สวนยางพาราแบบวนเกษตรในระยะเปิดกรีดในจังหวัดพัทลุง ภาคใต้ของประเทศไทย

Rubber Agroforestry Systems in Mature Plantations in Phatthalung Province, Southern Thailand

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บทคัดย่อ

ระบบวนเกษตรสวนยางพารามีการศึกษาการจำแนกประเภทของพืชร่วมในระยะยางพาราเปิดกรีดไว้แตกต่างกันออกไป การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อระบุและอธิบายประเภทของระบบวนเกษตรสวนยางพาราในระยะเปิดกรีดที่มีอยู่ในจังหวัดพัทลุงซึ่งเป็นตัวแทนของภาคใต้ของประเทศไทย ทำการเก็บข้อมูลโดยใช้แบบประชุมกลุ่ม จำนวน 5 กลุ่ม และแบบสอบถามแบบกึ่งโครงสร้างกับเกษตรกรจำนวน 56 ราย พร้อมทั้งทำการสำรวจแปลงปลูกพืชร่วมยางพาราของเกษตรกร จำนวน 44 แปลง จากการศึกษาพบว่าระบบวนเกษตรสวนยางพารามี 7 ประเภท โดยพบพืชร่วมยางพาราคือ ไม้ผล 20 ชนิด ไม้ยืนต้น 14 ชนิด และพืชท้องถิ่น 6 ชนิด ช่วงเวลาการปลูกพืชร่วมพบว่ามีความแตกต่างกันออกไป ชนิดของพืชร่วมและระยะเวลาการอยู่ร่วมกันกับยางพาราสามารถบ่งชี้ได้ว่าเป็นทางเลือกสำหรับเกษตรกรที่ปลูกยางพาราเชิงเดี่ยวเพื่อสร้างความยืดหยุ่นและการไม่พึ่งพาพืชเพียงชนิดเดียว อย่างไรก็ตามก่อนที่จะแนะนำการปลูกยางพาราแบบวนเกษตรจำเป็นต้องมีการวิจัยเพิ่มเติมเกี่ยวกับผลกระทบของระบบวนเกษตรสวนยางพาราโดยเฉพาะอย่างยิ่งต่อผลผลิตและความหลากหลายของสิ่งมีชีวิตในดิน

คำสำคัญ: พืชร่วมยางพารา ไม้ใช้สอย ไม้ผล พืชผัก

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Abstract

Rubber-based agroforestry systems (RAS) can be characterized by the type of trees/shrubs and crops associated with the rubber trees. The present study objective was to identify and describe the RAS in mature plantations existing in Phatthalung province. This province is representative of South Thailand and gathers many farmers with agroforestry practices. The methodology for data collection combined focus group discussions with 5 groups and individual interviews with 56 farmers using a semi-structured questionnaire and farmer's field survey for 44 RAS plots. The results showed an important diversity of the RAS. Seven types of agroforestry systems were identified with 20 species of fruit trees, 14 species of timber trees and 6 species of pluri annual local crops. The analysis of the timeline to plant rubber and intercrops showed some flexibility for the establishment of the RAS. The associated crops and the sometimes-long existence of these RAS indicate that they could be an interesting alternative to monoculture for the farmers to improve resilience and not rely only on one crop. However, before recommending these RAS, additional research is needed to better characterize the impact of these systems in particular on crop yield and soil biodiversity quality.

Keywords: Associate Plants, Timber Trees, Fruit Trees, Vegetables

Introduction

Rubber has long been a strategic commodity in Thailand. After its introduction in Southern Thailand, two cropping systems co-existed: monospecific and rubber-based agroforestry systems (RAS) [1-2]. In the 1960's, Thai government launched a rubber replanting scheme to improve smallholders' well-being based on clonal monoculture. So progressively, most local rubber plantations turned to be monospecific plantations increasing farmers' dependence on only one crop when rubber price do fluctuate a lot. After a pick in 2011, rubber prices started to decrease and the trend continues until now [3], decreasing rubber farmers income particularly in the southern region where rubber represents a big share of total landholding [2]. In this case, RAS could be an interesting alternative to monoculture as they allow diversifying sources of income for small-scale rubber farmers [4-5].

Agroforestry is defined as "the cultivation of the soil with a simultaneous or sequential association of trees and crops or animals to obtain products or services useful to man" [6]. The most common criteria used to define agroforestry are the system's structure, its function, its socio-economic scale and level of management, and its ecological spread. Structurally, the system can be grouped as agrisilviculture (crops including trees/shrub crops + trees), silvopastoral (pasture/animals + trees), and agrosilvopastoral (crops + pasture/animals + trees) [7]. In Thailand, RAS is an alternative agricultural practice for rubber smallholders to enhance both ecological integrity and crop diversity [8]. During the whole lifespan of the rubber plantation, RAS can be classified into three main types: 1) intercropping during immature phase with annual crops such as pineapple, chili, banana, rice, sweet potato, long bean and corn 2) the rubber-fruit system during mature phase with guava, long kong, salacca, mangosteen, durian, and levistona and 3) the rubber-timber species system with neem, mahogany and teak during both immature and mature phase [5]. RAS in mature plantations represent only 6% of the mature rubber plantations in South Thailand [9].

And very few information is available on these systems except surveys in the 2010's [4-5]. The aim of this study was to identify the RAS existing in Phatthalung province and to describe the main systems including the reasons for the farmers to adopt RAS with focus on mature rubber plantations.

Methodology

The study area was selected in Phatthalung province because of the presence of RAS. A preliminary survey was conducted with key informants i.e. some representative staff of the Rubber Authority of Thailand (RAOT) in the district level. The criterion for site selection was the high concentration of farmers with rubber agroforestry practices in mature plantations. Four areas: Pabon, Tamod, Srinakarin, and Sribanpod districts, close to the long Bantad Mountain in the western of Phatthalung were selected for the study. Five focus group discussions were conducted to identify the main RAS adopted in the four districts and to create a sample of farmers for field surveys. The focus group discussions addressed the following questions: 1) why adopting rubber agroforestry? 2) what are the reasons to select the kind of associated plants and the expected benefits? and 3) how many households have adopted rubber agroforestry? Then, individual interviews were conducted with farmers using a semi-structured questionnaire. Fifty-six farmers who grew the rubber agroforestry systems were selected by purposive sampling with the following criteria: the share of total landholding under agroforestry systems, the kind of association and planting year of association. To complete the interview with the farmers, field survey of 44 RAS plots was conducted to collect data on the composition of the system, the number of species of plants and spacing (planting pattern). Data analysis was typology of the structure of the rubber agroforestry systems at the cropping system scale based on the combination of species, spacing and planting year. Field work was conducted between May and August 2015.

Results

Diversity of Rubber Agroforestry Systems

The typology of RAS included seven types based on the associated crops: i) one species of fruit trees (38%), ii) one species of timber trees (35%), iii) pluri annual local crops (4%), iv) fruit tree, timber trees and pluri annual local crops (4%), v) fruit trees and timber trees (9%), vi) fruit trees and pluri annual local crops (9%), vii) timber trees and pluri annual local crops (1%). All associated crops were planted between the rubber rows in normal spacing using either systematic or non-systematic planting patterns. In the systematic planting, there were less than three species of plants when in non-systematic planting there were usually many species.

Species of Associated Plant in Mature Rubber Plantations

Twelve families and twenty species of fruit trees were found mostly local fruits (Table 1). Mangosteen, longkong, langsat and salack were the most frequent companion fruit trees with rubber. There were nine families and fourteen species for timber trees. They were mainly wild varieties common in the southern region. RAS with timber trees can have several species associated. Some of them grew by themselves; some were planted by farmers. Last, six families and six species of pluri annual local crops, i.e. vegetables for cooking grown one time and harvested more than 3 years, were found. The most frequent

companion crops in this group were lasia, gnenom and pineapple. These results show the diversity of associated crops in mature rubber plantations.

Timeline Planting of Associated Plants in Rubber Plantations

Three timelines to plant the companion crops in rubber plantations were identified that before rubber, together with rubber, after rubber (Table 1). Fruits trees can be planted long before rubber; sometimes, old fruit tree plantations was converted to RAS. The other companion crops were planted just before rubber or even after. These results show the flexibility for setting up RAS.

Discussion

Results showed that two types of agroforestry systems co-existed: simple agroforest characterized by only one type of crop associated with rubber and complex agroforest characterized by more than one, generally several, types of associated species [10]. With 77% of the RAS observed, simple agroforests were more popular than complex agroforests (23%).

Timber trees and fruit trees were planted in both systematic and non-systematic systems with complex and simple agroforests. Timber trees were the first preferred associated crop for farmers due to its low labor requirement for maintenance; however, income is obtained at a long term income, sometimes at the end of the rubber lifespan. Fruit trees were the second preferred crop for regular income and consumption. However, its high labor force requirement particularly in harvesting season and high input need for production (fertilizer, pesticide) are the main constraints. Jongrungrot and Thungwa (2014) already mentioned that fruit trees and vegetables crops in the plots would increase household income while timber can be considered as an asset for their children [4]. RAS in Phatthalung province were quite the same as some Indonesian RAS [11-12]. Improved RAS combining the use of clonal planting material and agroforestry practices were developed in Indonesia in the 1980 and studied between 1994 and 2007 by ICRAF/CIRAD partially after a visit in Thailand in 1996 to take advantages of local existing agroforestry systems [10, 13]. These RAS could be interesting alternatives to monospecific rubber plantations, rubber farmers in Phatthalung are interested by RAS combining rubber with fruit tree, timber tree, and pluri annual local crop. Rodrigo *et al*. (2005) showed that banana intercropping did not affect growth and yield of rubber at maturity [14]. However, to become recommendation, in depth study of the effect of associated plants in the RAS on crops yield and soil biodiversity quality is needed. This study also did not fully record the density of rubber trees and companion crops; this should be included in next study of the RAS in Southern Thailand. RAS improve farmers' income and increase their resilience to economic uncertainties [5]. Fruit trees and timber trees could also improve the environment. Indeed, agroforestry generates positive externalities in particular for biodiversity conservation, soil fertility maintenance and water conservation [15]. Their contribution is far from negligible, be it in terms of traded products, fuel wood, subsistence crops, nutritional value, medicinal plants, timber, etc. If farmers worldwide have developed such systems, it is certainly not only because they mimic forests or foster biodiversity conservation; there must be something else [16]: biological or eco-systemic advantages and economic outputs of specific local products through valorization of self-consumption (medicinal plants, fuel wood, timber, rattan…) [17-18].

Table 1 Species of associated plants in rubber plots and planting timelines.

Family	Common Name	Scientific Name	Planting Years
Fruit Trees			
1. Anacardiaceae	Marian plum	1. *Bouea burmanica* Griff	-20, 0, +15
	Plum Mango	2. *Bouea oppositifolia* Meissn	-20, 0, +15
	Mango	3. *Mangifera indica* Linn	-20, 0, +15
2. Bombacaceae	Durian	4. *Durio zibethinus* Linn	-10, 0, +15
3. Guttiferae	Mangosteen	5. *Garcinia magostana* Linn	-20, 0, +15
4. Leguminosae-Mimosodeae	Djenkol, Jenkol or Jering	6. *Archidendron jiringa* Jack	-10, 0, +15
5. Meliaceae	Longkong Langsat	7. *Lansium domesticum* Corr	-10, 0, +15
6. Minosaceae	Stink bean	8. *Parkia specioca* Hassk	-15, 0, +13
7. Moraceae	Jack fruit	9. *Artocarpus heterophyllus* Lamk	-15
	Champedak	10. *Artoca rpus champenden* Spreng	-5, 0, +20
8. Myrtaceae	Black plum	11. *Syzygium cacuminis* (Craib) Chantar	-10
9. Palmae	Coconut	12. *Cocos nucifera* Linn	-25
	Salak	13. *Salacca rumphii* Wall	0, +15
	Sala	14. *Salacca zalacca* Gaertn.	0, +15
	Areca nut palm	15. *Areca catechu* Linn.	0, +15
	Asam paya	16. *Eleiodoxa conferta* Griff	0, +15
10. Phyllanthaceae	Burmese grape	17. *Baccaurea ramiflora* Lour	+15
11. Sapindaceae	Rambutan	18. *Nephelium lappaceum* Linn	-6, 0, +15
	Longan	19. *Dimocarpus longan* Lour	
12. Stilaginaceae	Black Currant Tree	20. *Antidesma ghaesembills* Gaerth	+10

Table 1 Species of associated plants in rubber plots and planting timelines, continued.

Family	Common Name	Scientific Name	Planting Years
Timber Trees			
1. Dipterocarpaceae	Iron wood	1. *Hopea odorata* Roxb	-5, 0, +15
	Shorea	2. *Shorea roxburghii* G. Don	0, +8
	Yang	3. *Dipterocapus alatus* Roxb. ex G. Don	-5, 0, +5
2. Labiatae	Teak	4. *Tectona grandis* L.f.	0 to +5
3. Lauraceae	Litsea	5. *Litsea grandis* Hook.f.	0 to +12
4. Leguminosae – Minosoideae	Brown salwood	6. *Acacia mangium* Willd	0 to +27
5. Magnoliaceae	Champak	7. *Michelia champaca* Linn	0, +8
6. Malvaceae	Large-Leaved Hau	8. *Taliparitimacrophyllum* Fryxell (Large-Leave type)	0, +10
	Small-Leaved Hua	9. *Taliparitimacrophyllum* Fryxell (Small-Leave type)	0, +10
7. Meliaceae	Mahogany	10. *Wietenia macrophylla* King	0
	Siamese neem Tree	11. *Azardirachta excelsa* (Jack) Jacobs	0, +13
	Cigar box cedar	12. *Toona ciliata* M. Roem	+3
8. Rubiaceae	Bur flower tree	13. *Anthocephalus chinensis* (Rich. ex Walp.)	+3
9. Barringtoniaceae	Karuk	14. *Barringtonia macrostachya* (Jack) Kurz, Rep. Pegu	+3
Pluri Annual Local Crops			
1. Araceae	Lasia	1. *Lasia spinosa* Linn	+5
2. Brommeliaceae	Pineapple	2. *Ananas comosus* Merr	0, +7
3. Gnetaceae	Gnemon	3. *Gnetum gnemon* Linn	0, +25
4. Gramineae	Bamboo	4. *Bambusa multiplex* (Lour) Raeusch	+3
5. Padanceae	Pandanus palm	5. *Pandanus amaryllifolius* Roxb	+5
6. Palmae	Rattan palm	6. *Calamus caesius* Blume	+3

Note - = before rubber, 0 = together with rubber and + = after rubber

Conclusion

In Phatthalung province, two rubber agroforestry systems were found: simple and complex agroforests. Three different kinds of associated species in simple agroforests and systematic spacing patterns with rubber row. Most intercrops were planted by the farmers. The complex agroforests had non-systematic spacing pattern and more species. Some plants grew naturally. The associated plants in both systems were mostly local species plants, particularly fruit trees and pluri annual local crops while some timber trees have grown natural. Mangosteen, longkong, langsat and gnemom were the most popular intercrops due to existing markets. Through the development of both simple and complex agroforests, farmers have been able to diversify their source of income. Although research is still needed, these RAS could become in the future part of the RAOT recommendations. Indeed, RAOT role is still to provide smallholders with the necessary technical and financial assistance for rubber plantation or replantation and could be complemented with promotion of rubber agroforestry system to partially replace rubber monoculture. Therefore, developing transportation, marketing and processing for the non-rubber output, such as timber, vegetables and fruits are necessary as well as providing information on fruits and timber markets. In addition, researchers could develop innovation platforms in partnership with existing agroforestry groups in order to select and improve the best and most adapted and resilient agroforestry practices with new management methods to reduce maintenance costs and diversify sources of incomes. One of the most important points for innovation implementation is to explore and identify clearly local markets and labor force requirement of the associated plant species in rubber agroforestry system for smallholders.

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