Organic Rice Farming Systems in Taiwan: A Review of Technical and Economic Aspects

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Abstract—Nowadays, organic products are being famous for all people around the world. Due to the great global market demand, production of organic foods has increased rapidly in the past decades. Organic agriculture has become a great choice as means of organic product producing. As a staple food in the world, the high demand on organic rice has increased in last decades. In Taiwan, the high demand on organic rice has increased from year to year. Organic rice production has occupied the largest harvested area. From direct interview and searching on organic rice website, Taiwan also has developed an integrated farming system which involves both technical aspects (soil, agronomy, weed, and pest management) and economic aspects (input, output, and marketing) in organic rice production. From this review, technical aspects of rice organic farming in Taiwan shows modern concept and environmentally friendly. By this ways, the economic aspects in agriculture sector are being better.

Keywords—Taiwan organic rice, farming systems, technical aspects, economic aspects.

I. INTRODUCTION

T
ing is one of the world’s staple food. Most of Asian people consume the rice for getting energy that they need to do activities. Along with the increasing of human population, the demand for rice as a staple food also increased [3]. Rice is also the staple food in Taiwan.

Taiwan is one of country that located in East Asia. That country has four seasons; summer, fall, spring and winter. Taiwan has high temperature in summer (more than 30°C annual from average temperature of about 20°C - 28°C) and low temperature in winter and rainy. This condition has caused soil vulnerable, low organic matter and nutrient loss. Because Taiwan is located in a small island, agricultural land resources are also limited. The total area of agriculture is 85 hectare, accounted from the total land surface Area of 23.5% [4]. The cultivation area in 1997 was 202 010 ha for the first crop season and 162 202 ha for the second crop season in Taiwan [12]. In addition, [3] informed that rice cultivation covers about 260 thousand acres. From 2005 to 2007, the most popular rice varieties is Japonica rice, were Tainan 11 (39%), Taikeng 14 (10.8%) and Taikeng 8 (8.3%).

When specialization and intensification of agricultural have been developed in Taiwan, farmers often apply chemical pesticide, especially in high summer temperature. It will cause the pest outbreaks because in this situation, the probability of pest breeding will increase seriously. According to the Agricultural Statistics Annual Report 2001, chemical fertilizer and pesticide use in Taiwan reach up to 144.2 million tonnes and 3.81 million tonnes (including pesticides and herbicides, each about 1.68 million tonnes). Therefore, to enhance the quality and safety of agricultural products by maintaining ecological balance, Taiwan has promoted organic agriculture, including organic rice [4].

Organic farming is “an integrated farming system which involves both technical aspects (soil, agronomy, weed, and pest management) and economic aspects (input, output, and marketing) as well as human health” [7]. In Taiwan, the area of certified organic farm usually increased year by year, from 159.6 hectares in 1996 to 1,092.4 hectares in 2003. [7] also explained that in 1993, organic standards were drafted based on the Japanese MOA International version, and endorsed by the Department of Agriculture and Forestry of the Taiwan Provincial Government. The Organic Standard was later revised by the Council of Agriculture (COA). Organic rice certification occupied the largest proportion, followed by vegetables and fruits. Organic rice production occupied the largest harvested area of 1,209 hectares [7].

In rice organic application, Taiwanese farmers have applied some techniques in their rice farming system. Starting from soil management, water management, pest control and also harvest management. [1] informed that he was the first person that practiced the “rice with duck” system in Taiwan for controlling weeds and pests. [11] also reported that effective microorganism (EM) has been applied in Taiwanese rice field in controlling disease and insect infestations.

The objective of this paper is to inform the recent situation and development of organic rice field from different counties in Taiwan. Farmers in Taiwan have good experience in organic agriculture. Actually, database about Taiwan organic rice is still limited published. Many paper were published in Chinese version. This paper will explain more information about current condition of rice organic in Taiwan. This information
is very useful as a reference for developing organic rice in the other country especially in Asia region.

II. METHODS

A. Study Area

Organic rice field and agricultural district was visited for getting direct observation and information of organic rice management processing. Hualien County is the leader of Taiwan’s organic movement. Its high quality organic products have been become known throughout the country and abroad. As of the end of 2007, the county boasted more than 200 organic farmers who were cultivating a total of 440 hectares of land without the use of pesticides [13].

B. Data Collection and Analysis

Data on organic rice farming was collected by interview from farmers or researchers. Data has also been taken from website of Organic Agriculture (e.g. Agriculture and Food Agency (AFA), Yilan and Hualien Organic Agriculture (HDAIS), etc). A number of sources will be used to completed information about organic rice in Taiwan. These sources will include peer reviewed journals, review articles, workshop papers, and proceedings.

III. RESULTS

Rice planting procedures in Taiwan are following the government regulations. Especially for organic rice, from land preparation to post harvest, farmers follow the rule of organic agriculture. Taiwanese farmers are also developing ‘rice duck’ farms. The role of duck is to eat some pests and weeds. It will useful for pest and weed control.

Rice production is increase year by year. Farmers are getting good income of their rice production, because of high demand of organic rice in Taiwan.

IV. DISCUSSION

A. Organic Rice Planting Techniques

In organic farming, land preparation is away from residues and chemical fertilizer. Organic fertilizer or decaying plant (e.g. grass) is chosen for land nutrition. In observation, natural rice farming in Shitiping does not apply any fertilizer including organic fertilizer. This farming is located closed to the sea. The soil nutrients are from organic material of coral reefs. After harvest, the field rice is not planted by the other crops. Farmers are filling their rice field with some water to protect the field from nutrient loss. In Dong Hwa organic farm, the farmers have not also used chemical fertilizer. They have used animal manure or weed decay for fertilizing the rice field.

The land for rice planting is an area which has low excessive organic matter. The accumulation of excess organic matter can cause the necrosis of rice root, affects the shoot health and growth, delays the growth tiller and make the growth period of rice be longer. Land preparation can also help the seedling growth easily [5].

In organic rice farming, rice quality and resistance to pests and diseases have been chosen by farmer to increase their rice production. Many rice resistant from Japonica varieties were planted by farmers such as Taichung, Tainung, Kaohsiong and Tainan [5].

Water is a source of life for growing rice. To increase water use efficiency in Taiwan, the continuous irrigation method, which maintains a ponded water depth of 5 – 6 cm in rice plants except during weeding, fertilizing and harvesting, has been gradually replaced by a new irrigation scheme known as ‘rotational irrigation’. In this scheme, irrigation water is supplied in appropriate quantities, at the ideal time and in the proper order to ensure that all rice paddies receive their minimum water requirement [2]. In the paddy fields, the irrigation water requirements and deep percolation are 962 and 295 mm respectively, for the first rice crop, and 1114 and 296 mm for the second rice crop [9].

Water for organic farming comes from springs that are free from chemical residues. In Shitiping farming, water drains from the mountain. There are water canal that transfers the water to the rice field. Nowadays, using aquatic insects as a bioindicator of water pollution will be a new research to assess water quality in rice irrigation.

Different varieties have different tolerance on water needed. Taikeng No. 9 have the higher drought-tolerant than japonica varieties. According to different growth stage, the duration of giving water about 30 to 35 days after rice planting with water depth of 4 to 6 cm. For the second stage needs water for about 20 to 25 days with water depth of 7 cm [5].

Taiwan is located in tropical and subtropical areas with climatic conditions of high temperature and humidity. By these conditions, many pests and disease spread out quickly [10]. There are native species and immigrant pests species such as “the yellow stem borer (Scirpophaga incertulas Walker), striped rice borer (Chilo suppressalis (Walker)), pink borer (Sesamia inferens (Walker)), smaller brown planthopper (Laodelphax striatella (Fallen)), green rice leafhopper (Nephrotettix cincticeps (Uhler)), rice hispa (Dicladispa armigera (Olivier)) and rice leaf beetle (Oulema oryzae (Kuwayama)) are the native species” [8]. The immigrant species are “brown planthopper (Nilaparvata lugens Stål), whitebacked planthopper (Sogatella furcifera Horváth) and rice leaffolder (Cnaphalocrocis medinalis (Guénée))” [8]. In winter, populations of pests are decrease, but the population abundance mainly depends on the number of immigrants [8].

In organic farming, natural control (e.g. biological control, microbial control, and more) is chosen as pest control. Using biological controls are the most familiar method to control the pests. In Shitiping natural rice farming, there is no specific way to control the pest. Farmers are planting trap crop for attracting natural enemies and predators.

For harvesting, Taiwan uses some tractor machines for cutting the rice plant. The machines are held by all farm households. In comparison, tractor in Taiwan works more than 10 times than tractor in Japan. Taiwanese farmers are spending
more time in 1 hectare rice field rather than Japanese farmers. Throughout the process of economic development, Taiwanese farmers have worked shorter hours than have Japanese farmers [6].

To get organic certification, there are some rules that should be followed by farmers. Their crop must away from chemical material. Both organic farms and organic home gardens are entitled to organic certification. Upon receiving an application for field certification, the certification unit will dispatch an inspector to conduct “On Site Inspection.” When the field inspection is passed, the farm can be designated as “Transitional Organic Field.” A certificate together with a farm label (plate) will be issued for posting on the farm. The certification is effective for 3 years, and can be renewed after the expiration of the term. If the certified farm does not follow the standards of organic farming, the certified document would be revoked [7].

B. Rice Production and Economic Aspects

Agricultural statistics in Taiwan inform that every year rice production increased. Rice production is increased in the first crop, but in the second crop is decreased. This case is caused by declining of soil nutrients after the first harvest. The total area of rice organic was increased year by year. This is also caused by high demand of organic rice.

According to [7], “Taiwan’s retail stores for organic foods increased from 300 units in 2002 to 643 units in 2004, which is a two-fold increase in two years”. Total amount of organic rice were sold faster than conventional rice [7].

V. CONCLUSION

Organic farming is very important in Taiwan, because chemical pesticides had given bad effects for healthy. Organic products in Taiwan are not only including fruits and vegetables but also rice as a staple food of this country. Some techniques in planting rice are also important to apply for getting a good quality and quantity of rice production. Presently, total area of rice organic in Taiwan is increased year by year. It will be impacted to rice production and economic aspect in Taiwan and also income for farmers.

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REFERENCES