

Proceedings of the 4th International
Asia Pacific Conference on Citrus Rehabilitation
Chiang Mai, Thailand, 4-10th Feb. 1990
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SUCCESSFUL INTEGRATED MANAGEMENT OF HUANGLUNGBIN DISEASE IN SEVERAL FARMS OF GUANGDONG AND FUJIAN, BY COMBINING EARLY ERADICATION WITH TARGETED INSECTICIDE SPRAYINGS

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Abstract

In various large state farms of Guangdong and Fujian, such as Yangchun or Red Star farms, successful integrated control of Huanglungbin was achieved by combining proper nursery management with early eradication of infected plants and adequate insecticide sprayings. These measures resulted not only in the successful elimination of early Huanglungbin outbreaks, but also in preventing further new contaminations.

Introduction

For half a century, citrus Huanglungbin plagued the citrus producing areas of Fujian and Guangdong. Many citrus farms, including the most famous state plantations, were so affected that they went out of cultivation and had to be replaced by other crops.

But recently, citrus production soared again with the application of integrated measures aimed at

- 1) promoting wide scale production of healthy nursery plants
- 2) organizing a systematic and early eradication of infected plants in existing orchards
- 3) applying insecticide sprayings at critical flushing periods.

1. Yangcun Farm

Yangcun Citrus Farm, one of the largest citrus farms in China, is situated in Boluo county of central Guangdong. It was set up in 1953 and has now an area of 1467 ha, where the leading citrus cultivars are Ponkan and Tankan grafted either on red Lemon or on sunki. During 1977-1981, 960000 citrus plants, almost all of which were grown

before 1977, were eradicated because of *Huanglungbin*. Thus, the production dropped to 5000 tons in 1982, compared with 450000 tons in 1977.

Since 1978, the farm has been gradually replanted with disease free material after the removal of infected trees. If separate plots showed more than 50% infection they were completely eradicated. This integrated programme included adequate insecticide sprayings for controlling *Diaphorina citri* populations. One or two sprays were usually conducted before the spring bud break, then during the spring shoot, during the summer shoot and at last during the autumn shoot. Rogor emulsion (800x) or 1605 emulsion (1000 x) served as the pesticides.

The strict implementation of the above mentioned measures has brought about such an excellent result that the incidence of *Huanglungbin* has fallen to around 1% since 1977 whereas the annual production has raised year after year and has reached 30000 tons this year, with significant improvement of productivity (T/ha) (Table 1).

Table 1. The annual incidence of *Huanglungbin* and the annual production in Yangcun citrus farm in 1978-1989

Year	Plant No.	Incidence (%)	Fruiting areas (ha.)	Production (t.)	T/ha
1978	558453	6.88	909	10960.8	12.2
1979	907831	3.23	755	7285.9	9.6
1980	898729	1.25	675	8576.8	12.7
1981	658312	3.76	709	6980.0	9.8
1982	684590	2.18	569	5294.0	9.3
1983	1612798	0.96	674	6700.0	9.9
1984	1610364	1.23	821	12751.6	15.5
1985	1749858	0.98	1070	14500.0	13.5
1986	1764852	0.88	1233	14500.0	11.7
1987	1716311	1.29	1384	27500.0	19.8
1988	1803378	0.86	1418	31379.8	22.1
1989	1804588	0.81	1467	32500.0	22.1

2. Red Star Farm:

The Red Star Farm, 12 kilometres away from Fuzhou, is situated in its southern outskirts of the city near the international airport. It was set up in 1966 with an area of 151 ha., of which 91 ha covered with citrus. There are 100,000 citrus plants in the farm. Fuju Mandarin and Xuegan oranges are the leading cultivars; Ponkan, Tankan and Satsuma ranking next. All these plants are grafted either on trifoliate orange or Fuju mandarin rootstock. For many years 15-20% of them were infected with *Huanglungbin*. Since 1979, *Huanglungbin* has been curbed and the production has raised year after year, reaching 3,000 tons in 1989 (Table 2), as a result of the effective measures taken, i.e. prompt eradication of infected plants, immediate replacement of healthy plants and a timely spray of pesticide. A sharp increase of productivity was obtained with such sanitation measures since an average yield of 37 T/ha was obtained in 1989.

3. Donghutang Overseas Chinese Farm:

This farm is located in Ningde county, N.E. Fujian, and has an area of 1050 ha, including paddy rice field, upland crops and fish ponds.

Table 2. The annual incidence of Huanglungbin and the annual production in Red Star Farm in 1979-1989

Year	Plant No.	Incidence (%)	Fruiting area (ha.)	Production (t.)	T/ha
1979	57750	2.50	54	565	10.4
1980	68950	2.00	42	630	15.2
1981	76300	0.90	42	810	19.3
1982	88620	1.00	50	865	17.3
1983	90920	0.50	58	1042	17.9
1984	92120	0.90	72	1485	20.6
1985	93030	1.00	76	1975	25.9
1986	91140	0.80	80	2100	26.2
1987	92050	0.80	80	2250	28.1
1988	103670	0.90	81	2500	30.8
1989	113260	0.80	81	3000	37.0

In 1985, 100 ha. of paddy field was converted into citrus so as to increase the net income of the farm. In order to set up a disease free citrus grove, the farm took the following measures:

- Before growing citrus plants, backyard trees including a number of infected citrus plants and some sporadic wampee (*Clausena lansium*) and *Murraya paniculata* plants were eradicated.
- Every 10 ha. of citrus grove, a windbreak (horsetail beefwood trees, *Casuarina equisetifolia* L.) was planted for protecting the plantation.
- The citrus cultivars were Fuju mandarine, Ponkan and Liu orange grafted on trifoliate orange or on Fuju mandarine. All nursery trees were healthy, supplied by the Pomology Institute of Fujian Academy of Agricultural Sciences.
- Huanglungbin has been examined regularly and any infected individual was immediately replaced by a healthy young plant.
- As a rule, fertilizer application, irrigation and pruning were carefully implemented. Introduction of citrus fruit and Rutaceous plants has been prohibited.

The 70,000 citrus plants which were grown in 1985-1986 have a good development and none of them has been found to be infected with Huanglungbin. In 1988, the plantation began to bear fruit and produced 200 tons of fruit.

There are some more new Huanglungbin-free citrus groves which have taken the same measures as in Donghutang Overseas Chinese Farm. They are listed as follows:

- Changyan Citrus Farm: It was set up in Cunxia village, Minho, in 1982 and has an area of 1.5 ha. Now it has 1900 plants of Fuju mandarine and Xuegan orange grafted on trifoliate orange or Fuju mandarine. They began to bear fruit in 1985 and produced 60 tons of fruit in 1989.
- Changtai Citrus Farm: It was set up in Changtai county of South Fujian in 1985 and has an area of 10 ha. Now it has 7500 plants of Ponkan, Xuegan orange, Tankan and Liu orange grafted on Fuju mandarine. They began to bear fruit in 1987 and produced 50 tons of citrus in 1988.

- 3) Yangchun Citrus Farm: It was set up in Yangchun county of South Fujian in 1985 and has an area of 8 ha. Now it has 6,000 plants of Ponkan, Xuegan orange, Xinhui orange and Fuyu mandarine grafted on trifoliate orange and Fuyu mandarine. They began to bear fruit in 1988 and produced 50 tons of fruit.
- 4) Xiaojiao Citrus Farm: It was set up in Sanmim city of North Fujian in 1985 and has an area of 15 ha. Now it has 12,000 plants of Xuegan orange, Xinhui orange, Liu orange and Fuyu mandarine grafted on Fuyu mandarine. They began to bear fruit in 1989 and produced 50 tons of citrus fruit.
- 5) Chaotian Citrus Farm: It is located in Yangcun farm of Boluo county, Guangdong, and has an area of 15 has. 7,000 plants of sweet oranges were grown in 1983, another 2,520 plants were grown in 1985 and 2,400 plants of Xuegan orange in 1986. They began to bear fruit in 1985 and could produce 180 tons of fruit in 1989.
- 6) Dawang Overseas Chinese Farm: It is situated in Huiyang of East Guangdong and has an area of 10 has. 4,170 plants of Liu orange were grown in 1987 and 4,100 plants of Tankan were grown in 1988. Now they are growing very well and are expected to bear fruit next year.

The success of the integrated management, i.e. an ample production of registered disease-free nursery trees, a prompt eradication of infected plants and a timely control of pests, proves that such practices can not only eliminate or reduce the incidence of Huanglungbin in a new plantation, but also rehabilitate old contaminated plantations.