

NEW AGRICULTURAL POLICY: TOWARD A BETTER PITAYA INDUSTRY IN TAIWAN

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ABSTRACT

In recent years, Pitaya (Hylocereus spp.) has rapidly grown and developed in Taiwan with a production area growing from 900 ha to 2,500 ha over the last decade with annual export volume reaching to 110 tons. Meanwhile, the red pitaya is the most popular one in Taiwan, although hand pollination, unstable fruit size, cracking and serious diseases are the major weaknesses of the fruit. In order to upgrade the status of the country's agriculture, the Council of Agriculture, Taiwan recently carried out the new agricultural policy, and we are looking forward to establishing a new paradigm for protecting farmers, agricultural development, and environmental sustainability through the principles of innovation, employment, distribution, and sustainability to stabilize the supply chain. This is being done to improve the quality of agricultural products, ensure the safety of agricultural products and consumer relief, enhance marketing promotion, and make agriculture step to a new milestone that is considered profitable and sustainable. Under the policy framework of establishing a new paradigm for agriculture, Taiwan will promote a friendly farming environment, sustainable agriculture resources, together with scientific and technological forces, to increase the market and value of agricultural products. This article will introduce the results and projects of pitaya in Taiwan under these policy guidelines, including achievements and ideas on breeding, cross-domain solution, post-harvest, and pest and disease management.

Keywords: pitaya, agricultural policy, sustainable agriculture, cross-domain solution, disease control

INTRODUCTION

Pitaya Industry in Taiwan

Commercial production of pitaya in Taiwan began in 1983. The production were fueled by farmers Whose Tu-Sha Chen, Huo-Quan Shi, Pei-Ran Wu, Lian-Fang Wu, and Qun-GuangWang (Jiang and Yang, 2016). The first varieties were introduced from Vietnam and Latin America. Few years later, breeding works were carried out by farmers and released some famous varieties such as 'Jan-Long', 'Chou-Zou Large', 'Xi-Long' and 'Xiang-Long'. Those varieties have different peel and flesh color (Liu *et al.* 2016). Meanwhile, Red flesh pitaya are becoming more popular in Taiwan since those new varieties were released.. Until now, 30% of the common varieties belong to *H. undatus*, and 70 % of them belong to *H. sp.* Notably, 'Da Hong' and 'Fu Gui Hong' are the two most popular *H. sp.* cultivars in Taiwan with 60 % and 25 % of market occupancy, respectively (Jiang and Yang, 2016). According to the Statistical Yearbook of Agriculture in 2016, the production of pitaya in Taiwan is 2,490 hectares (Fig. 1). The major production areas of dragon fruit are in the central and southern Taiwan. Among them, Erhlin Township of Changhua County (304 ha), Chichi Township of Nantou County (81 ha) and Waipu district of Taichung (33 ha) and others. The remaining counties and cities in Taiwan, including Kinmen and Penghu islands (Chimei) are also areas where pitaya is grown. Taiwan's total output for dragon fruit is 49,016 tons in 2016. In addition to domestic demand, dragon fruit has also been exported in small quantities with total foreign sales of about 110 tons, of which most were exported to China (78 tons), while the others were exported to Japan, Singapore, Hong Kong and Canada (Table. 1) (COA, 2017).

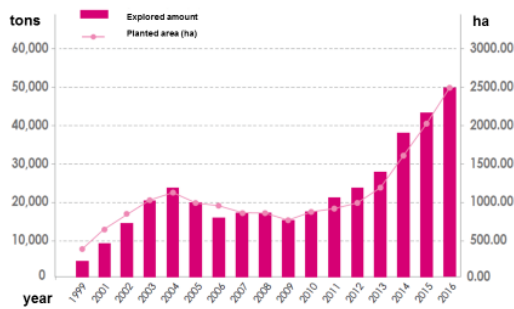


Fig. 1. Fig. 1. The production of pitaya growth quickly last decade in Taiwan.

Year	2016		2015		2014		2013	
	Amount (kg)	%	Amount (kg)	%	Amount (kg)	%	Amount (kg)	%
China	78,426	70.89	156,642	92.07	133,931	85	39,058	85
Hong Kong	23,870	21.58	7,200	4.23	6,132	3.89	700	1.5
Japan	3,750	3.39	1,332	0.78	918	0.58	-	-
Canada	2,610	2.36	2,864	1.68	16,171	10.26	1,508	3.3
United Arab Emirates	1,200	1.08	1,928	1.13	-	-	-	-
Bahrain	150	0.14	-	-	-	-	-	-
Brunei	-	-	140	0.08	24	0.016	36	0.08
Macau	-	-	18	0.01	209	0.13	-	-
Others	250	0.22	-	-	-	-	-	-
Total	110,622	100	170,124	100	157,565	100	44,450	100

Table 1. Major export countries of pitaya in Taiwan

Bottlenecks and challenges

In the early years, the production system was complicated because some nurserymen used to sell seedlings from seeds to the growers. The fruit characteristics and quality could not be stable such as flesh color, fruit shape, cracking, self-compatibility, etc. until when the true-to-type clones were released since 1999. In recent years, some plants were observed with systemic mottling on the stems, and these were found to be infected by a potyvirus, Cactus virus X (CVX), potyviruses Zygocactus virus X (ZVX) and Pitaya virus X (PiVX) in Taiwan (Li *et al.* 2016), it may be another problem of the pitaya industry. Meanwhile, although when compared to other fruit crops, there are not many pests and pathogens causing serious problems on pitaya, we still have some problems of inappropriate pesticide use; planted area increased too fast; small scale production; higher production cost: short of labor and competition with other countries. Moreover, Climate change and extreme weather, environmental resources depleted, increasing competition in the international trade market, the aging laborers and lack of professional management, agricultural value is underestimated and farmers' income unstable, and diversification of consumer became the major challenges of the dragon fruit industry in Taiwan (Fig. 2).

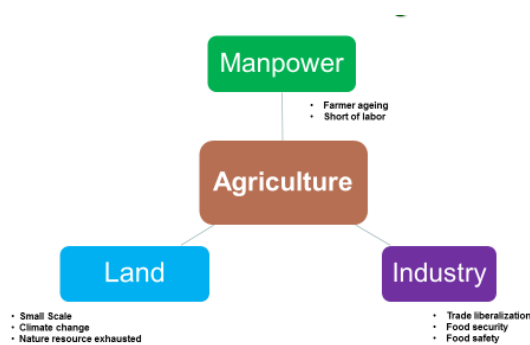


Fig. 2. Dilemma and Challenges of Agriculture

New agricultural policy

In order to upgrade the status of the country's agriculture, the Council of Agriculture, Taiwan recently carried out the new agricultural policy, and we are looking forward to establishing a new paradigm for protecting farmers, agricultural development, and environmental sustainability through the principles of innovation, employment, distribution, and sustainability to stabilize the supply chain. The ultimate goal is to reverse the conservative subsidy policy in the past so that existing resources could be redistributed to strengthen interdisciplinary communication and integration, expedite industry structural transformation, create favorable environment for young talents to return and work in agriculture, in hopes of raising agro-business added value and forging a revolutionary new agriculture. The overall objective included increasing food self-sufficiency ratio by 40%, expanding total agricultural output to NT\$219 billion, creating employment opportunities for over 370,000 people, and exporting agricultural

product to overseas emerging markets with annual rate of 57%. The three pillars of new agriculture policy are: (1) Establishing new agricultural paradigms: promote green payment on farmland; and stabilize farmers' income by: Developing agricultural production equipment and smart production management models to increase productivity per unit area; Introducing the basic database of agricultural environment and smart analysis technology to improve the immediateness and effectiveness of disaster prevention and early warning mechanisms; Establishing disaster damage assessment technology and assessment mechanism and implementing clear agricultural insurance operation mode. Advocate environment-friendly farming by: Developing diversified planting and aquaculture co-production technologies to promote the maximum application of agricultural areas; Developing technologies for natural resources reuse and strengthen the evaluation and verification of the efficacy of biological fertilizers and pesticides; Constructing environmental database and interpretation technology to improve management of agricultural water resources and effective land use. Supporting sustainable usage of agricultural resources, and developing innovation agriculture by: Optimizing programming algorithms that are in line with agricultural production and improving the degree of automation of machinery; Strengthening the integration and application of information and communication technologies, promoting the friendly communication of agricultural and industrial bridges, and automating the collection of agricultural production data; Strengthening functional verification of active ingredients to improve nutrition, health and safety for all people.; (2)Constructing food security and food Safety System: enhancing food security and ensuring agricultural product safety; (3)Enhancing abilities of agricultural marketing: expanding diverse domestic and overseas distribution channels for agricultural products by: Combining multidisciplinary technology such as ICT creating various transportation path and enhance trade safety; Optimizing the postharvest packaging and storing to maintain the quality and meet up modern logistics; Developing various processing products to fulfill different demands., and increasing agricultural added value by: Applying processing and functional techniques, developing localized and safe functional crops; Combining local specialty producing mode and certificate mark, elevating additional values; Combining sale big data, establishing consuming behavior database (Fig. 3) (COA, Taiwan. 2017).

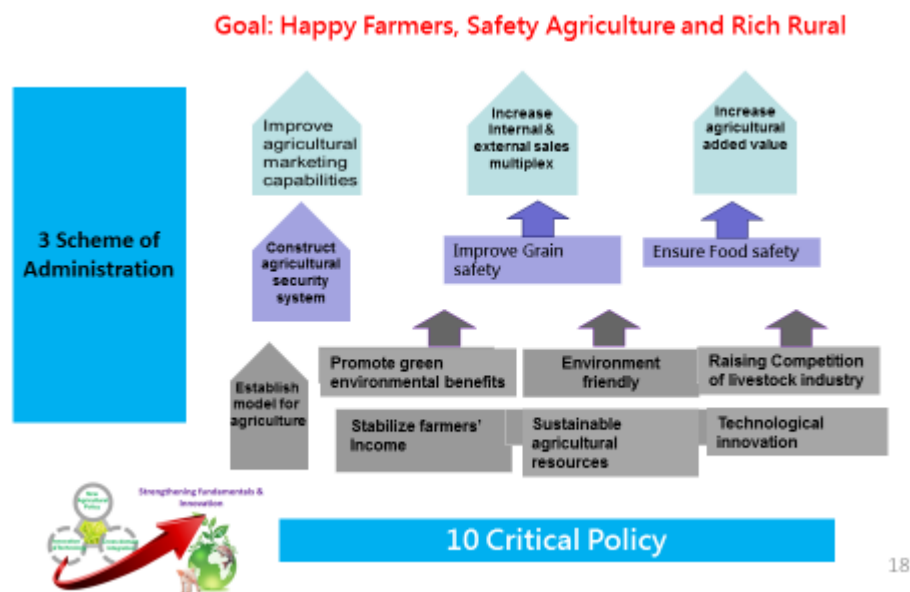


Fig. 3. The goal of new agricultural policy are build up happy farmers, safety agriculture and rich rural area in Taiwan.

A better pitaya industry in Taiwan

The pitaya industry belongs to the intensive type of agriculture in Taiwan, which needs stable of high quality fruits and cultivation technique. In the past decade, we built a system of new variety breeding, shoot management, pest control techniques and off-season production which can be achieved between December and May and suggested growers to do pruning before previous December so as to increase their yield. The fruit appearance can be assured through bagging (Jiang and Yang, 2016). Even more, by encouraging growers to establish net houses for cutting down bagging labor cost and avoid bird and

oriental fruit fly damage; Constructing productive information databases of pitaya provide real-time dynamic information for farmers; Establishing integrated productive information network; Increasing the multiple pathways for domestic and foreign markets; and practicing integrated pest management for pitaya. Through the help of the new agricultural policy, Taiwan's pitaya industry has indeed taken a giant step forward. We wish to enrich the lives of farmers, and promote safety in agriculture and enhance and revitalize the rural areas in Taiwan.

CONCLUSION

The pitaya industry in Taiwan is facing big challenges especially in the areas of over expansion and productivity, competition with other countries like the lower priced fruits from Vietnam, the major importing countries like China which had boosted their pitaya plantation, which could reduce the market demand for dragon fruit. To solve these issues, the pitaya industry in Taiwan should start to make ways to enhance the fruit quality, safety and quiet for balance of the output capacity. The growers must be understanding only those high-quality production clusters, having fine varieties, with technical service support and ensure of the premium quality of crops, follow QR-code implementation, promote GAP (Good Agriculture Practice) labeling, organic farming, and traceability systems. Establishment of facilities to reduce unstable weather conditions may be a good way to make sure that the income of pitaya growers improve, and that the equipment of those who belong to the supply chain would enhance competitiveness in the international market.

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