野菜の周年栽培による沖縄県における野菜の自給率向上に関する研究：パミスサンド栽培法による野菜の生産と販売に関する事例研究

Study on the Improvement of Vegetable Self-Sufficiency Rate in Okinawa by Introducing all the year round Vegetable Production

— Case Study of Vegetable Production and Sale by Introducing the "Pumice Sand" Cultivation —

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Key Words : Self-sufficiency rate, "Pumice Sand" cultivation, Supply and demand, Hydroponic cultivation
キーワード：自給率，パミスサンド栽培，需給，水耕栽培

Summary

The self-sufficiency rate of vegetables of Okinawa prefecture is low. The reason of low self-sufficiency rate is because vegetable production of summer is small.

All the year round vegetable production by the "Pumice Sand" cultivation spreads in Okinawa prefecture from early stage in 1980s.

Y farmhouse of Kadena town is producing lettuce all the year round by introducing the "Pumice Sand" cultivation.

The "Pumice Sand" cultivation method is effective as vegetable production measures of summertime and contributes to improvement of self-sufficiency rate, but how to make use of equipments and facilities in the winter when the open field production increases is a subject in the "Pumice Sand" cultivation.

Introduction

The characteristics of vegetable supply and demand in Okinawa are concentration of production in winter and spring and small production and autumn and summer. The small production is covered with vegetable produced outside Okinawa. As a result, the self-sufficiency rate of vegetable becomes low. One of the authors pointed out that to raise the self-sufficiency rate of vegetable in Okinawa, the establishment of vegetable production system in autumn and summer was a must.[1)]

In this study, the authors show one method to raise the self-sufficiency rate of vegetables in Okinawa by introducing all the year round production by the "Pumice Sand" cultivation and want to point out it's subjects.

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Sci Bull Agric, Univ Ryukyus 44 : 211～218 (1997)

What is the "Pumice Sand" cultivation ?

The "Pumice Sand" cultivation is one method of the hydroponic cultivations which developed by Agricutural Experiment Station, the College of Agriculture, University of the Ryukyus early in the 1980s. The "Pumice Sand" is a pumice rock ground to a fineness of no larger than 2 mm. The "Pumice Sand" cultivation uses "Pumice Sand" for culture medium.[2)]

The "Pumice Sand" cultivation in vinyl house is the vegetable cultivation as a factory like production system removing influence of weather, the soil, biological environment, and artificially controlling the most suitable vegetable production environment. By introducing this method, planned production, shortening of cultivation period, labor saving, and no pesticide cultivation will become possible.[3)]

The 8 farmhouses including Y farmhouse in Okinawa island, Miyao island, and Ishigaki island produce lettuce, cucumber, etc. by the "Pumice Sand" cultivation.

Background of Introduction of the "Pumice Sand" Cultivation by Y Farmhouse

The manager (43-year old) of Y farmhouse was employed in the fertilizer company in Okinawa after graduation from the university. Through work, he paid attention to all the year round cultivation of vegetables by vinyl house. Upon retiring from the fertilizer company together with his father's retirement of Okinawa prefecture, the manager and his father have been engaging in all the year round lettuce production and shipment system by introducing the "Pumice sand" cultivation since 1994.

1 Investment, Equipments and Facilities

Y farmhouse is renting 1,800 ㎡ of land for vinyl houses from Kadena town office at 18,000 yen per year.

Two vinyl houses were built borrowing from JA (7 million yen) and the Okinawa Development Finance Corporation (15 million yen) (Photo 1). One vinyl house area is about 600 ㎡.

Photo 1 Vinyl House

Other equipments and facilities are growing boxes, "Pumice Sand", and pipes.

Growing boxes are one meter high from the ground (Photo 2) and already equipped with drip pipes, which were introduced from Israel. Ten of the growing boxes, 1.2 m in width and 30 m in length could be seen in one vinyl house. In another vinyl house, "Pumice Sand" are covered by white sheet to protect from heat and to control the sand's temperature as well (Photo 3).

Photo 2 Growing Box (Normal)

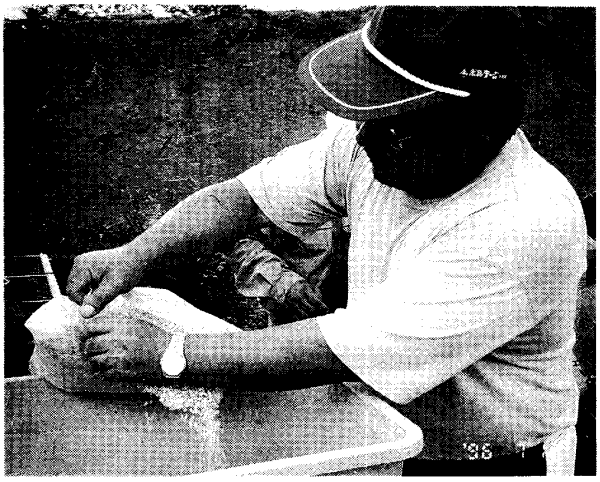

Photo 4 "Pumice Sand" 1

Photo 3 Growing Box (white sheet)

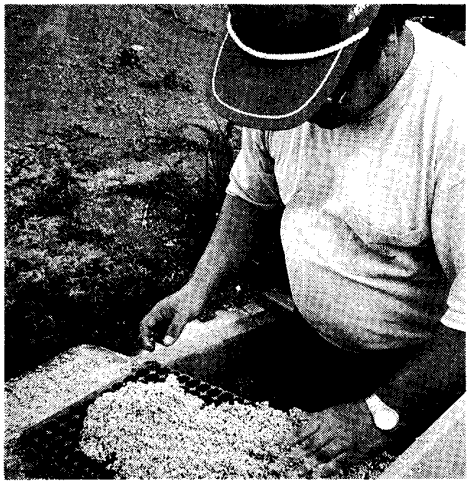

Photo 5 "Pumice Sand" 2

The vinyl house temperature is controlled at about 20～27 ℃ and the blue sheet is used as roof which can be automatically covered or opened.

2 Labor force

Lettuce production by the "Pumice Sand" process is running with 2 full time family labors and one part time labor. The farm practices other than packaging lettuce are done by two family labors and one part-timer labor works 500 yen per hour, for two hours packaging lettuce in the morning a day.

3 Production Process of Lettuce (Saradana)

1) Seed bed preparation

"Pumice Sand" are washed with water (Photo 4) and put in a tray which contains 200 holes (Photo 5), and then dips in fertilizer solution for a few seconds. 200 coated lettuce seeds are sown in the tray at once by using seed drill and watered after sowing (Photo 6). These seed are imported from Holland and better than Japanese variety in quality. Germination occurs in one week (Photo 7).

Photo 6 Watering

Photo 8 Making Holes in Growing Box with Board

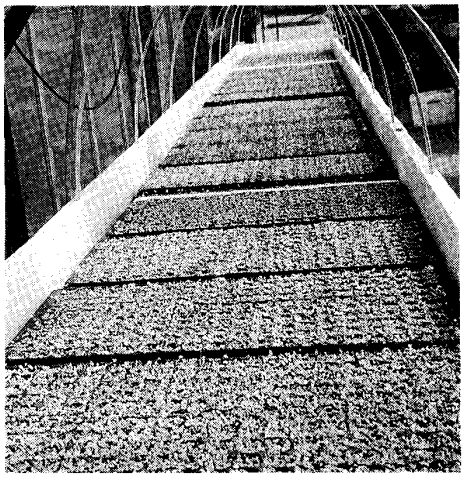

Photo 7 Different Stage of Lettuce Seedling

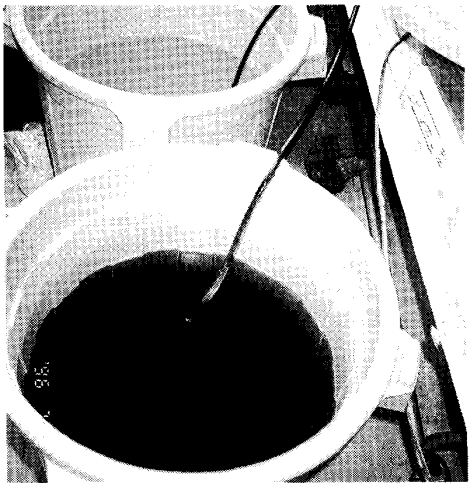

Photo 9 Fertilizer Solution

2) Transplanting practices

The seedlings could be transplanted after 14 or 16 days of germination. The tray should be dipped in the water for easy taking off the seedlings and the seedlings are planted in holes, those are 5 cm in depth and 15 cm apart (Photo 8). Watering should be done gently before transplanting and more water is necessary after transplanting.

3) Fertilizer solution

Two kinds of fertilizer are used as a solution in the "Pumice Sand" cultivation. 15 kg of N(10):P(8):K(27) and 10 kg of Ca(23):N(11):Mg(4) are soluted in 90 liter water and stored in a tank (Photo 9). Fertilizer solution is contributed by drip pipes 4 times a day and each time takes 3 minutes in the winter and 5 minutes in the summer, 90 liter of nutrient solution can be used 10 days in the summer and 14 days in the winter.

4) Harvesting and storage

Lettuce can be harvested 40 to 45 days after transplanting in the summer and 45 to 50 days in the winter. The plants should be pulled out very gently and cut at the bottom and then small leaves are taken out (Photo 10).

Photo 10 Lettuce Harvesting

Photo 12 Cold Storage

Photo 11 200 g of Lettuce

Photo 13 Supermarket

All the boxes are leveled and cleaned as soon as harvesting for next transplanting.

Harvested lettuce plants are needed to clean with wet cloth. 200 g of lettuce plants are packed in a polyethylene bag and put into a cartoon and then finally stored at 5 ℃ in JA Yuina's cold storage until the lettuce are delivered by JA Chokuhan (Photos 11, 12,13).

5) Sales and prices by the market stages

Generally, 40 kg (in the summer) or 70-80 kg (in the winter) of lettuce per day could be harvested and sold.

Lettuce marketing channel and prices by the market stages in the summer, 1996 are shown in Fig. 1

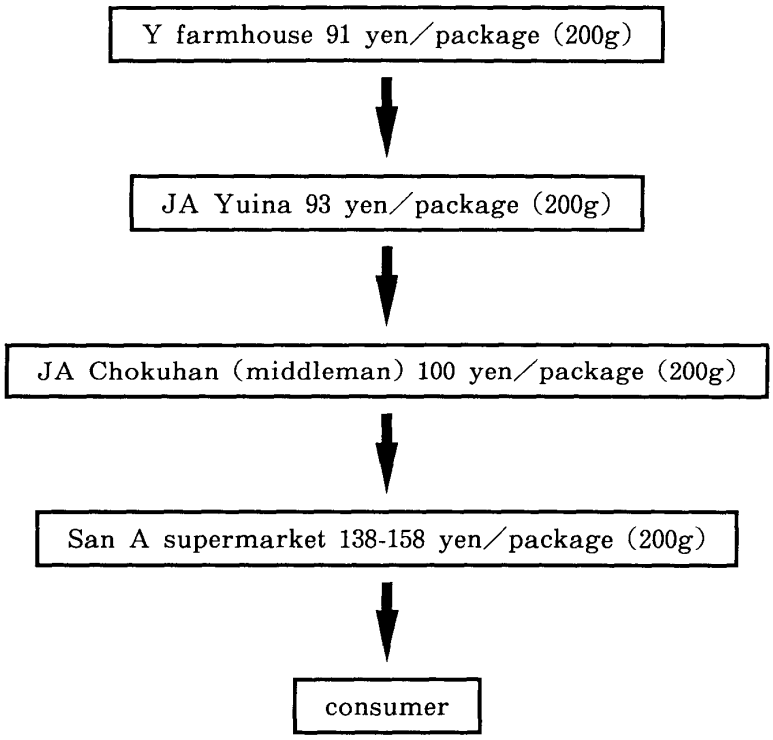

Fig. 1. Marketing channel and prices

All the lettuce produced by Y farmhouse is sold to San A supermarket by way JA Yuina and JA Chokuhan. JA Chokuhan collects the lettuce from JA Yuina's cold storage and delivers them to San A supermarket.

According to JA Yuina, JA Chokuhan, and San A supermarket, day durability and quality of vegetables produced by the "Pumice sand" cultivation were better than those of the water cultivation.

If farmhouse introducing hydroponic cultivation increase, vegetable production in summer increases and contribute to improvement of self-sufficiency rate. But the farmhouse must examine the effective use of equipments and facilities of winter season.

Conclusion

All the year round lettuce production by the "Pumice Sand" cultivation is achieved with minimal investment in labor. High quality lettuce can be produced daily and quality is always uniform. Y farmhouse could obtain constant income and he can control the production. Heavy cultivation practice and pest and disease control are eliminated. The quality of lettuce, grown by the "Pumice Sand" is better than by water cultivation. Now, he is testing other vegetables in the vinyl house.

The summer lettuce production by the "Pumice Sand" cultivation is small compared with winter production. It is a subject to solve this technically.

The winter lettuce production competes with the open field vegetable production. It is a must to lower the production costs or to grow vegetables that doesn't compete with vegetables which produced by the open field production.

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－パミスサンド栽培法による野菜の生産と販売に関する事例研究－

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要 約

沖縄県の野菜の自給率は低い。自給率の低い原因は夏期の野菜生産量が少ないためである。

1980年代の初め頃から沖縄県内でパミスサンド栽培法による野菜の周年生産が行われている。

嘉手納町のＹ農家はパミスサンド栽培法によりレタス（サラダナ）の周年栽培をしている。

パミスサンド栽培法は露地野菜が少ない夏期における野菜生産には有効であり，自給率向上に寄与する。しかし，露地野菜の最盛期である冬期に施設を有効に利用することができるかがパミスサンド栽培法の課題の１つである。

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