COMPARATIVE STUDY OF TRADITIONAL AND SMART-FARM IRRIGATION SYSTEMS FOR MELON FARMS IN CHAI NAT PROVINCE, THAILAND

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ABSTRACT

The comparative study on melon farm water management with the cases of traditional and under controlled environment as we are known smart-farm irrigation systems were investigated in 2017 - 2018. The study areas located in NongMamong district, Chai Nat province, Thailand. The traditional melon farm is usually opened-air and supplied water from the public or individual pond using a small gasoline engine combined with an axial flow pump to the farm plot and plant root via pipes and drip or sprinkler irrigation systems. Each farm size is approx. to 1.8 ha with local variety melon.The other type is the under protected environment system that is usually in a greenhouse. The smart-farm size is approx. to 72 sq. m with high yield-variety melon, which depends on the owner budget and time paying attention at the farm as a hobby job. The solar system or house electricity is a power-supply to the small pumping from the water tank to the plant root via the small tubes and drip irrigation combined with the automatic control systems. The net income earns from a smart farm that is higher than an opened-air farm in term of farm size, labors, water efficiency, energy consumption, paying farm attention, and cheaper as long-term operation and maintenance cost of an irrigation system.

Keyword: Melon farm, traditional irrigation, smart-farm system, farm-water management.

1. INTRODUCTION

Due to the water shortage problem is normally a rain-fed cropping area and sometimes occurs in the irrigated area in Thailand as well. The Royal Thai Government has encouraged farmers to use of low-water crops instead of rice cultivation in both the irrigation and non-irrigated areas to encourage farmers to save water and to increase their water use, income for farmers after the farming. The popular drought-resistant crops are soybeans, green beans, peanuts, corn, vegetables, as well as short-lived and good-quality fruits such as melon, which are now very popular in Thailand. The northern part of Thailand growing melon is in Phrae, Phitsanulok, Phichit, and the Central Thailand such in Ayutthaya. Nat, PrachinBuri and Nakhon Si Thammarat in the southern region.

In Chai Nat province, even though the Chai Nat province has a complete irrigation system of more than 60 percent, most of it is the lowland area receiving water from the Chao Phraya Dam for irrigation systems. However, in the rest of the area, almost 40% are also located outside the

rain-fed irrigation or natural canal. In some years, floods and floods often occur in the dry season, such as the area in NongMamong and Han Kha districts, etc. In this area, although most of the rice is grown as a main crop, and other such cassava and sugarcane. The unstable yield depends on the amount of precipitation and the soil condition. Local governments in the area have campaigned to find solutions to water shortages and floods was carried out by creating water pools, re-dredging swamps and canals, or built new canals as to divert water from overflowing mainstream into the ponds, such as in the area of NongMamong, including Wang Takian, KutChok, and TaphanHin sub-districts, in cooperation with the Royal Irrigation Department, Department of Local Government Promotion, Department of Water Resources, Land Development Department,Department of Agricultural Extension, Chai Nat Provincial, and others. In order to develop the canal of HuayKhot-Wangnam canal, the water from the watershed area in HuayKhot District and the HuayKhunKaew Canal in Uthaithani Province were transported to the canal with potential water storage capacity of 4 million cubic meters. In the dry season, water can be stored in the dry season and many thousands of acres, such main pond: Nong Du (400 rai of ponds) with a capacity of 1.3 million cubic meters. If this project has been completed and good water management is in place, the well-drained water system will be able to grow up to 2,000 rais(6.25 rai = 1 ha) of dry water in the dry season [1]. Agricultural extension and related agencies have encouraged farmers to plant less water, especially melon. There are two types of melon that has been growingin recently: open farm systems that grow melon outdoors in rice fields after harvest season and can be considered as traditional or conventional melon farm. Another system isa closed farm with a greenhouse or greenhouse lining with material net and can be determined as controlled environment or smart-farm systems [2] to [11]. The research needs for comparative study in local melon and modern farms economics included the farm management and irrigation water systems as shown in the next paragraphs.

2. STUDY AREA

The 2-sites inthe study area of individual small melon farms are located in NongMamong district, Chai Nat province within the central region of Thailand shown in Fig.1. The other site is large individual smart-farm in Chai Nat province as well. The first site is a conventional melon farm with an area of 1.76 ha, the second site as for a small modern farm as current study. The other is a very large smart-farm growing some kinds of fruit including melon in Manorom district, Chai Nat province [8], and [9].

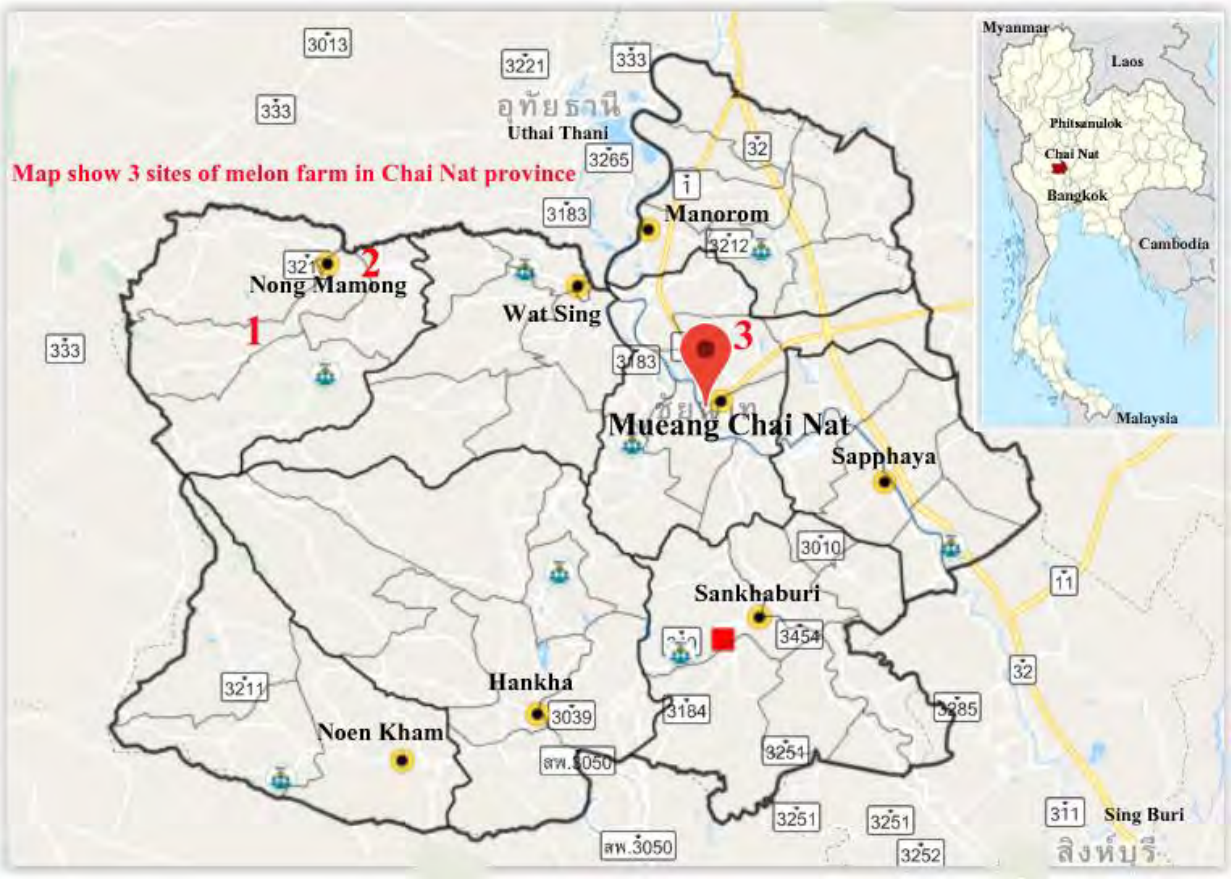

Fig.1 Map of study area within 2-sites: 1 for conventional farm, 2 for small modern farm [1], and other is 3 for large smart-farm [9] in Chai Nat province.

3. METHODOLOGY

This study is a preliminary comparison of traditionalor conventional melon farming in paddy field(opened farm) and modernized or smart farming (closed farm) practices including water supply systems, farm maintenance, cost, and profitability. This research was concluded after the interviews with farmers who planted melon in the paddy field and farmers in smart farmsin NongMamong and KutChok sub-districts, NongMamong District, Chai Nat Province in 2017 and 2018.

4. RESULTS

The most of traditional or conventional melon farm is opened in rice paddies. It is a large plot size of about 1.76 hectares / year and lying in many villages in NongMamong.The former cultivated cassava and sugarcane, after the drought, the yield and price are lower than before. Therefore, it turned to cantaloupe or melon, which is a plant that uses less water. To replace the former career suffered due to drought. There are now 27 farmers who have encouraged changing their occupation, with a total area of 32 ha, using water from the man-made public pond in the village for example Mr. Dane is one of the farmers who accepted this technology growing melon.

The modern melon farm is made at least a greenhouse and part time pays attention in the farm as hobby job, forexample, such Ms. Duangrudi with coffee shop as a permanent job, and Mr. Tawaeesak with the permanent job as an official staff in the NongMamong Municipality [1]. With the concept of planting non-chemical plants. Started experimenting with melon by learning and doing from the symbiotic media showed planting of melons in both paddy field and the greenhouse. The owner of the big bird farm in Chai Nat (site 3 in Fig.1) grows is planted melons in the house which can control pests without the use of chemicals and not affected by drought in the water [8].

The comparative results of interview in both conventional melon farm and young smart farm by Mr.DueanKhiwas and Ms.Duangrudi Sri-aroon with farm size 1.76 ha and 72 m^2, inNongMamongand KutChok sub-districts, respectively, NongMamong district, Chai Nat province shown in Table 1 and Fig.2 to Fig.3. The annual net income for a conventional melon farm is approx.US $39,410 per ha. Modernization farm with a greenhouse (GH) as smart melon farm earns annual benefit of US$2,568 per GH.

Table 1 Summary of interview results of cost and profit in growing melon based on a conventional farm and young smart farm in the NongMamong district, Chai Nat province.

Name of interviewers (unit in US$)		**Mr.Duean**	**Ms.Duangrudi**
	Farm size, ha	1.76	0.0072
Fixed costs	Rental land or greenhouse (GH)	343.75	468.75
	Land preparation	240.63	-
	Materials i.e. plastic sheet, Drip irrigation systems, net, wood, metal wire etc.	4,546.88	1,812.50
	Sub total fixed cost	**5,131.25**	**2,281.25**
Variable costs	Fertilizers 5 times	384.75	93.75
	Insecticide & pesticide chemical control 6 times	45.00	-
	Labors	1,520.63	-
	Seeds	426.14	50.00
	Sub total variable cost	**2,376.51**	**143.75**
Annual round	Cropseasons/annual	4.00	4.00
	Sub total variable cost/yr	**9,506.05**	**575.00**
Annual cost	**Total cost/annual**	**14,637.30**	**2,856.25**
Production	Yield; fruits	30,000.00	200.00
	Yield; kg	42,000.00	300.00
	Market price unit US$/kg	0.50	4.69
	Income US$/crop	**21,000.00**	**1,406.25**
Annual income	Crops/annual	4.00	4.00
	Income	**84,000.00**	**5,625.00**
	Net income	**69,362.70**	**2,768.75**

Name of interviewers (unit in US$)	Mr.Duean	Ms.Duangrudi
Net income/ha or GH	39,410.63	2,568.75
% Labor/material cost	29.63	-

Note that the above cost excluding water fee, power supply i.e. gasoline fuel for pumping engine machine, electricity, solar cell panels, automatic control room, tensiometer, and etc.

Fig.2 Conventional water and fertilizer tanks, as for dripping irrigation systems in Mr.Duean farm [1]

Fig.3 Modernization and greenhouse for a young smart farm water and fertilizer tanks, as for dripping irrigation systems in Ms.Duangrudi farm [1]

5. DISCUSSION AND RECOMMENDATION

The above result is almost similar to the other farms in Phitsanulok, Ang Thong, SuphanBuri, Nakhon Phathom, Phichit, and others in Chai Nat provinces [2] to [11]. The slightly differences are from the owner of land or rental land, seed price in the market, automatic control system, power supply, water sources, and other pay attention in the farm. Watering and fertilization systems suggestion for melon [10] during crop stages are seedling stage (0-11 days) spraying water with only an optimum field capacity, and during the stemming (16-20 days) to optimum irrigation above the wilting point and upper limit to the field capacity and give the fertilizer formulation 27-5-5 (NPK). Before pollination stage (20-27 days) slightly reduce irrigation rate and fertilizing with 15-52-17 and during pollination time (35-40 days) spraying full watering and fertilizing 20-20-20 and 13-0-46, as well as the boron injection of calcium to produce a beautiful fruit product. Before harvest time (40-45 days) reduce the irrigation rate down and fertilize with

20-10-30 to strengthen the stalk together with fertilizer 7-1-40 to a beautiful color. Then until full maturity (45-55 days), give full water and fertilize the foliar spray to develop sweetness with 0-0-50 formula. After given fruits, the melon will be harvested to gradually reduce the rate of water and harvesting for consumer supply in the market.

Fig.4 Modified conventional melon farm water and fertilizer tanks, as for dripping irrigation systems [10]

The conventional melon farm needs for more lookingother land after finish growing 4 crops end of the year and change to other new land in order to avoid disturbance of insect pest as for easily control. Moreover, the farm size needs larger area, more labors, less market priceof yield than a modern or smart farm with a greenhouse for growing melon within the same period of 4 crops per year. The net income earns from a smart farm that is higher than an opened-air farm in term of farm size, labors, water efficiency, energy consumption, paying farm attention, and cheaper as long-term operation and maintenance cost of an irrigation system. Labor cost is approx. to 30% of variable cost. If the net annual income is fixed approx. to $40,000 for the farm size of the conventional method approx. for 1 ha. The smart farm would be increased to 16 numbers of GH and addition 30% for extra labor cost because it needs more attention on the farm, whilst the other items could be estimated using the proportional method. The total area of smart farm needs only 0.12 ha excluding larger automatic control-room farm roads and pond. However, the 16 - 20 farmers should pay attention together as joining inthe cooperative group or smart farm is better than single owner. More benefit from this suggestion will be met such the efficient in water management, farm attention, powerful marketing, higher income, etc.

6. CONCLUSION

The net income earns from a young smart farm that is higher than an opened-air tradition or conventional melon farm in paddy field in term of farm size, labors, water efficiency, energy

consumption, paying farm activities in attention, and cheaper as long-term operation and maintenance cost of an irrigation system.

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