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# Study on effect of Comprehensive Preventing Measures on Continuous Cropping Disease of Strawberry in Greenhouse

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**Abstract.** Strawberry Toyonoka which was the mainly planted strawberry breed in Longkou City of Shandong province, was taken as samples to study high temperature disinfection, plastic Mulched Irrigation, greenhouse sealing and other comprehensive measures, and to test the preventing effect of the abovementioned measures. Result showed that effective rate of the comprehensive preventing measures reached up to 90% on prevention & cure of soil borne nematode disease, prevention of strawberry powdery mildew, botrytis cinerea and red stele root rot. Single fruit weight increased 25% and overall yield increased 40%. The comprehensive measure was significantly effective on preventing continuous cropping diseases.

**Key words:** Strawberry planting; Continuous Cropping Disease; Comprehensive Preventing Measures; Lime Nitrogen.

## INTRODUCTION

The application of lime nitrogen has obvious advantages in soil remediation, killing diseases and pests and improving strawberry root ecological environment [1-3], which can increase strawberry yield and farmers' income. The author applies lime nitrogen in the strawberry greenhouse of Xinjia Subdistrict Office, Longkou City, Shandong Province, in combination with other control measures. The study is conducted to study the control effects of powdery mildew, gray mold and red heart root rot on the quality and economic benefits of the main local strawberry cultivars "Fengxiang", so as to provide reference for the production of green, safe and high -yield strawberry.

## MATERIALS AND METHODS

### Overview of Test Site

The test site is located in the strawberry greenhouse of Luan defeng, Bolan Village, Xinjia Subdistrict Office, Longkou City, Shandong Province. The test greenhouse is an east-west simple sunlight greenhouse covered with thin film. The greenhouse is about 90m long and about 6m wide. The planting density is about 10000 per 666.7 m<sup>2</sup>, and the row spacing is about 25cmx30cm [4].

### Test Material

Strawberry powdery mildew, gray mold and red heart root rot are relatively serious in two greenhouses which had been used for three years. The test variety is Strawberry Toyonoka, the main strawberry variety in Yantai, Shandong province. According to the test design, other materials are lime nitrogen dedicated for greenhouses produced by Ji'nan Xinnuo Chemical Co., Ltd., chopped corn stalk, rotten chicken manure and transparent plastic film.

## Test Method

The test was conducted from July 2017 to May 2018. A control greenhouse (A) and a demonstration greenhouse (B) were set up, and no control measures were taken in the greenhouse A and the planting values were all in the greenhouse. Lime nitrogen and other comprehensive control measures were applied in greenhouse B. Other routine cultivation management was consistent.

On July 27, a high-temperature day, we cleaned the weeds and debris in the demonstration greenhouse, watered it at one time, deeply ploughed it after two days, closed the greenhouse so that the temperature of the greenhouse could reach above 40°C for 10-15 days; evenly spread 75kg lime nitrogen, 3000kg chopped corn stalk and 6 cubic meters decomposed chicken manure, cultivated it in the rotary way with rotary tillage machine for 5 times, evenly dumped the corn stalk, chicken manure and lime nitrogen into 40 cm deep in the soil to ensure the uniform distribution of organic matter, lime nitrogen and soil plasmid; leveled the land, made the ridge with the height of 20-30 cm and width of 60-70 cm, covered with transparent film and compacted with soil around, completely closed the soil surface and irrigated a large amount of water until it was thoroughly wet, so that the water -holding capacity of the field could reach about 70%; completely closed the greenhouse so that the temperature in the greenhouse could be kept above 50°C for 30 days.

## Measurement Items and Data Calculation

About thirty days (1) and fifty days (2), in the middle of January (3) and late January (4) of the next year after strawberry was planted, soil 50 g soil was separately sampled randomly to separate nematodes in strawberry rhizosphere soil, and obtain the amount of nematodes; the survival rate of two greenhouses and the incidence of gray mold, powdery mildew and red heart root rot were calculated by the formula (number of diseased plants/total number of investigated plants) $\times$ 100%=incidence (%); 20 strawberries were picked randomly in two greenhouses at the early, middle and late ripening stages, and weighed by electronic scales.

## RESULTS AND ANALYSIS

### Comparison of Strawberry Plant Survival Rate, Incidence of Common Diseases and Number of Nematodes in Soil

According to the data calculation, the number of nematodes is 67.7 (1), 77.3 (2), 85.3 (3) and 89.7 (4) per 50g soil in the control greenhouse (A); the survival rates of plants is 92% (1), 82% (2), 76% (3) and 75% (4); the incidence of powdery mildew is 1.84% (1), 1.96 (2), 5.60% (3) and 5.73% (4), respectively; the incidence of gray mold is 5.98% (1), 6.00% (2), 17.68% (3) and 18.98 (4); the incidence of root rot of red heart is 0.32% (1), 0.98% (2), 2.12% (3) and 2.83% (4); the number of nematodes is 10.3 (1), 12.7 (2), 15.3 (3) and 15.7 (4) per 50g soil in the demonstration greenhouse (B), respectively; the survival rates of plants is 98% (1), 96% (2), 90%, (3) and 90% (4); the incidence rates of powdery mildew is 0% (1), 0.10% (2), 0.50% (3) and 0.56% (4); the incidence of gray mold is 0% (1), 0.12% (2), 0.29% (3) and 0.29% (4); the incidence of root rot of red heart is 0% (1), 0% (2), 0.12% (3) and 12% (4), respectively.

From the above data, it can be seen that the comprehensive prevention of continuous cropping obstacles can effectively kill the residual bacteria in soil, the pathogens of soil-borne diseases and the underground pests such as nematodes. The occurrence of the main strawberry diseases such as powdery mildew, gray mold and red heart root rot has also been significantly inhibited, and the survival rate of plants has been greatly improved compared with previous years. Although the survival rate of the plant in the demonstration greenhouse (B) will decrease, the number of nematodes in the soil, the incidence of powdery mildew, the incidence of gray mold, and the incidence of red heart root rot will increase with time, it is not difficult to find that compared with the control greenhouse (A), the survival rate of the plant in the demonstration greenhouse (B) increases by 12%, the incidence of powdery mildew, gray mold, red heart root rot and the number of nematodes decreases by 4%, 12%, 2% and 67 respectively.

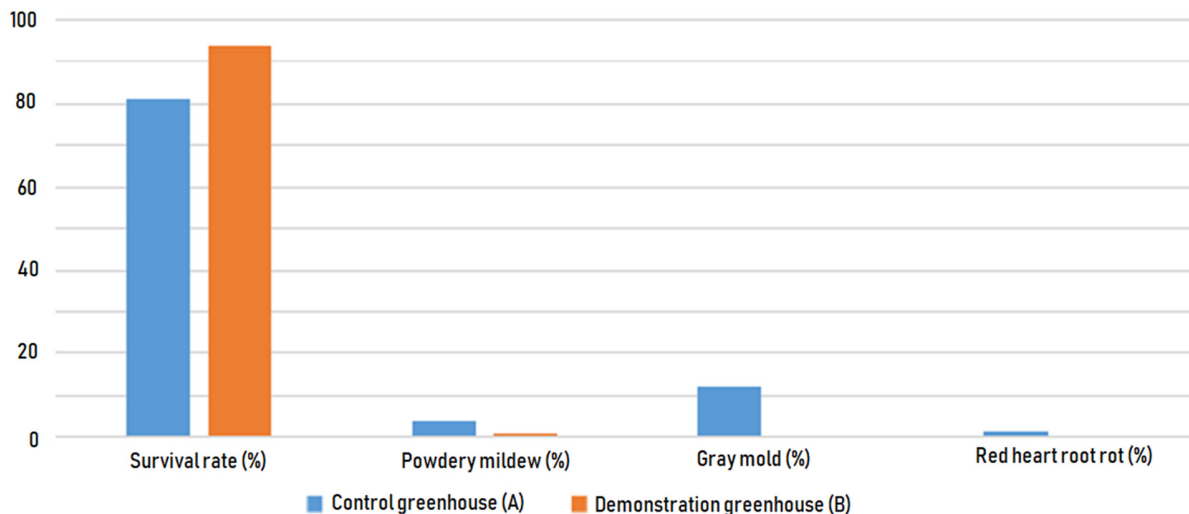


FIG 1. Comparison of occurrence and survival rate of common diseases and pests in Strawberry

### Comparison of Strawberry Quality, Yield and Economic Benefits

Strawberries in Longkou City, Shandong Province begin to appear in the market from mid November and can be picked up until May 1 next year. According to the survey, local strawberries can be sold at a price of up to RMB 70~80 yuan /kg and the trade price is RMB 12~24 yuan /kg when they begin to appear in the market. Table 1 shows that the weight of the single strawberry in greenhouse B is 25% higher than that in greenhouse A, the taste of fruit in greenhouse B is obviously better than that in greenhouse A. The specific income and total yield data (provided by Luan Defeng) show that the yield of greenhouse B is significantly higher than that of greenhouse A, with an increase of 40%. For greenhouse B, with the decrease of plant incidence, seedling replenishment, pesticide application and labor costs decrease correspondingly, and economic benefits increase significantly.

TABLE 1. Comparison of economic benefits between greenhouse A and greenhouse B

Strawberry greenhouse	Average fruit weight (g/piece)	Output (kg/greenhouse)	Average retail price (RMB yuan /kg)	Gross income (RMB yuan / greenhouse)	Increased income (RMB yuan / greenhouse)
Greenhouse A	80	2500	16	40000	
Greenhouse B	100	3500	16	56000	16000

### DISCUSSION AND CONCLUSION

At present, some methods of dealing with continuous cropping obstacles cannot be popularized because of the high cost and complex technology. The results show that the comprehensive prevention of continuous cropping obstacles is effective, and the effect of continuous cropping on strawberry in greenhouse can reach more than 90% and the cost is low, simple and easy to operate, which is a production model worthy to be promoted.

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