

# **RICE SEED SYSTEM IN THAILAND**

**Orachos Napasintuwong**

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## ABSTRACT

Thailand's rice has set a supreme quality standard in the world market. Seed is one of the important factors contributing to good quality grains. As the competition for quality rice in the world market is becoming intensive, rice seeds play a significant role not only to ensure food and income security but also to retain quality and competitiveness of Thai rice in the world market. This paper reviews policies and regulations related to rice seed industry in Thailand, current situations of rice seed system, the supply and demand of rice seeds, and implications for future rice seed industry development. It is found that some of current regulations and business environment do not create much incentive for investments for the private sector. The imports and exports of rice seeds are practically prohibited. Thus, most of existing rice seeds in the market comprise of mainly public varieties produced by formal seed sector with a few exceptions of privately developed varieties by Thai companies, farmers' groups and research institutes. None of the foreign stakeholders is in rice seed industry in Thailand presently. As seed producers do not hold exclusive rights to reproduce public varieties, and because all of the varieties are not hybrids, informal seed system is the major source of rice seeds. The systems of rice seed suggest that formal and informal systems can be integrated and linkages between both systems should create incentives for business opportunities.

**Keywords:** seed system, rice seed, certified seed

JEL: Q13, L1

## Introduction

Rice is the most important food and cash crop in almost all Asian countries, including Thailand. Access to rice seeds, as a result, is important for ensuring food security for farmers and the nation and also for economic viability of rice cultivation. Good quality seeds of improved varieties are one of the most essential factors for the production of good quality grain. From smallholder farmers' perspective, the availability of good quality seeds (easily obtain the seeds they need) is important but other dimensions of access to seeds such as affordability (farmers can afford to use quality seeds of improved varieties), suitability (tailored to the needs of smallholder farmers), capability (the capacity and the enabling environment) and autonomy (freedom of choices of farmers as users and producers) are equally important for sustainable seed industry (Access to Seeds Foundation, 2016).

Thailand is the country of a surplus supply and one of the major rice exporters. Nevertheless, Thailand's production of rice is rather limited to improved good grain quality cultivars, namely Hom Mali (commonly known as Jasmine rice in the international market), Pathumthani fragrant rice, other non-glutinous rice (i.e. white rice, parboiled rice and industrial products such as flours and noodles), and glutinous rice. In 2017/2018, it was estimated that the demand for rice seeds was about 1.117 million tons while the supply by formal sectors was about 0.42 million tons or only about 35% of total rice seed demand (Rice Seed Center, 2018). This implies that farm saved seeds, exchanged seeds and informal local seeds markets played an important role in the system of rice seed in Thailand. This paper aims at describing regulations and policies related to rice seed industry in Thailand, current situations of rice seed system, the supply and demand of rice seed, and providing implications for future rice seed industry development.

## Regulations and policies related to rice seed industry

Under Thailand's seed law or commonly known as 1975 Plant Variety Act (PVA), rice is one of 37 regulated plant species. Unlike other regulated plant species that seed imports for commercial purposes can be requested on a case by case basis, the importation of rice seeds for commercial purposes have never been permitted. For the purposes of research or as samples, rice seed imports may be requested for the approval by the Department of Agriculture (DOA), but for the exchange of rice germplasm with foreign countries for a study or research, the agreement of benefit sharing has to be approved by the DOA (Napasintuwong, 2018). Exportations of rice seeds from Thailand are also prohibited under PVA. This has become one of the great impediments for rice varietal improvement by the private sector and has created unappealing investment in rice seed business by foreign companies. While several countries in Asia such as Bangladesh, China, India, Indonesia, Myanmar, Nepal, Pakistan, Philippines, and Vietnam have adopted hybrid rice, hybrid rice seed industry in Thailand does not exist at the present. In 2011, Thailand has successfully developed and registered two first hybrid rice varieties, one by public sector namely the Rice Department (RD) and another by a Thai-parent conglomerate company, Charoen Pokphand (CP). Although there had been an effort to start hybrid rice seed business in Thailand by CP and Bayer, due to unsurpassing yield, undesirable grain quality for eating, significant higher seed price, and high difficulty of seed production, the market of hybrid rice in Thailand essentially does not exist at the present. Furthermore, the production of hybrid rice seeds from imported inbreds are virtually forbidden, Bayer had terminated its rice breeding programs in Thailand.

Under PVA, the registration of varieties by the DOA is required for all commercial collections and sales of rice seeds. This registration of rice varieties requires information on varietal characteristics, sources of germplasm and/or the history of varietal development. The registration of rice varieties by the DOA only protects the rights to use the varietal names and trademarks, and remains valid indeterminately or until modified by the DOA on advice from the RD. Furthermore, although Thailand is not a member of the International Union for the Protection of New Varieties of Plants (UPOV) which promotes an effective system of plant variety protection, in 1999, Plant Variety Protection (PVP) law which protects the plant breeder's rights came into effect. Unlike approved varieties by the RD which demand outstanding characteristics and value for cultivation and use (VUS) (for recommended suitable areas), registered varieties under the PVP requires distinctness, uniformity and stability (DUS). Varieties developed by private sector such as Thai companies or universities are often registered for PVP rather than approved varieties by the RD. Figure 1 shows the number of PVP registered rice varieties between 1999 and 2017.

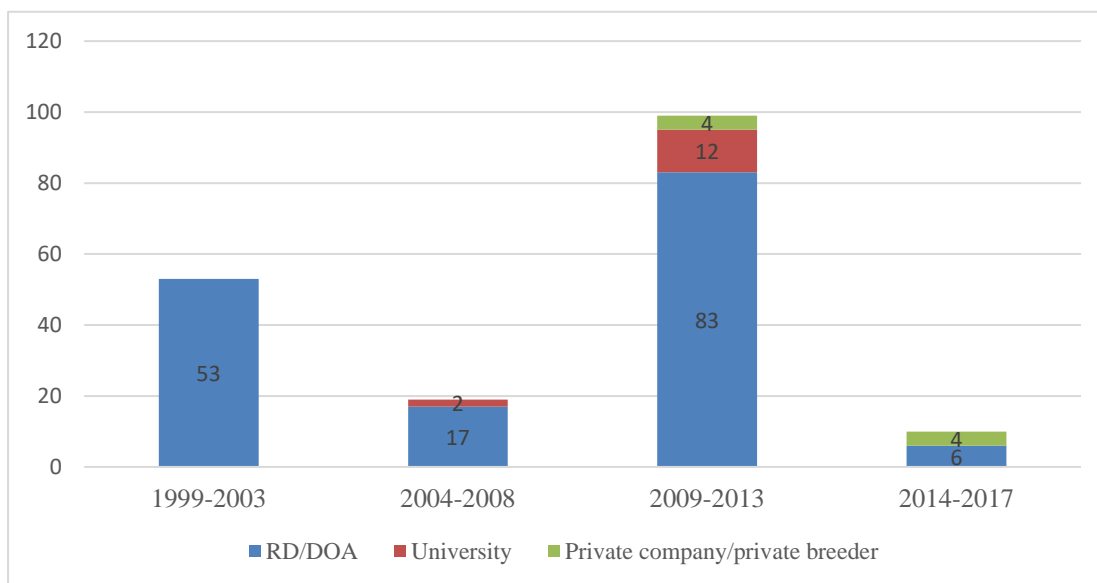


Figure 1. Number of registered rice varieties by the Department of Agriculture  
 Note: Prior to 2006, the Rice Department functions were under the Department of Agriculture  
 Source: Napasintuwong, 2018 cited Plant Varieties Protection Office, 2017

On the contrary, the RD who is the main public body responsible for rice varietal development have released and approved outstanding rice varieties for recommended suitable areas. Although the number of approved varieties by the RD has increased over time (Figure 2), the approval of rice varieties by the RD is not required for seed trade and because the approval requires much higher standards and tests that most local private companies could not meet, much fewer number of rice varieties is approved by the RD than those registered by the DOA.

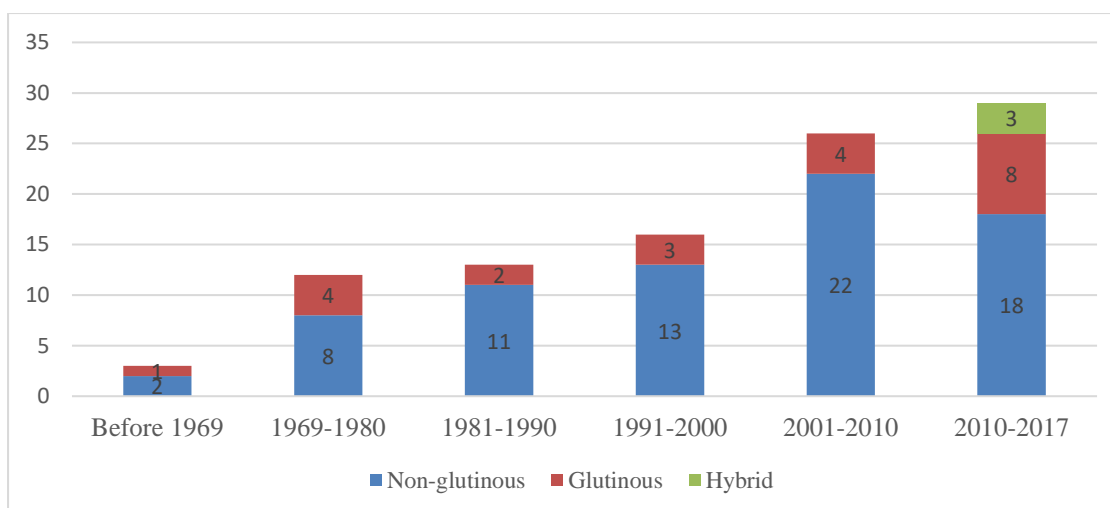


Figure 2. Number of approved rice varieties by the Rice Department

Note: Excluding upland rice, deep water rice, red rice and Japanese rice

Source: Napasintuwong, 2018 cited Bureau of Rice Research and Development, 2009 and others

Like other regulated plant species under PVA, the certification of rice seeds produced by private companies or by any producers is not required. However, in addition to the requirement that rice varieties have to be registered with the DOA, the quality of rice seed must be equal or higher than the standards set under the PVA. The standards of commercial rice seeds under revised 2006 PVA includes the minimum of 98% purity and 80% germination rate. In 2009, additional standards for commercial rice seeds require the maximum of 20 kernels of other varieties and the maximum 10 kernels of red kernels in 500 grams of paddy. The RD, however, has set its own rice seed standard (Table 3), and even though the RD's seed standard was set higher than the requirements under PVA, it became a norm for commercial rice seeds produced by the formal sector.

Table 3. 2014 Rice Department's seed standard

Qualification characteristics	Rice Seed Classes		
	Foundation/ Basic	Registered/ Stock	Commercial
1. Minimum purity (%)	98	98	98
2. Minimum germination rate (%)	80	80	80
3. Maximum number of other varieties kernel	1 in 1,000 grams of paddy	5 in 500 grams of paddy	15 in 500 grams of paddy
4. Maximum number of red kernel (weeds) in 500 grams of paddy	0	1	5
5. Maximum moisture content (%)	14	14	14

Source: Rice Department, 2014

Under PVA, rice seed labeling requires information on varieties and type of seed, trademark, date of inspection of purity and germination rate, date of collection, date of expiration, place and name of collector, total weight, registration number and year, lot number, and must show the message “regulated seeds” and “keep in dry, cool and good ventilation area, and avoid sunlight”. The enforcement of rice seed standards is technically done by random sampling of seed shops, distributors, processing plants and seed producers by inspectors authorized by the RD to confirm the compliance with the seed standards. These commercial seeds are generally called quality declared seeds (QDS). However, rice seeds may be certified for Good Agricultural Practices (GAP) (Ministry of Agriculture and Cooperatives, 2017). Although the price of commercial QDS produced by private sector is not controlled, rice seeds produced by the RD is sold at a controlled price. Dealers who sell RD seeds generally charge for transportation cost, and that sets a benchmark for the market price of rice seeds of RD varieties. It is worth nothing that the RD is responsible for the production of breeder seeds, foundation seeds, registered seeds, and commercial seeds of all public rice varieties. However, because of limited capacity, the supply of registered and commercial rice seeds by the RD is far less than the demand. The price of commercial rice seeds sold by the RD is presently set between 15 and 20 THB/kg depending on the variety. Note that these public varieties are not property right protected, and price of seed was set by the RD is based upon the cost of seed production without taking into account RD staff’s salary and nor investment in breeding. Rice seeds of the same varieties sold by the private producers are often perceived by farmers as lesser quality than ones produced by the RD. The market price of rice seeds sold by the private producers, as a result, is more or less the same as the controlled price by the RD, except when varieties are highly demanded, the price of commercial seeds produced by private producers can be higher. It was estimated that the cost of rice seed production by the private companies was 12.6 THB/kg excluding depreciation (Rice Seed Complier and Supplier Association, 2018).

### **The system of rice seed in Thailand**

It is well-recognized that accessibility to seeds is challenging as seeds need to be available at the right time, at the right place, in the required quantity, of acceptable quality, at an affordable price, and need to be of varieties suited to the local agro-ecological conditions and farmer/market demands. Seed system can be understood as a network of seed supply channels that provides farmers with seeds from different sources, depending on the required variety, price and availability (Schöley and Padmanabhan, 2016). Two seed systems: informal and formal are commonly characterized in developing countries. Formal seed system is often referred to the organized, formal mechanisms through which farmers obtain seeds and through which seed quality can be guaranteed. This formal seed system typically consists of activities, starting from genetic resource management, breeding research and crop improvement, seed multiplication, marketing and distribution of seeds to farmer end users while informal seed system, also referred to as farmer-managed seed system, traditional seed system or local seed system, covers methods of seed selection, production, and diffusion by farmers, including the exchange of seed. In developing countries such as Thailand, particularly when conventional rice varieties are mainly released by public institutes, the informal system is important and should always be taken into account.

Through systematic and scientific breeding, the formal seed system organizes formal instruments through which farmers obtain seeds of uniform varieties that have been evaluated for their adaptation to certain agroecological areas and through which seed quality can be assured. The structure of the formal seed system typically involves plant breeding and varietal



development, controlled seed multiplication by either public or private sector (Louwaars and de Boef, 2012). In the informal seed system, farmers may obtain seed by exchange with or gifts from relatives and neighbors, or through bartering with other farmers or buying from local markets (Louwaars and de Boef, 2012). Among these, farm-saved seed is the most prominent source since farmers are familiar with the seeds they grow themselves and know that the variety is adapted to local conditions and preferences. At the same time, informal system tends to generate and maintain landraces of less uniform materials adapted to local requirements and still may provide an opportunity for exchange of materials derived from modern varieties (Louwaars *et al.*, 2011). The exchange of local varieties and non-certified improved varieties within informal system can also be recognized as in situ conservation which may be particularly important for neglected areas by the formal system such as deep water floating rice and color rice.

Seed systems may also consist of something in between formal and informal in terms of type of varieties (landrace, improved, exotic, hybrid), type of seed quality assurance (informal, quality declared seed (QDS), certified) and type of dissemination mechanism (farmer saved, local exchange, agro-input distribution schemes, agro-dealers) (Thijssen, 2016). The rice seed systems in Thailand (Figure 3) may be classified as informal, intermediate and formal. The informal rice seed system characterizes farmers' saved seeds and exchange of seeds in local communities and does not need to meet PVA requirements for seed trades. This informal system predominately occupied the majority of current rice seed use, and farmers' saved seeds alone propose threats to food security and income security for small holding farmers because seeds are not always readily available in informal systems. Such shortages can be critical because farmers are unable to put seed aside from the harvest as a result of low productivity, for example, owing to drought, flood, and diseases or substandard quality of seeds due to poor and unintentionally seed farming. As a result, the RD has launched programs of capacity building for quality rice seed production for farm household use by establishing 73 rice seed banks during 2014 to 2016, and other programs educating farmers to produce quality and saved seeds for their own use. These quality saved seed production is accounted for about 45,237 tons or 3.7% of rice seed demand in 2016/2017 (Rice Seed Center, 2018). Totally supply of saved seeds and exchanged seeds was projected for 798,792 tons or 65% of rice seed demand in 2016/2017.

Intermediary system of local rice seed business involves small traders in local markets who buy and sell seeds in small communities. This may involve traders who select seeds from paddy fields that were observed good and uniform crop at harvest time and were not necessarily intended for seed production and considered informal seed supply. This normally materializes when there is a shortage of seed supply of popular varieties. Others maybe substandard seeds from contracted seed farms that cannot be sold as seeds to seed companies; however, farmers that has good reputation for producing seeds can still trade small volume of substandard seeds in local markets. These selected paddies after harvesting is generally dried and packed without labeling. For larger local seed business, QDS must be complied with PVA regulation and sell in the market with proper labeling.

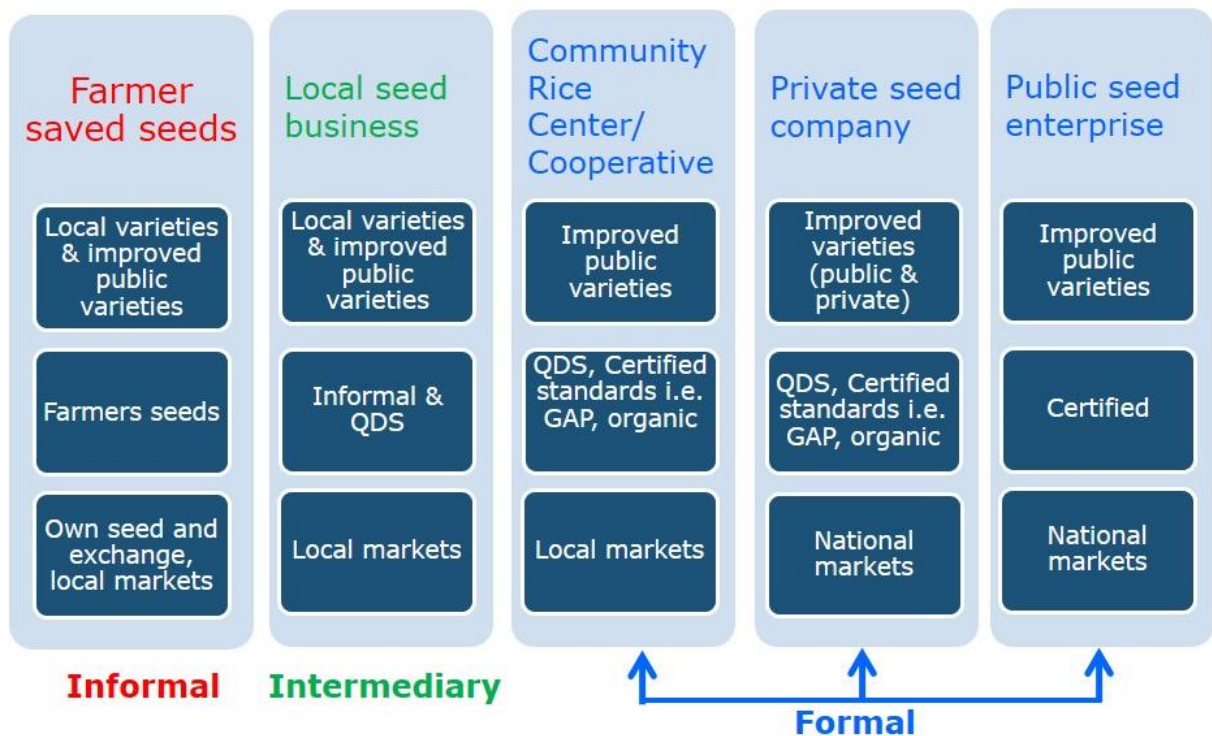


Figure 3. Rice seed system in Thailand

The formal rice seed systems include community rice centers, agricultural cooperatives, private seed companies, and public seed enterprises. The RD is the dominated public rice seed enterprise that engages in genetic resource conservation, breeding programs for improved varieties, releases and approves rice varieties, production of breeder seeds, and multiplication of foundation seeds, registered seeds and commercial seeds. At presents there are 23 rice seed centers that produce about 81,900 tons of rice seeds nationwide. Other public enterprises include public universities and public research institutes that possess the plant breeders' rights of protected varieties. Although the certification is not required for commercial seeds, farmers who obtain seeds from the RD are ensured with the RD's seed standards. Community Rice Centers (CRC) and agricultural cooperatives essentially produce public varieties' seeds. They typically buy foundation seeds or registered seeds from the RD for commercial seed production. In 2016/2017, there were about 1,650 CRCs producing 82,500 tons of rice seeds, and the RD targets to expand 850 more of CRCs producing additional 42,500 tons of rice seeds in the coming year. There were about 64 agricultural cooperatives nationwide that are engage in rice seed production contributing to about 37,000 tons of rice seed supply in the same year. The total supply of private seed companies was about 150,000 tons by over 200 enterprises (Rice Seed Center, 2018).

Private rice seed companies are concentrated around supplying high yielding non-photoperiod sensitive varieties suitable for irrigated areas. Exceptions are Hom Mali rice seeds that are also sold by private rice seed companies. The formal seed systems almost always contract to farmers for commercial seed multiplication by providing them with registered seeds. Alternatively, formal rice seed companies procure seeds by setting a farm gate seed price above the market price of paddy to their member farmers who have to follow seed farming practices to ensure quality. Rice seed farms are inspected by the seed companies and the seeds are tested for minimum standards at the point of sales. It is worth nothing that none of rice seeds companies in Thailand is foreign-owned company.

The supply of glutinous rice seeds and specialty rice seeds such as local varieties, upland rice, and deep-water rice are still limited to the supply from farm saved seeds and local seed business. Due to the complexity of rice seed system as commonly found in other countries (Janaiah, and Debdutt, 2017; Schöley and Padmanabhan, 2016), the concept of Integrated Seed Sector Development (ISSD) is recognized that different agricultural systems operate within a country and each requires specific needs with regards to seed systems. By combining the strengths of different systems (Louwaars *et al.*, 2013), the concept of ISSD seeks to:

- recognize the diversity of driving forces for seed policies, such as food security, economic development and the promotion of agricultural entrepreneurship, and biodiversity management;
- recognize the importance and consequent relevance of both informal and formal seed systems, and integrate the plant genetic resources and the knowledge present in informal and formal seed systems;
- endorse and support a pluralistic approach to seed-sector development at the level of policy-making; and provide a basis for designing a variety of programs to support specific seed systems involving a diversity of international, national, and local private seed companies and various public and civil society actors; and
- provide a basis for enabling policies and institutions that foster pluralistic approaches in those seed systems evolving in response to the dynamic nature of various systems with seed sector development.

Figure 4 depicts the integrated setting between formal and informal seed systems; a similar concept of integrated seed system is also found in Thailand’s rice industry. In this integrated system, the informal activities usually involved farmers and local traders who produce, select and disseminate saved seeds (in the circle). The RD can engage informal seed sector by recognizing that farmers and local communities conserve biodiversity of genetic resources i.e. through selection and conservation of local varieties by farmers’ groups, involving farmers in participatory plant breeding, varietal selection, and varietal field trials of formal breeding programs, contracting farmers for seed multiplication of the public varieties, and engaging them in local business activities such as the promotion of geographical indication (GI) rice production.

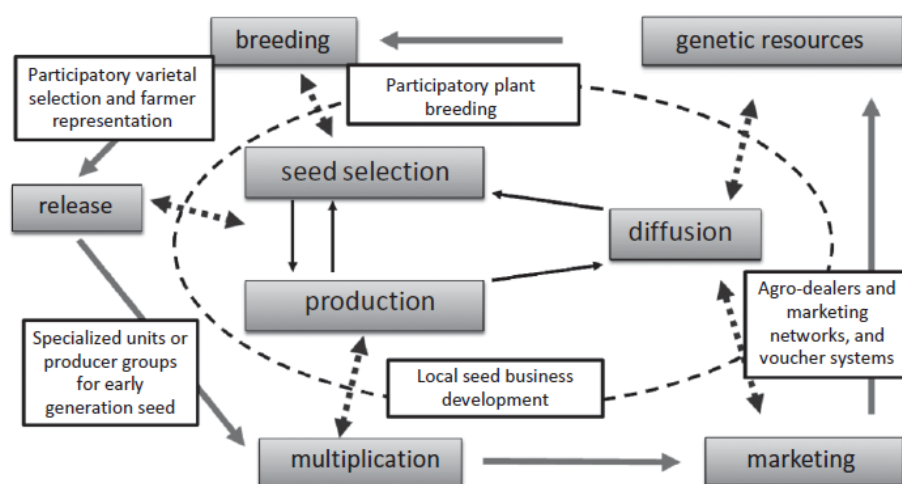


Figure 4. Integration between formal and informal seed systems  
 Note: Dashed arrows represent linkages between the formal and informal seed systems  
 Source: Louwaars and de Boef, 2012.

## Rice seed sources, replacement, and demand

In the past decade, rice production in Thailand has increased and the prospect of quality rice exports remains optimistic. Good quality rice seed (Table 1) is one of the key determinants for maintaining quality rice supply, and as a result, has an increasing demand.

Table 1. Rice balance in Thailand (milled equivalent) (million tonnes), 2000-2013

Year		Supply				Demand				
Year	Production	Import	Export	Stock Variation	Domestic supply	Food supply	Feed	Seed	Processing	Losses
2000	17.24	0.00	6.29	-0.52	10.44	7.31	1.03	0.50	0.30	1.30
2001	18.70	0.00	7.84	-0.51	10.35	7.12	1.12	0.50	0.21	1.41
2002	18.67	0.01	7.50	-0.71	10.46	7.25	1.12	0.50	0.19	1.41
2003	19.66	0.01	8.57	-0.31	10.79	7.43	1.18	0.49	0.21	1.48
2004	19.03	0.00	10.22	2.05	10.88	7.44	1.14	0.51	0.29	1.50
2005	20.20	0.01	7.69	-1.01	11.51	7.71	1.62	0.43	0.24	1.51
2006	19.77	0.01	7.60	-0.51	11.68	7.88	1.58	0.52	0.21	1.48
2007	21.41	0.02	9.25	-0.30	11.87	7.45	2.03	0.52	0.28	1.59
2008	21.11	0.03	10.29	1.57	12.42	7.80	2.11	0.53	0.35	1.62
2009	21.42	0.04	8.68	-0.25	12.53	7.80	2.14	0.60	0.40	1.59
2010	22.95	0.03	8.99	-1.01	12.98	7.57	2.30	0.61	0.80	1.70
2011	24.10	0.04	10.78	-0.30	13.05	7.46	2.41	0.62	0.77	1.79
2012	24.99	0.06	6.77	-4.55	13.73	7.65	2.50	0.61	1.12	1.86
2013	24.05	0.05	6.86	-3.64	13.61	7.68	2.41	0.61	1.13	1.79
%										
Growth	39.54	2,106.2	9.12	605.15	30.35	5.06	132.57	22.35	274.60	37.59

Source: FAOSTAT, 2017

Note: domestic supply = production + import - export + stock variation

Consumption = food supply + feed + seed + processing

Unlike many rice producing countries, Thailand does not require certification of commercial rice seeds but the producers and sellers of rice seeds have to ensure minimum quality standards, and seeds may be sold as QDS. Chawagul (2016) found that current quality control system of seed supply by the government is inefficient. The assurance of quality rice seeds is performed by random inspections of seed products by the RD authorized inspectors, and the certification of quality seeds, only GAP seed standard is voluntarily. She suggests that in addition to seed product inspection, field seed standards have to be met to ensure that the final seed products meet the minimum requirements. Potential farmers or enterprises could be trained to be professional field inspectors. Because the supply of certified seeds by the RD is less than 10% of total seed demand, she suggested that this control system would increase the supply of quality seeds.

As opposed to saving portions of the harvest for replanting the following season, farmers may acquire new seeds from external sources for various reasons. A varietal change particularly for a new variety with better and more suitable characteristics such as higher yield potential, better resistance to stresses, or improved qualities requires demands a seed replacement (Morris *et al.*, 1999). For rice farmers in Thailand, especially in the Central region where most of the harvest is sold change their varieties and basically replace their seeds when there is a change in the market demand towards particular varieties reflected by paddy prices.

However, many farmers also regularly replace seeds without changing varieties typically among those who are certified with standards such as Geographical Indication (GI), organic or GAP. These standards require that seed replacement must be obtained from reliable sources such as CRCs and the RD. **Presently, the RD recommends a seed replacement after replanting three crops to avoid losses in performance associated with planting seeds that may become diseased, genetically impure, or mixed with seeds of other cultivars or weeds.**

A survey of 640 rice farmers who are members of CRCs during 2014/15 cropping seasons showed that all farmers replace their seeds within three years. Most of farmers in the Northeastern areas replaced their seeds within two years except in Surin where most of the farmers replace seeds within three years. In contrast more than 70% of farmers in the Central region replaced their seeds every year (Potchanasin *et al.*, 2015). A survey of 350 farmers in 2016/17 by Potchanasin *et al.* (2017) found that farmers in both Central and Northeastern regions had more than one source of seeds. Most of farmers in the Northeast kept their own seeds for following crops. Farmers' groups, cooperatives and CRCs were the key sources of seeds in both regions, and public institutes played an important role in providing seeds to farmers in the Northeast while the local traders and millers did in the Central region. About 79% of farmers in the Northeast whereas only 10% of farmers in the Central region kept seeds for rice production.

Rice seed rate is also differentiated by planting methods. On average, farmers in the Central region used about 168.75 kg/ha for broadcasting, 156.25 kg/ha for pre-germinated seed broadcasting, and 81.25 kg/ha for transplanting and drilling (Potchanasin *et al.*, 2017). In contrast, farmers in the Northeast used much lower seed rate. About 106.25 kg/ha of rice seeds were used for broadcasting and only 56.25 and 31.25 kg/ha were used for drilling and transplanting. This might be because the Central region is mostly irrigated, and farmers generally produce high-yielding non-photoperiod sensitive varieties while glutinous rice and Hom Mali rice are more commonly produced in the Northeast. A survey of 4,200 rice farmers in 50 provinces during 2011/12 cropping season by Wattanutchariya *et al.* (2013) found that rice farmers in the Northeast allocated about 5.9% of their harvest for seed use while only 0.8%, 1.18% and 2% of rice harvest was kept for seed use in the Central, Southern, and Northern regions, respectively. Furthermore, Wattanutchariya *et al.* (2013) also found that on national average Thai rice farmers spent about 9.19% of their total cash cost on rice seeds. Farmers in the Northeastern, Northern, Central, and Southern regions spend 2.98%, 10.8%, 13.00%, 13.53% of their total cash cost on rice seeds, respectively.

## **Discussion and Conclusion**

The review of rice seed system in Thailand suggests that the informal system is still a primary source of seed supply. Commercial rice seeds are regulated under the Plant Variety Act or the seed law. Seeds produced by the formal sector including seed companies, agricultural cooperatives and community rice centers are presumed that the quality is met with the minimum standards of PVA and sold as quality declared seed since seed certification is not required. Farm saved seeds still play a significant part in seed supply and influence the quality of grain. Most of the rice seeds sold in the Thailand's market are open pollinated public varieties without property right protection. The popularity of certain public varieties depends also on the demand of grains; thus, the shortage of specific varieties and substandard seeds remain common problems. To strengthen the capacity of formal seed suppliers to provide

quality seeds, instead of imposing a control system of quality assurance to the public sector alone, potential farmers and seed producers can support the process of certification system by authorizing trained field inspectors. However, seeds of certified standards such as GAP are voluntarily and the price of certified GAP rice seeds presently is no different than non-certified seeds. This does not create much incentive for seed producers to adopt such standards.

As the private sector plays a very small role in varietal development due to protective seed trade and difficulties in importing international germplasm, protected varieties under intellectual property rights protection contribute to only a small share of seed supply. This may be also a reflection stringent varietal approval by the Rice Department that makes the development of new varieties unattractive investment opportunity. It is suggested that public private partnership on seed industry can be promoted. Not only activities between formal and informal systems such as participatory varietal selection, contracted seed farming for multiplication and distribution, but benefit sharing between public and private sectors may have to be more materialized such as a joint research program that authorizes exclusive rights of protected varieties to the private investors.

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