality. Chlorophyll, carotenoid, ascorbic acid and soluble solids contents (SSC) of cabbage differed with leaf position in the head. Outermost leaves (first 3 leaves from outside) had the highest chlorophyll, carotenoid and ascorbic acid contents while the innermost leaves (leaves 18 to 24) had the highest SSC. Minimizing postharvest quality losses of cabbage in the supply chain was also studied. Low temperature storage remarkably increased storage life of cabbage. Storage life was about 18 days at 4 °C and 12 days at 10 °C compared with only 4 days at 28 °C. The extending of storage life was due to the delay of the loss in chlorophyll and water content of leaves. Respiration rate and ethylene production were also retarded with low temperature storage and by delaying senescence processes. In addition, low temperature storage reduced the losses in SSC and ascorbic acid contents thereby maintained the nutritive value of cabbage.

Keywords: Cost of Production / Good Agricultural Practices / Supply Chain

Management / Traditional Chain