Year-round Vegetable Production under Simple and Movable Construction[1]

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Abstract

CHEN, Y. W. and H. B. CHEN · 1991 · Year-round Vegetable Production Under Simple and Movable Construction. Research Bulletin of Tainan District Agricultural Improvement Station. 27 : 1~6.

The benefits of year-round vegetable production using simple and movable constructions including the reusage of constructions to reduce production cost, earlier harvesting of vegetables, less harzardous caused by continuous cropping and less pesticide. In this experiment, various kinds of vegetable were grown continuously throughout the year under a simple and movable construction. During the hot and humid summer season of July to October, four or five plantings and harvestings of pai-tsai, water convolvulus, and chin-kerg pai-tsai were possible in the same field covered with green net plastics. While in the cool season of fall and winter between November and February, the constructions were covered by transparent PE films for muskmelon, watermelon or cucumber production. From February to June, it can be covered with rope nets to grow bitter gourd. This cropping pattern can be continuously used for two years in same location and not showing the problems of succession cropping in comparison to traditional cultivation. The construction can be moved to a new location after two years for vegetable production of the same cropping system.

Key words : vegetable, production, protected culture.

Accepted for publication : October 30, 1991

Introduction

Vegetables production under protected structures with simple plastic nets

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house began in 1973[2] in ROC on Taiwan. Due to the hazardous and pest problems of succession cropping, it is abandoned gradually after several years of trial[1]. The study is attempted to overcome the problems of production in tradition plastic houses. A fixed structures of early models were revised and changed to become a movable or reusable structure which can be easily moved to a new field and reconstructed for the second use of the facility. Different crops can be arranged for a year-round sequence production of continued croppings according to their growing season. Due to the changes of crops in production and fully use of construction facility, continued cropping harzards and pest problems were greatly lessened which resulted in lowering of the production cost.

Material and Methods

Lead pipes, PE films, green net plastics and rope-net with large eyes are used to construct the simple tunnels. Each tunnels is 100m^2 in area size (length×width ×height=20×5×2m), and six tunnels are used in this study. The tunnles are covered with green net plastics between July and October, with transparant PE plastic films between November and February, and with rope-net with large eyes between late February and June. Experiments are conducted in sandy loam for two years from July 1987 to June 1989. Three cropping patterns as listed on table 1 are practiced and each with two replications. A tradional open field cultivation without covering is served as control. Because the harzardous in continuos cropping watermelon, muskmelom and cucumber were not grown on the same field but bitter gourd during two years of experiment.

Table 1. Cropping patterns in simple constructions

Cropping patterns	Months		
	July~Oct.	Nov.~Feb.	Feb.~June (lst year) Late Jan.~June (2nd year)
1	Leaf vegetables (Paitsai-chinkerg paitsai-water convolvulus-paitsai)	Muskmelon	bitter gourd
2	〃	Watermelon	〃
3	〃	Cucumber	〃

Note: No continuous cropping harzard was observed in bitter gourd to muskmelon, watermelon and cucumber.

Results and Discussion

From July to October, three kinds of short growing leafy vegetable of paitsai, water convolvulus and chinkerg paitsai were suceessionally planted in four plantings in green net plastic tunnel house.

The average growing time between each planting was approximately 25 days. The cropping sequence is paitsai→Chinkerg paitsai→water convolvulus→paitsai. Table 2 summarized the average yields in two years. It showed that the yield in simple tunnel structure was higher than in open field due to floating climatic conditions in summer which can be easily control under tunnel cultivation. The netting could prevent vegetables from damage of breaking heavy rain drops. The growth rate in tunnle was faster and the yield was also more stable. Air temperature inside the tunnel was 3−4℃ higher in day and 1−2℃ higher in night than those in open field. The amount of pesticides used in tunnel is reduced to one fourth of open field in the first year and half in the second year. However insects still remained the major pests in tunnel cultivation.

During the winter growing season from November to early February of the following year, tunnels were covered with transparent PE films to grow muskmelon, watermelon and cucumber. These seedlings were prepared in mid-October and then transplanted in the early November. The yields of the testing crops are shown in Table 2. Due to the lowtemperature in winter season, the growth of muskmelon and watermelon plants in open field was very poor, therefore, no yield was obtained. Although cucumber was able to grow normally, the fruit quality was poor and marketable yield was low. However, sugar content was 13−15 Brix for muskmelon, and 10-11 Brix for watermelon those were grown in tunnels. Air temperatures inside tunnels was 4−7℃ higher in day and 2−3℃ higher in night time than that in open fild. Powdery mildew and dowery mildew were the major diseases of the cucubits in tunnels. Fusarium wilt was also observed in muskmelon. For the early harvesting of bitter gourd, cucubits seeds were sowed on the 2nd of October, and transplanted on the 25th of October in the second year's experiment. The yield of muskmelon, watermelon and cucumber were showed on Table 3. The difference of yields, pests and temperature between the first year and the second year was very similar, but damage of pests in the first year was higher than those in the second year.

Bitter gourd seedlings were transplaned on the 15th of February in the first year and on the 25th of January in the second year. Seeds were sown at three weeks before transplanting. Seedlings of bitter gourd were transplanted two weeks before the complete harvest of the previous crop, closely to the lead pipe frames. When previous crops are harvested, the fields were cleaned and the

frames were used as supportion poles to stretch the rope-nets with large eyes for climbing growth of vines. In the open field, bamboo sticks were used as supporting poles. The PE plastic tunnels were removed. When temperature was getting warmer in middle of March which would enhance the growth of bitter gourd in the early stage. Bitter gourd can be harvested two weeks earlier than those grown in open field in the first year, and harvested 40 days earlier in the second year as well as higher yield. Yields in the first year and the second year were listed in Table 2 and 3, respectively. Powdery mildew was the major disease during the growth, although the presence of the fruit fly that can be prevented by bagging of the fruits at the early fruit setting from injury.

When cucurbits are grown in the protected environment, hand pollination of muskmelon and watermelon are regired, but not for the cucumber and bitter gourd. As shown in Table 2 and 3, yield in the first year was lower than that in the second year, which may be due to the lack of management experience in the first year. In general, disease and insect in the second year were more serious than that in the first year. Therefore, the construction of tunnel is better to be moved to a new land for continuing use.

Table 2. Yield of leaf vegetables and cucurbit crops growing under protected and open field in the first year between 1987 and 1988

Crops	Growing period	Yield (kg/0.1ha)	
		Protected cultivation	Open field cultivation
Leaf vegetables *	7.03 ~ 10.26	5,980	5,300
Muskmelon	11.06 ~ 2.28	1,560	0
Water melon	11.06 ~ 2.28	2,640	0
Cucumber	11.06 ~ 2.28	2,315	850
Bitter melon	2.15 ~ 6.20	2,100	1,920

* Include : Paitsai, water convolulus and chinkerg paitsai.

Table 3. Yield of leaf vegetables and cucurbit crops growing under protected and open field cultivation in the second year between 1988 and 1989

Crops	Growing period	Yield (kg/0.1ha)	
		Protected cultivation	Open field cultivation
Leaf vegetables	7.02 ~ 10.20	6,410	6,040
Muskmelon	10.25 ~ 2.10	2,640	0
Water melon	10.25 ~ 2.10	3,180	0
Cucumber	10.25 ~ 2.10	2,870	1,800
Bitter melon	2.25 ~ 6.20	2,800	1,840

Table 4. Analysis of cost and return on year-round vegetable production under simple and movable construction.

	Items	Cost and return (US$/0.1ha)
A.	Input :	6,300
1.	Materials of structure (including average cost of 6 years used)	1,700
2.	Labor	4,000
3.	Seeds	200
4.	Fertilizer and pesticides	400
B.	Return and (net profit)	
1.	Leaf vegetables+Muskmelon+Bitter gourd (0.8×6195+1.8×2100+1.2x2450)	11,670 (5,370)
2.	Leaf vegetables+Watermelon+Bitter gourd (0.8×6195+1.3×2910+1.2×2450)	11,679 (5,379)
3.	Leaf vegetables+Cucumber+Bitter gourd (0.8×6195+1.3×2592+1.2×2450)	11,266 (4,966)

As the results presented in Table 4, year-round production of vegetables in simple and movable tunnel is feasible and profitable. When vegetables price is high in hot and warm summer season, the net plastic tunnel can be used for fast-growing leaf vegetables and use less pesticides. In winter season, the PE plastic tunnel provided the function of forcing production, it can be used to grow muskmelon, watermelon or cucumber of high profit crops. The bitter gourd harvested from this system was earlier than the traditional method, and the price of productsis obviously higher.

Literature cited

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移動式簡易設施蔬菜周年栽培[1]

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摘　要

利用移動式簡易設施進行蔬菜周年栽培，其優點爲充份利用設施，可降低生產成本，提早收穫，無土壤連作障害問題，及可減少使用農藥。本試驗利用不同種類蔬菜周年栽培結果：(1)七月至十月覆蓋綠色尼龍網栽培小白菜、青梗白菜或蘿菜等短期蔬菜四～五次。(2)十月至一月覆蓋白色塑膠布栽培洋香瓜、小胡瓜或西瓜。(3)二月至六月利用設施骨架栽培苦瓜。同一土地可以此模式栽培二年，然後更換土地。本設施爲可移動式，遷移方便。

關鍵詞：蔬菜，生產，設施栽培。
接受日期：1991年10月30日。

1.台南區農業改良場研究報告第199號。

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