Current Situation and Management Recommendations about Betel Nut Planting in Hainan

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Abstract The betel nut planting area and yield in Hainan have reached 94000 ha and 231000 t, respectively. There are some problems in betel nut planting such as dispersed cultivation, irrational planting layout, excessively dense planting and serious betel nut yellows. For the sustainable development of Hainan betel nut, it is necessary to focus on building the disease-resistant betel nut plantation, so as to prevent and control the occurrence and spread of betel nut yellows; transform the low-yield betel nut plantation, and strengthen betel nut production management, in order to improve betel nut yield and promote sustainable development of betel nut industry.

Key words Betel nut, Planting, Current situation, Management, Recommendations

1 Current situation of betel nut planting in Hainan

Betel nut originated from Malaysia, and is mainly distributed in Asia and tropical regions of the Americas. China is the world's second largest producer of betel nut, and the main producing area is in Hainan Province, accounting for 99% of total betel nut yield in mainland China[1]. The betel nut in Hainan is mainly spontaneously planted by farmers, and few of enterprises plant it. In recent years, the low price of natural rubber has seriously affected the enthusiasm of farmers for planting rubber. Meanwhile, during 2013-2014, the prices of betel nut continued to rise, which increased farmers' willingness to plant betel nut; betel nut was planted in some incomplete rubber plantations in the main producing areas of betel nut, showing a good trend of development.

1.1 Planting area The planting area of Hainan betel nut was 1047 ha in 1952, 1120 ha in 1980, 27000 ha in 2000, 69000 ha in 2010, 94000 ha in 2014. The planting of betel nut in Hainan during 2000 – 2014 can be shown in Table 1. From Table 1, it can be found that the planting area of betel nut in Hainan during 2000 – 2014 continuously increased, and the harvested area also increased. The betel nut is widely grown in Hainan, because betel nut is easily managed and requires a small investment, and the economic benefits of betel nut are high under normal management.

1.2 Yield China's betel nut yield was 1100 t in 1952, 35500 t in 2000, and 231000 t in 2014. The betel nut yield in Hainan Province during 2000 – 2014 is shown in Table 2. From Table 2, it is found that from 2000 to 2014, the total output of betel nut continued to increase, but from 2007 to 2014, betel nut yield never increased. According to statistics, the province's betel nut yield was 3562.95 kg/ha in 2014, 4 kg of fresh fruit could be processed into 1 kg of dried fruit, and the fresh betel nut yield was 14251.8 kg/ha. Obviously, Hainan's betel nut yield is significantly low, mainly due to betel nut yellows and extensive management of betel nut plantations.

Table 1 The planting of betel nut in Hainan during 2000 – 2014

Year	Planting area//10^4 ha	Harvested area//10^4 ha
2000	2.7	1.3
2001	3.0	1.4
2002	3.5	1.5
2003	4.3	1.7
2004	4.7	1.9
2005	4.8	2.1
2006	5.3	2.3
2007	6.0	2.7
2008	6.3	3.1
2009	6.6	3.6
2010	6.9	3.9
2011	7.9	4.8
2012	8.6	5.5
2013	9.1	6.0
2014	9.4	6.5

Note: Data are from Hainan Provincial Department of Agriculture.

Table 2 Betel nut yield in Hainan Province during 2000 – 2014

Year	Planting area//10^4 ha	Harvested area//10^4 ha
2000	2 818.95	3.55
2001	3 002.85	4.18
2002	3 256.95	4.97
2003	3 313.20	5.50
2004	3 383.10	6.27
2005	3 101.25	6.43
2006	2 958.15	7.48
2007	3 546.45	9.54
2008	3 721.20	11.65
2009	3 976.50	14.35
2010	3 860.40	15.21
2011	3 511.50	16.92
2012	3 621.60	19.81
2013	3 711.30	22.33
2014	3 562.95	23.10

Note: Data are from Hainan Provincial Department of Agriculture.

2 Problems in Hainan's betel nut planting

2.1 Serious betel nut yellows "Yellows" is one of plant diseases usually caused by fungi of the genus Fusarium or viruses of the genus Chlorogenus and characterized by yellow or yellowish

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discoloration. It is an infectious devastating disease for the betel nut, and currently it is still a technological fix having not yet been overcome in the world[2]. Yellows poses a serious threat to the development of betel nut industry in Hainan Province, and it is the main problem for the betel nut planting. The disease occurs universally in the contiguous betel nut plantations of Hainan's Tunchang, Qionghai, Wanning, Lingshui, Sanya and Baoting. The incidence of disease reaches as high as 90% in the plantations with serious yellows, a decrease of 78% to 80% in production; the incidence of disease is 30% to 40% in some betel nut plantations. Currently, the incidence areas and the disease-affected area continue to expand, and after the betel nut suffers from yellows, it can not be cured.

2.2 Too dense planting At present, Hainan's betel nut is still mostly planted by farmers spontaneously, and the plantation lacks scientific planning. The planting technical measures are neglected and the betel nut is densely planted. The planting amount per unit area is seriously over the standard. In the hilly land with a steep slope, the insufficient light and accumulated temperature make the betel nut grow poorly, leading to low yield and short economic life. Normal betel nut can be harvested for 50 to 60 years, but in some Hainan's betel nut plantations, it begins to degenerate in 20 years.

2.3 Irrational planting layout The betel nut can be planted in the mountains with an altitude of below 300 meters and swampy ground. Most of the farmers plant betel nut in unreasonable sites, and in some betel nut plantations, the water table is too high, but there is no high ridge and drain ditch, so the water logging in betel nut plantations causes the betel nut root to be long immersed, resulting in poor growth and low yield of betel nut. In the hilly land with steep slope, the planting of betel nut has caused serious soil erosion and severe water shortage in betel nut plantation due to lack of rows of land reclaimed around mountains in advance. In some betel nut plantations, the spacing between betel nut and other intercrops is not increased, so that they can not grow in harmony, thereby failing to achieve the best economic benefit of intercropping ecological model.

3 Conclusions and recommendations

3.1 Conclusions There have long been some problems in Hainan's betel nut planting, such as excessively emphasizing sowing, harvesting but ignoring management, planting on a small scale, and paying no attention to soil improvement and fertilizer management, resulting in inadequate nutrients for betel plant, and low yield and short harvest period in many betel nut plantations. Therefore, for the sustained development of Hainan's betel nut, it is necessary to focus on building the ecological disease-resistant betel nut plantations to prevent and cure diseases such as yellows, implement agronomic measures, and strengthen water and fertilizer management to increase betel nut yield.

3.2 Recommendations

3.2.1 Building ecological disease-resistant betel nut plantations. Yellows has posed a serious threat to the sustainable development of betel nut industry, becoming a major constraint on the development of betel nut industry. In order to build ecological disease-resistant betel nut plantations, it is necessary to focus on the following three aspects. (i) Retaining the weeds and dwarf plants around the trunk as covering in the betel nut plantations. There is a need to preserve the weeds and dwarf plants around betel nut trunk, because they can increase the surface shading, and reduce direct sunlight on the ground, so as to form a growth environment with adequate sunlight on upper canopy and shade covering on the lower part. (ii) Avoiding the use of herbicides when controlling the weeds in betel nut plantations. The betel nut root is shallow, and avoiding the use of herbicides can help to prevent the damage of herbicides to betel nut root and the impact on betel nut root's absorption of nutrients. (iii) Strengthening the soil and water conservation in betel nut plantations. The betel nut plantations should try to create the environmental conditions suitable for the growth of betel nut based on local conditions, strengthen soil and water conservation, and reduce soil erosion, in order to maintain moisture and nutrients, and improve the soil microbial environment for betel nut. (iv) Applying the organic fertilizer. The 30 – 40 cm deep half-moon-shaped hole is dug around tree crown, 10-15 kg of compost, manure or manure fertilizer is applied on each plant, and then it is earthed up. Biogas is one of the best fertilizer for betel nut, and 10 – 50 kg of biogas can be applied on each plant.

3.2.2 Improving the low-yielding betel nut plantations. The planting density of betel nut is generally 1600 – 1650 plants/ha, it begins to fruit 5 – 6 years after planting, and the production period can be up to 30 years; the betel nut yield per plant is generally about 15 kg, and can be up to 25 kg. However, the majority of Hainan's betel nut growers have long emphasized planting and harvesting but ignored management, resulting in generally low yield in many betel nut plantations, mainly due to extensive management, poor water conditions and plant diseases[3]. Hainan's low-yielding betel nut plantations account for about 20% to 30% at present, and these plantations need to be transformed into high-yielding plantations in order to increase yield per unit area. The betel nut plantations should carry out timely weeding, and cut down the bushes, leaving the annual leaf weeds to cover the ground. There is a need to use betel nut leaf, green manure and vines to cover the soil so as to increase soil organic matter and nutrients, improve the growth environment of betel nut and promote root growth. The low-yielding betel nut plantations should seek to build irrigation systems, strengthen irrigation during the dry season, and dig drains during the rainy season. The low-yielding betel nut plantations with serious pests and diseases need to remove the diseased plants, make the soil of plantations under the blazing sun for quite a long time before planting, and strengthen planting, water and fertilizer management in strict accordance with the technical requirements of betel nut planting.

3.2.3 Strengthening betel nut production management. Strengthening the betel nut production management can help to tap betel

nut's potential for high yield. According to the survey of Wanning Liqing Planting and Breeding Cooperative in September 2015, this cooperative established 4 ha of standard betel nut plantations, with betel nut yield of 18750 kg/ha. It is necessary to strengthen the management of fertilization, vegetation management and pest management. In recent years, due to the increase in labor costs, decline in the source of organic fertilizer and reduction of organic fertilizer input, the soil fertility is reduced and soil's aggregate structure is damaged in betel nut plantations. The fertilization management of betel nut should focus on the application of organic fertilizer, and combine the use of organic manure and chemical fertilizer, in order to keep betel plant's nutritional balance and improve fertilization effect. It is necessary to maintain good ground cover, and retain dwarf plants and weeds between the rows of plants. There is a need to take the manual weeding, and avoid the use of chemical weeding to reduce the impact of chemicals on betel nut. There are about 5 – 7 t of leaves, buds, ear, fruits and other wastes dropping in mature betel nut plantations per hectare per year, if these wastes can be converted into the organic fertilizer to be effectively used, it can not only improve the soil fertility, but also reduce pests and diseases in betel nut plantations. As for the pest management, there is a need to build the ecological diseases-resistant betel nut plantations.

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but there is a certain lag. However, dominated by market mechanism from 1978, there is only one-way support relationship: rural economic growth brings about quantitative growth of rural financial market. The empirical results exactly reveal the fact that China's rural financial market growth is not in coordination with rural economic development.

4.2 Recommendations (i) It is necessary to simplify the rural financial market access procedures, reduce access risk under controllable risk, actively nurture and develop rural micro-finance institutions, vigorously develop rural financial services, and promote the quantitative growth of rural financial market. (ii) There is an urgent need to accelerate rural financial legislation, improve the rural financial trading rules, foster rural financial culture, establish incentive mechanisms for rural credit, reduce risk costs of rural financial services, improve the enthusiasm of financial institutions for supporting agriculture, and develop rural securities, insurance, futures, to optimize market structure and disperse agricultural loan risk. (iii) We must make a strict distinction between fiscal and financial support for rural economic development in terms of boundaries and functions, and establish the mechanism of rural public finance and financial support for agriculture, to promote the coordinated development of rural public goods and private goods. (iv) It is necessary to use preferential fiscal, taxation and financial policies, and establish the incentive system for rural financial institutions to support agriculture, in order to increase benefit for farmers and prevent the non-farm trend and urbanization tendency of rural capital. (v) It is also necessary to speed up the innovation of rural informal finance and private financial regulation, and well handle the relationship between rural exogenous finance and endogenous finance. (vi) The government has to protect the active role of market mechanism in promoting growth of rural financial market, and establish effective rural public financial system and fiscal incentives, to promote the rapid development of rural finance and prevent non-farm trend of rural finance. (vii) It is necessary to positively develop rural economy, gradually eliminate the comparative advantage gap between urban and rural areas, improve farmers' enthusiasm for investment in agriculture, foster effective rural financial needs, encourage and guide urban financial market to drive the rural financial market growth.

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