

# **STUDY ON VEGETABLE PRODUCTION IN POLYETHYLENE HOUSE UNDER HOT CLIMATE CONDITION**

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Polyethylene houses (polyhouses) have been popularly used in many countries, especially in temperate ones such as Japan, Mexico, The Netherlands, Korea, France, UK, USA and China. However, they are also used in tropical regions as Israel and Arizona desert (USA). In Vietnam, for 10-15 recent years, polyhouses have been rapidly developed in Lam Dong province with hundreds ha expanded for flower and vegetable productions. In polyhouses, vegetables and flowers expressed 5-10 folds of economic value higher than those in open fields. However, polyhouse and growing vegetables in polyhouse under hot climate condition of the Southern parts of Vietnam has not been well studied.

In 2001, Vinh *et al.* conducted tests of growing vegetables in Hoc Mon district, under a 400 m<sup>2</sup> polyhouse. Then, in 2005, a 20-m<sup>2</sup> polyethylene roof that built inside a net house. In 2006, Vinh designed a 200m<sup>2</sup> polyhouse for a person in Cu Chi District, Ho Chi Minh City to produce safe vegetables. In 2005, two farmers in Binh Duong province built a multi-polyhouse about 2000m<sup>2</sup> for growing hydroponic tomato. The results of production indicated that yields of vegetable in polyhouses/roof increased 20-30 % higher than those in open field.

From successful tests and practices mentioned above, a research entitled: “Study on growing vegetables in polyethylene house” was conducted from May 2007 to December 2009 in Tan Thanh district, Ba Ria Vung Tau province. The research aimed at studying and building a suitable polyhouse and techniques for growing vegetables in hot climate regions (such as Ho Chi Minh City, Dong Nai, Ba Ria-Vung Tau ...) in order to produce safe leafy vegetables all year round.

## **POLYHOUSE AND MICROCLIMATE CONDITION IN THE POLYHOUSE.**

A polyhouse of 495 m<sup>2</sup> (15m x 33m) had been built in Tan Thanh, Ba Ria Vung Tau. The house frame, rafter, roof, gutter are made of steel, bamboo, polyethylene, corrugated iron; respectively. The arsis is 4.5m high. The top of house is totally 6.2m in height, the roof is alternate and 0.5m in height. The house surrounded by polyethylene 0.6m in height from ground, 0.6m to 2.5m in height by net (in the standard of 32 holes/cm<sup>2</sup>), from 2.5m to 4.5m in height by net (9 holes/cm<sup>2</sup>). Inside the polyhouse, a sprinkler irrigation system has been installed.

In the polyhouse, mean temperature ranked from 31.4 to 32.9 °C (2°C higher than those outside), mean humidity was 54.6-56.6% (6.7-7.8% higher than outside's), mean sunshine was from 41.8 to 44.2 Klux (17.8-18.8 Klux lower than outside's). In 24 hours, temperature in polyhouse was the lowest from 8:00 pm to 4:00 am, varied 24-26°C, after that temperature increased gradually, reached to 29°C at 8:00 am and 34.7 °C at 12:00 noon. In the afternoon, temperature reduced at 29.7 °C at 4:00 pm. Observations both inside and outside of polyhouse, it is indicated that from 4:00 pm to 4:00 am, there was not different in between. From 8:00 am, temperature was still cooler than outside but up to 12:00 noon, inside temperature was higher than outside one, with mean difference of 1.3 °C (34.7 °C as compared to 33.4 °C) This gap was not much and plant might tolerate in this range. Another, there were differences in heat value, humidity, sunshine in area of 40cm (effect on plants) and 150 cm (people can feel hot when stand in polyhouse) from the ground. Data showed that at 150cm height, the temperature is 1.5 °C higher and the humidity is 2% lower those in 40cm height. This explained that normally we feel hot when standing in the house but plants can.

## **GROWING VEGETABLES IN POLYHOUSE**

### **Rainy season (September 19 - October 24, 2007)**

In the rainy season, nine kinds of vegetable were grown under polyhouse condition that spent a severe temperature period. In all crop-growth duration, temperature ranged from 31.4 to 32.9°C. Especially, there

was a period of continuously 11 days, temperature ranged from 39 to 40°C (October 5-15, 2007). This happened right in the period that vegetable are developing (mid-season). However, yields were rather high, not less than yields of main season's vegetable, which grown outside. Below are yields of vegetables in this case as compared to those outside (tons/ha, inside/outside): Green mustard 24.5/12.9, Lettuce 30.7/20.7, Edible Amaranth 36.5/21.8, Coriander 15.9/10.7 and Garden Chrysanthemum 22.7/15.0.

### **Dry season**

In this season, stripped flea beetle (*Phyllostreta striolata*) had strongly developed, Green mustard grown in the field was lost by them meanwhile in polyhouse it produced 22.3 tons/ha. This is the important advantage point of polyhouse utilization. Lettuce, Garden Chrysanthemum and Edible Amaranth grown in polyhouse were harvested earlier and gained higher yield (40-77%) than outside's. Farmers harvest 2 days and 4 days sooner for Lettuce and Garden Chrysanthemum; respectively. The yield of Lettuce was noticed as 30.4/20.8 t/ha of inside and outside polyhouse; respectively, then Edible Amaranth 27.2/15.3, Coriander 16.2/11.6, and Garden Chrysanthemum 23.0/13.4.

### **Economic performance of vegetable cultivation under polyhouse condition**

Investment for growing vegetables in polyhouses requires high cost than outside's. It means VND 46.0 million/year/1000m<sup>2</sup> for inside polyhouse as compared to VND 27.3 million/year/1000m<sup>2</sup> for outside ones. However, inside polyhouse gross return and net return was much higher. For example, data of inside polyhouse cultivation from 9 crops/year/1000m<sup>2</sup>, including 2 Garden Chrysanthemum crops, 2 Coriander crops, 3 Lettuce crops and 2 Green mustard crops created a gross return of VND 123.3 million and a net return of VND 77.3. Meanwhile, nine crops (four Green mustard and five Lettuce crops) under outside ones created VND 65.0 million and VND 37.7 million for gross return and net return; respectively.

### **CONCLUSION**

The polyhouse model built in Ba Ria-Vung Tau has been able to leafy vegetables production in Ba Ria-Vung Tau and other provinces under similar weather condition. Inside polyhouse, temperature is rather high but leafy vegetables can normally produce and obtain good yields.

In rainy season, Coriander, Garden Chrysanthemum and Lettuce are high economic kinds in polyhouse. Meanwhile, Green mustard may give high economic value all year round there. Because they are protected from stripped flea beetles.

### **SUGGESTION**

Recommendation on polyhouse would be made for safe vegetable production in areas, which have similar climate condition as Ba Ria-Vung Tau and in where city land at suburb areas is quite restricted.



Vegetables in polyhouse in Tan Thanh, Ba Ria-Vung Tau