

Vegetable Marketing Channels, Post-harvest and Adjustment in Taiwan

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Abstract

The vegetable production in Taiwan has been unstable in rainy spring, summer and winter seasons. To maintain the balance between production and consumption demand, planned production based on the amounts of domestic production/consumption and imports trade is important, especially when the production and price is fluctuated. Those sensitive for production and marketing vegetables include garlic, onion, cabbage, Chinese cabbage, and Welsh onion. Most vegetables especially leafy vegetables are highly perishable. Cold chain system for vegetable storage is an advanced operation compared to other traditional operations in postharvest handling and marketing channels, which can reduce postharvest loss and maintain quality. To establish a high efficiency agricultural marketing system of vegetables, cold chain system is necessary for sustainable practices.

Introduction

Taiwan is located in the subtropical zone. It has high temperature and heavy rainfall in summer, but warm and dry in winter, with about 822,364 hectares cultivated land for crops production. The output of agricultural and food produces valued at 179.1 billion NT dollars which accounted for 43% of the total agricultural production value in Taiwan in 2008. Among the output of agricultural produce value, fruit crops contributed 38% of the total value, followed by vegetables (27%), rice (17%), flower crops (7%), special crops (5%), upland crops (4%), and other crops (2%).

In Taiwan, the average temperature is over 22°C, so that the temperature keeps high for more than half year. However, climate influences the vegetable production extremely. The rainfalls concentrate in summer, and plum rain, cloudburst, typhoon also happen frequently. With such a condition, it induces serious natural diseases problems for growing vegetables from May to October, so called “summer vegetable problem”. For this reason, the vegetable production is not enough for consumption. In contrast, vegetable grows fast in the winter season after paddy rice. During this period, vegetable is always over-supplied and the price decreases even lower than the production cost.

Vegetable Industry in Taiwan

More than 100 vegetable crops are cultivated on 153,964 hectares of land in Taiwan. The total production exceeded 2.64 million tons valued at 48.5 billion NT dollars in 2008. Table 1 indicated that the cash vegetable was about 65% of production area and 73% of total vegetable production, which mostly are short-time cultural crops, such as leafy vegetables and flowers. Those are high value per unit area and make most income for farmer. The major production area locates in central part of Taiwan, particularly like Yunlin and Changhua County. Yearlong vegetable, including bamboo shoot, taro and yam, etc., was mostly produced in south Taiwan which is about 19% of production area and 12% of production volume. Melons include watermelon, cantaloupe, and strawberry.

In Table 2, the data indicated that vegetable production was an important industry in Taiwan. The vegetable crops to total crops increased from 21.74% in 1992 to 27.09% in 2008. According to the statistics, the vegetable consumption increased from 40 kg per year in 1950 to 120 kg in 2000.

Table 1. The vegetable production in Taiwan from 1995-2008.

Year	Total		Cash vegetables		Yearlong vegetables		Melons	
	Planted area (ha)	Production (M.T.)	Planted area (ha)	Production (M.T.)	Planted area (ha)	Production (M.T.)	Planted area (ha)	Production (M.T.)
1995	174,749	2,887,017	111,222	2,011,715	33,820	410,348	29,707	464,954
1996	178,521	3,098,097	113,024	2,229,869	33,973	361,651	31,524	506,577
1997	182,393	3,056,290	115,628	2,188,904	33,588	394,921	33,177	472,465
1998	180,072	2,911,734	113,987	2,064,417	33,998	385,311	32,087	462,006
1999	183,600	3,513,788	118,439	2,563,797	34,477	411,550	30,684	543,476
2000	177,074	3,262,194	115,569	2,279,210	33,374	388,094	28,131	494,890
2001	173,672	3,045,605	113,637	2,222,768	32,907	365,845	27,128	456,993
2002	179,473	3,461,803	116,945	2,485,830	33,093	386,942	29,435	589,031
2003	165,822	3,093,970	108,954	2,233,743	32,718	392,212	24,150	468,015
2004	168,338	3,064,607	110,715	2,264,830	31,612	356,630	23,011	443,097
2005	160,337	2,654,613	108,903	2,072,316	31,462	270,480	19,972	311,817
2006	157,184	2,877,991	106,017	2,162,465	30,699	357,977	20,468	357,549
2007	154,112	2,595,162	101,776	1,959,713	30,567	326,397	21,769	309,052
2008	153,964	2,640,700	104,979	2,070,571	29,854	288,267	19,131	281,862
Average %	100%	100%	65%	73%	19%	12%	16%	15%

The data is collected from Agricultural Statistics and Yearbook, Council of Agricultural, Executive Yuan, R.O.C., 2008.

Table 2. The variation of crop production in period of 1992-2008.

Year	Total Production	Ratio (%)
	(ha)	Vegetable
1992	142,312,811	21.74
1993	157,523,597	19.82
1994	160,263,443	18.35
1995	168,517,511	20.35
1996	172,781,410	21.17
1997	173,744,104	20.89
1998	163,618,674	21.75
1999	170,523,785	23.43
2000	165,214,487	23.34
2001	160,758,570	22.87
2002	151,853,269	23.26
2003	147,274,670	23.52
2004	162,300,578	25.09
2005	162,630,935	26.21
2006	172,691,533	25.49
2007	168,368,459	27.90
2008	179,108,569	27.09

The data is collected from Agricultural Statistics and Yearbook, Council of Agricultural, Executive Yuan, R.O.C., 2008.

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The production and marketing of vegetables are monitored continuously by the Council of Agriculture (COA)/Agricultural and Food Agency (AFA) for the purpose of regulating market supply and price, especially in the conditions of abnormal fluctuations in prices and supply in rainy spring and typhoon season. Vegetable soybean, spinach, head lettuce, short-term leafy vegetables, melons and mushrooms are vegetables in high daily demand by the consumers. The government promotes vegetable protective cultivation of green-house structure and the technique of the integrated pest management to ensure the stable supply in quality and safety produce. The application of grading system, with improved packaging and post-harvest techniques, facilitates the export of vegetables, such as lettuce, carrot and cabbage, to neighboring countries.

Regarding to vegetable trade, the import quantity and value of vegetable products were increasing by year, from 1992 to 2008 the quantity increased from 171.8 thousand tons to 417.7 thousand tons and the value increasing three times, from 96 million US dollars to 264.3 million US dollars. But the export quantity decreased from 204 thousand tons to 66 thousand tons and the value decreased from 299.6 million US dollars to 112.7 million US dollars, from 1992 to 2008 (Table 3).

Table 3. The statistics data of trade on vegetable products in the period of 1992-2008.

Year	Import		Export	
	Weight (ton)	Value (1,000 USD)	Weight (ton)	Value (1,000 USD)
1992	171,857.07	96,106.64	204,556.66	299,636.10
1993	197,366.18	100,255.56	169,720.74	263,652.80
1994	235,563.30	111,117.41	152,789.66	222,918.09
1995	212,692.19	116,959.93	161,984.48	213,172.45
1996	231,261.88	139,309.10	152,662.87	184,483.60
1997	260,818.27	158,742.60	115,533.05	151,636.00
1998	302,413.73	163,948.90	91,053.81	128,071.80
1999	297,235.06	169,418.80	112,406.40	134,146.80
2000	303,333.52	170,468.00	105,592.34	131,191.80
2001	336,461.53	166,907.20	85,464.37	109,116.40
2002	321,596.47	172,911.10	81,029.67	98,194.50
2003	239,012.96	170,876.50	80,405.07	104,389.80
2004	340,039.84	184,107.20	88,153.75	113,311.50
2005	466,210.19	236,487.60	76,950.78	97,587.30
2006	421,950.99	217,801.80	66,500.38	94,016.60
2007	473,245.01	239,654.50	59,674.98	87,734.90
2008	417,723.25	264,284.70	78,470.41	112,753.70

The data is collected from General Bureau of Tariff, Ministry of Finance, R.O.C.

The Supply System and Cold Chain of Vegetables Marketing

Agriculture is vital and multi-functional. It serves all facts of human life and is an integral part of environmental conservation and culture. However, agriculture is facing a series of global challenge today. According to statistics and other scientific evidence, global temperature and sea level will raise, and frequency of extreme weather conditions will also increase. These global changes will bring in great impacts on agriculture production and threaten food security.

Climate of Taiwan has both subtropical and tropical types, and the meteorological phenomena are unstable. The natural disaster includes monsoon, typhoon, cloudburst, high temperature, high humidity and cold current, which often attack this island. Due to the climatic characteristics, the agricultural disasters often happen, and high temperature becomes the main restricting factor for cultivating vegetable crops.

In Taiwan, vegetable production is unstable in rainy spring and summer seasons and is over supply in winter time. Developing cold chain system provides high quality, safety, convenience and stable vegetable supply. There are two major pathways of vegetable marketing. Traditionally, vegetables are transported from growers at growing area to wholesale markets, and auction markets are nearby the consuming city, and then transported to retailers (Fig.1). For the purpose to keep product quality, it is necessary to shorten the transport time. To ensure the products arriving convention retail market in early morning and reaching to consumer's refrigerator in 24 hours, vegetable is always transported in the midnight for auction.

About 45% of vegetables are sold through the traditional channels. Because of the distance from southern to northern Taiwan is short, most vegetables can be kept well due to these prompt transportation. The quality of vegetables is maintained by such a good short time and direct transportation.

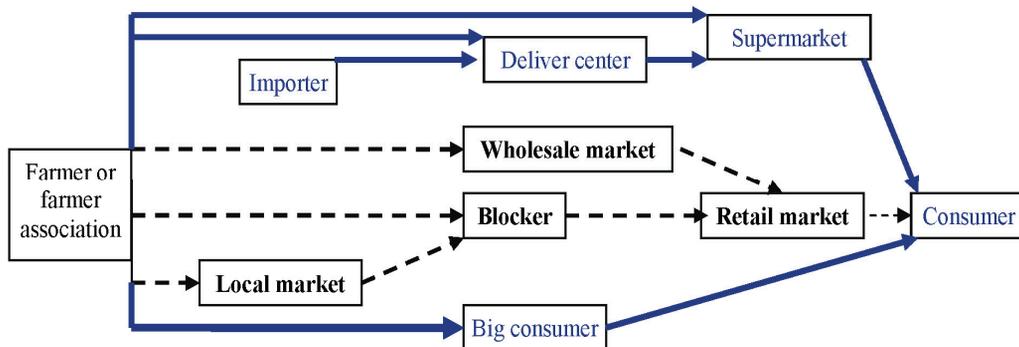


Fig. 1. The vegetables supply system of Taiwan. The solid line means the supply by cold chain.

Another way is to supply for supermarket and hypermarket. In this system, cold chain vegetable is widely accepted, and vegetables are also sold to big group, like military, companies, and schools, etc. Cold chain management for vegetables can reduce post-harvest loss and keep better quality, especially for highly perishable vegetables such as leafy vegetables. Theoretically cold chain system for vegetables should be widely applied. At present, only about 30-40% of vegetables are sold through this system.

Various kinds of practices are used in cold chain operation, especially for horticultural crops. Different practices are adopted for different situations, depending on vegetable properties, available facilities, and consumer's demands. Post-harvest handling is a very important step for most horticultural products prior to shipping and marketing. Among them, the use of "pre-cooling" technique has greatly improved vegetable quality. Pre-cooling is a very important step in cold chain operation. The facilities and techniques include hydrocooling, room cooling, forced air cooling and vacuum cooling.

Low-temperature storage is well-used in cold chain management. The use of "controlled atmosphere" storage (CA storage) provides a chance to prolong the storage life of cabbage and other vegetables. In this system, the suppliers, such as supermarkets, can keep vegetable quality stable in quantity. However, the supply and price of vegetables from growers or wholesale market are often fluctuate when climate change unexpectedly. Short term storage of leafy vegetables is commonly used by farmers' associations. Long term storage for certain seasonal vegetables, such as onion and cabbage, is more professional

Newly Supply Choice – "Fresh-cut" Vegetables

Fresh-cut vegetables are easy to become spoiled. The procedure for producing fresh-cut vegetables is very complicated to keep the product fresh and away from microorganism contamination. Among the products, fresh-cut vegetables need the most precise control in all steps of operations. Shredding and slicing cause damage to vegetables tissues.

In addition to keep fresh-cut vegetables fresh, safety control in microorganisms' contamination is also important. Processing operations such as cutting cause damage to vegetable tissues and lead to leakage of nutrients and cellular fluids providing opportunities for microorganisms' contaminations. The microorganisms may result in a public health problems caused by food borne disease, especially for the fresh-cut vegetables like salad which are consumed without cooking.

The other choice is frozen vegetable, which has been developed for 30 years in this place and not only supply for domestic market but also for export to Japan. According to the modern consumption habit, consumers need more fast and safety food, and frozen vegetable now becomes more popular in the supermarket, especially when the vegetable price arises.

Vegetable Adjustment Measures in Taiwan

For improving marketing efficiency, the Agency of Food and Agriculture (AFA) helped wholesale market to enrich trade facilities, increase service quality and develop shared software. Government assists farmers' associations establishing cold-chain for domestic agricultural production, enhancing their supermarket operations, increasing its cooperation with direct sale channels, such as supermarkets, hypermarkets or consumers who booking large orders.

For vegetable shortage problems caused by natural disasters such as typhoons and extremely rainfall in summer, the AFA assists farmers' associations to establish large scale refrigeration facilities for storing long-term vegetable like cabbage and Chinese cabbage. The storage product will be released to Taipei Wholesale Market when local markets are shortage of supply and/or when market price has abnormal fluctuation. The market-regulate measures implemented by government are listed as followings:

A. Storage facilities improvement

Carefully select the qualified farmer groups, and help them to improve their refrigeration facilities and the marketing ability.

B. Restore measures

Disaster relief and vegetable restore are implemented shortly after the occurrence of natural disasters. Technical and financial assistance for shortening period of leaf vegetable replanting are offered to meet market vegetable demand as early as possible. The replant vegetable can compensate market shortage until it restores to the original quantity in 15 days.

C. Emergency measures

The government will release storage vegetables to compensate for the shortage caused by natural disaster. The government collect weather forecast information continuously and take measures to prevent disasters. The government also monitors crops damage condition and fluctuations in vegetable prices during the period of natural disasters.

AFA will inform the agricultural groups who are taking part in the storage program to release vegetable, when there is AFA showing abnormal fluctuations in prices and supply of vegetable.

Conclusion

Abnormal climate and extreme weather cause the shortage of vegetable in Taiwan. Cold chain system for vegetables is an advanced post-handling system compared to the traditional marketing channels, which helps to expand the vegetable preservation life. However, many factors may restrict the application of cold chain system. These factors include increased cost, complicate

facilities and treatment techniques, high investment and management, and competition from other marketing channels. The main competitions are low cost, easy to handle and high quality channel which is achieved by prompt and short time transportation.

In addition, high quality cold chain system provides products with more stable supply, high convenience and safety than other marketing system. For sustainable operation of cold chain system, farmers' associations build large refrigerators and establish a more efficiency supply system. An integrated management is needed for better control in supply, treatment of products, operation in packing house, and stable outlet. Government will continue efforts on collecting supply and market information, improve techniques and facilities for vegetable production and handling, and develop new products.

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