



Original Research Article

Multiplication of Mungbean Seeds Through Farmer Networks Enhancing Seed and Food Security

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ABSTRACT

The multiplication of good seeds quality supporting crop production are linked the sustainable food security. This project was to multiply farmer seed networks and produce four classes of mungbean seeds following breeder, foundation, registered and certified seeds in order to increase seed supply to seed system and crop production in our country. The collaboration between Department of Agriculture (DOA) and farmer networks to produce mungbean seeds were operated from October 1, 2021 to March 31, 2022. There were 16 organizations of DOA, and 37 farmer groups of 18 provinces participating in this project. The participating farmers came from Central, Northern, Northeastern and Southern parts of Thailand. The mungbean seed yield was totally 623.17 tons of the plan, 620 tons that consisted of breeder, foundation, registered and certified seeds for 3.01, 25.30, 200.79 and 394.06 tons, respectively. The production of breeder and foundation seeds responded by DOA' staffs, while registered and certified seeds were conducted through farmer networks. The utilized mungbean seeds by 570.56 tons or 91.56% were distributed to government agencies, private sectors and farmers around country up to 39 provinces that approximately support planting area 57,016 rai. Data analysis from the questionnaires showed over 80% farmer seed networks satisfaction to DOA's staffs and seed production technology. Moreover, they gained higher net incomes from this project by 1,200 baht/rai/crop due to using good seed quality. The utilization of 524 growers were calculated. Fifty-one percent of mungbean sold in term of grain, followed by using as soil fertilizer by 21%, alternate crops by 16%, farm saved seed by 6%, drought situation by 4%, and others by 2%, respectively. Seed multiplication through farmer seed networks could help to reduce inadequate seeds. This would enhance seed availability for farmers, resulting to enlarge grain volume in the market and also expand accessibility of mungbean for users. This project attempts to maintain and multiplied farmer groups to keep a sustainable seed and grain in community that result to encourage seed and food security in Thailand.

INTRODUCTION

Mungbean belongs to legume plant species and known as sustainable food crop. A lot of number of mungbean use for consumption as fresh produces and also pass through food and feed industries. The production area of mungbean has been reported to decrease from 813,847 rai (130,215.52 hectare) in 2019 to 803,522 rai (128,563.52 hectare) in 2020 (OAE, 2020), that might be connected to inadequate mungbean in Thailand. Moreover, mungbean seed, which is produced in our country, can support only 10% in demand (Wattanakupakin *et al.*, 2022). Many factors are involved in this problem such as less production area, decreased farmer number, low market price, high competitive economic crops, and limited seed for planting. According to this crop contained in food security crop or minor crop which is non-high profit. Government, then, has to take accountable to this crop.

In Thailand, Department of Agriculture (DOA) is the main organization responding to produce legume crop seeds and distribute seed up country. Due to limited staffs and production lands, DOA has cooperating with farmer networks for seed production together with providing knowledge and technology to farmer groups. However, decreased farmer number has been observed, that affects in agricultural sector and also causes in reduced seed quantity. Multiplied seed farmer networks may assist enhancing seed and grain supply in community and market. Moreover, farmer seed networks are important for building viable and diverse crop populations especially for minor crops and transmission of non-core crops or other plant species which are ignored by formal supply (Coomes *et al.*, 2015). The International Center for Agricultural Research in the Dry Areas (ICARDA) (2014) reported that farmer seed networks (informal seed system) supplied 80-90% of food grains in many developing countries.

As we known, seed is an essential input for crop growing that link to food chain and food security (Mcguire & Sperling, 2011). The initiate and maintain seed farmer networks is an important role to accumulate and dissemination mungbean in term of seed and grain. The multiplication of farmer seed networks is the challenges. The aims of this research are multiplied seed networks, produced mungbean seed through seed network, supported seed for grain production and reserved seed for natural disaster. This chain is a vital linkage between seed and food security that assist to motivate seed and food sustainability in our country.

MATERIALS AND METHODS

Mungbean seeds cv. Chainat 72, Chainat 84-1 and Chainat 3 were prepared to produce all seed classes comprised of breeder, foundation, registered and certified seeds for 3, 25, 200 and 392 tons, respectively. Breeders responded to produce breeder seeds in the plot experiment at Chainat field crop research station, Department of Agriculture (DOA). Foundation seeds were multiplied from breeder seeds under the cared of researchers at Chainat field crop research station. In case of registered and certified seeds, these kinds of seeds were conducted through seed farmer networks under the control of DOA's researchers and officer staffs. The processes of registered and certified seed production were consisted of 10 steps as followed;

1. DOA's researchers investigating production area and selecting farmers to participate in the project.

2. Meeting between researchers and seed producer networks were took placed at their location to explain project background, seed production technology and all essential issues.

3. Foundation and registered mungbean seeds were prepared for seed producers. The recommendation of mungbean seed per rai was 5-6 kg for both registered and certified seed classes. These kinds of seed were, then, distributed to seed producers by DOA's staffs.

4. Both seed classes were produced in farmer's field. The foundation seeds were used as a starter for registered seed production, while registered seeds were applied for certified seed multiplication.

5. Seed producer networks looked after mungbean field followed by the instruction of DOA and recommendation of researchers, e.g. water irrigation, fertilization, plant pest protection and management.

6. Field inspection, roughing or investigating pest and plant growth, was conducted by seed producer networks and monitoring by researchers or officer staffs under the guidance of DOA's standard.

7. Harvesting was carried out around 65-75 days after planting by a combine harvester.

8. Seed processing was operated by DOA. After harvested, officer staffs took mungbean crop back to the station as soon as possible to reduce its moisture content to 10-11% before cleaning by air screen cleaner and separating by gravity separator. Seed was sampled for quality testing before packing.

9. Seed was kept in warehouse at room temperature and fumigated with aluminium phosphide by 2-3 tablets per ton before storage. The concentration of aluminium phosphide during fumigation for 7 – 10 days were ranged 1.0-1.5 g/m³.

10. Seed was distributed to DOA networks, Agricultural Extension, Agriculture and cooperatives and farmers etc.

Data record and analysis

Seed production yields and seed quality e.g. moisture, physical purity, germination were recorded. The questionnaire was created to evaluate both seed producer networks and the growers. The detail of questionnaire was focused on production cost, incomes, utilization and farmer satisfaction. All data were gathered and analyzed using excel programme. Duration of this project was taken from 1st October, 2021 to 31st March, 2022.

There were 16 DOA's organizations and 37 farmer groups came from 18 provinces joining as followed;

- **DOA centers;** Seed Research and Development Center at Phitsanulok, Lopburi Chiang Mai and Bangkok, Field Crops Research Center at Chai Nat and Songkhla, Research and Development Center at Uthai Thani, Nakhon Sawan, Phichit, Sukhothai, Phetchabun, Lampang, Nong Bua Lamphu, Roi Et, Nakhon Ratchasima, Buriram and Phatthalung, and Phusing agricultural development center
- **Farmer groups locations;** Chainat, Lopburi, Saraburi, Uthai Thani, Nakhon Sawan, Phichit, Phitsanulok, Sukhothai, Phetchabun, Chiang Mai, Lampang, Nong Bua Lamphu,

Roi Et, Nakhon Ratchasima, Buriram, Sisaket, Phatthalung and Songkhla

RESULTS AND DISCUSSION

DOA’s researchers have searched for farmers and agricultural lands for mungbean seed production in this project. This research showed that there were 37 farmer groups, consisted of 308 people, located at 18 provinces participated in our project that came from central, north, northeast and south parts of Thailand (Figure 1). The training of mungbean seed production and technology was transferred to seed producer networks before planting that responded by research centers nearby farmer groups.

Mungbean seed production was begun at dry season between mid-November to late December 2020, and late rainy season between mid-July to early August, 2021. Breeder and foundation seeds were conducted by the researchers of the Chai Nat field crop

research center. Registered and certified mungbean seeds were produced in the agricultural lands of farmer seed networks totally 5,967 rai (954.72 hectare) under the control of DOA’s staffs (Figure 1). The production fields were carried out by 37 farmer groups, consisted of 308 people, located at 18 provinces of Thailand (Figure 2). The total mungbean seed yield was 623.17 tons from the plan 620 tons. The number of breeder, foundation, registered and certified seeds was 3.01, 25.30, 200.79 and 394.06 tons, respectively (Table 1). Mungbean seeds were utilized totally 570.56 tons or 91.56% and distributed to users such as government agencies, private sectors and farmers up to 39 provinces around country (data not shown). Our seeds support planting area by 57,016 rai or 9,122.56 hectare approximately. The research data revealed that most mungbean seeds up to 92.18% was purchased by users i.e. government sectors (Agricultural Extension and Cooperative Promotion Department), farmer groups, farmers and private sectors, kept for DOA production project by 4.38%, used for research by 0.07% and other by 2.72% (Table 1).

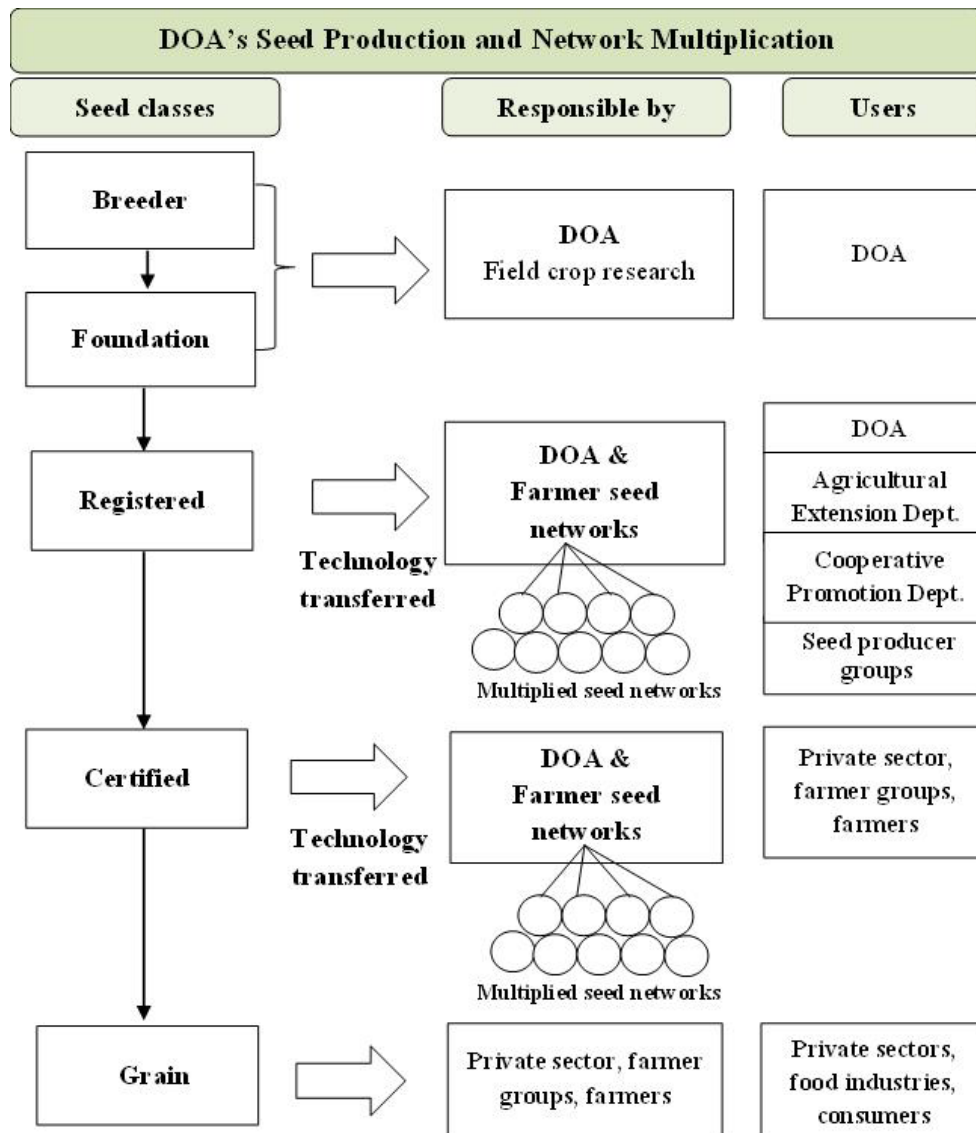


Figure 1. Mungbean seed production and multiplication networks of Department of Agriculture (DOA), Thailand.

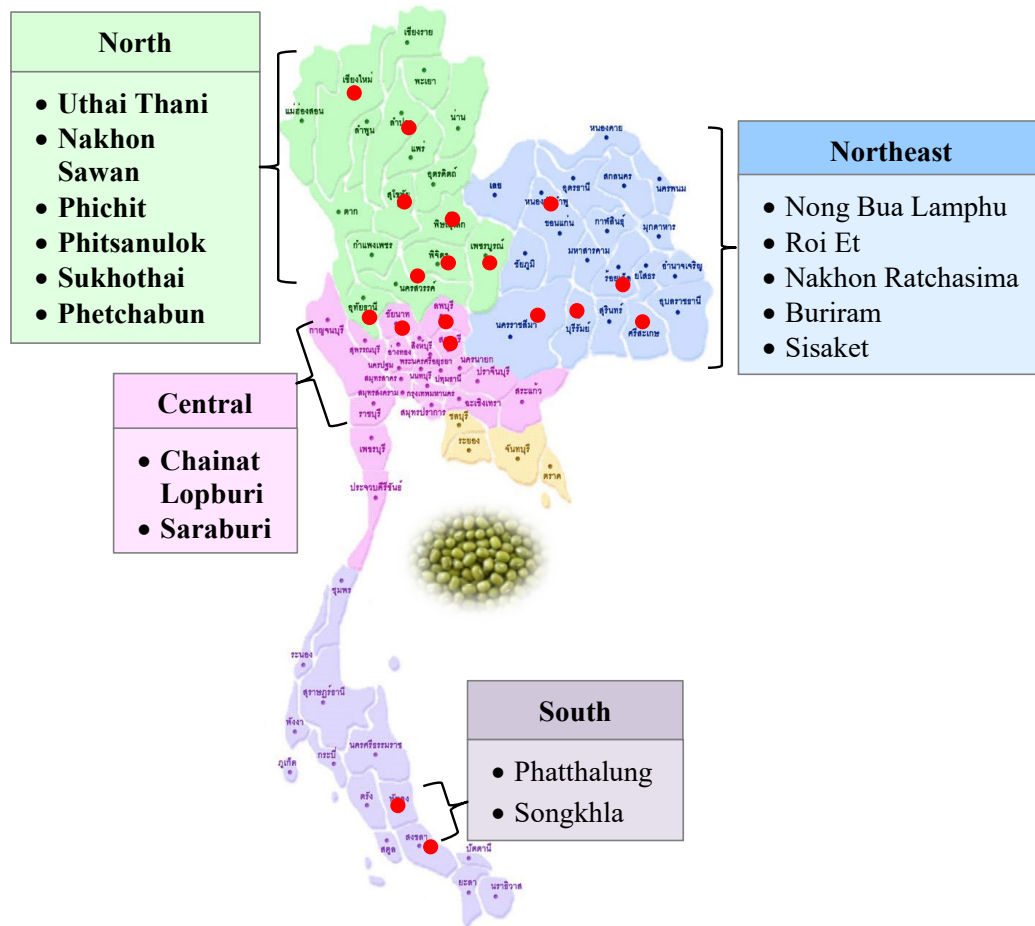


Figure 2. Seed production area of farmer seed’s network totally 308 people of 37 groups from 18 provinces of Thailand. The color, green, pink, blue and purple, indicate the north, central, northeast and south parts of Thailand.

Table 1. Quantity of mungbean seed production and utilization in each seed classes

Production	Seed classes/ Quantity (Tons)					Utilization		
	Breeder	Foundation	Registered	Certified	Total	Tons	%	Details
Plan	3.00	25.00	200.00	392.00	620.00			
Actual Yield	3.01	25.30	200.79	394.06	623.17	570.56	91.56	Sell; 92.81%
								DOA production project; 4.38%
								Research; 0.07%
								Others; 2.74%

Remark; the rest seed around 8.5% was reserved for disaster or emergency case relied on the government policy.

The questionnaires were created to survey satisfaction of seed producer networks and growers who used mungbean seed in this project. All data from farmer seed networks and grower were collected and analyzed. In case of seed producer networks, the result showed that over 80% satisfied taking care of DOA’s researchers or stuffs, roughing, harvesting methods and participating this project. The moderated satisfaction, that the score ranged between 61.6–75.8%, found in seed production rate, application of rhizobium, pre-emergence herbicides, pesticides, fertilizer, gained knowledge or technology, reduced cost from farm saved seeds, and satisfactions of yield, cost, incomes and

project. This research also found that 76.7% of seed producer networks recommended other farmers to be a seed producer (Table 2). Moreover, they gained higher net incomes from this project by 1,200 baht/rai/crop due to using good seed quality.

The utilization and satisfaction of growers, who used mungbean seeds in this project, was surveyed and analyzed from 524 growers. The research found that mungbean seed was produced in term of grain and sold up to 51% followed by soil fertilizer by 21%, alternate crops by 16%, farm saved seed by 6%, drought situation by 4%, and others by 2%, respectively (Figure 3). The satisfaction up to 80% of grower aspects

were found in seed quality, drought situation applying, willingness in mungbean growing, and recommended mungbean production to other farmers. However, the preference of seed price, yield, production cost and incomes showed a moderated rating scale that was 76.42%, 77.04%, 75.71%, and 77.98%, respectively (Table 3).

This research revealed that mungbean seed was high demand indicated by over 90% distributing to users. The farmer seed networks satisfaction to this project by 81.4% may imply that they willing to continuously produce mungbean seed. Furthermore, the growers satisfied over 80% in seed quality, continuous growing mungbean and recommended this crop to other farmers. These evidences showed farmer seed networks and growers were pleasant to be apart of mungbean production. However, the decreased production area of mungbean may relate to insufficient good seed quality due to unstable policy and limited budget of government. If the initial seed classes (breeder, foundation and registered seed) were not enough, farmer seed networks cannot continuously produce mungbean seed. This also caused in decreased mungbean production in term of grain and continuously effect to food insecurity. In addition, unavailable good seed quality may come from farmers obtained low seed quality from local production or local market, so food insecurity arising from poor harvest and market failures (Mcguire & Sperling, 2011). Moreover, this research found only 6% of farmer saved seed for their growing (Fig.3).

This figure could mention that most farmers are not aware to save

their seeds; they get used to rely on government support. The problems are complex because farmer seed system is embedded in social relations, institutions and rural life (Almekinders & Louwaars, 2002; Louwaars *et al.*, 2013; Coulibaly *et al.*, 2014).

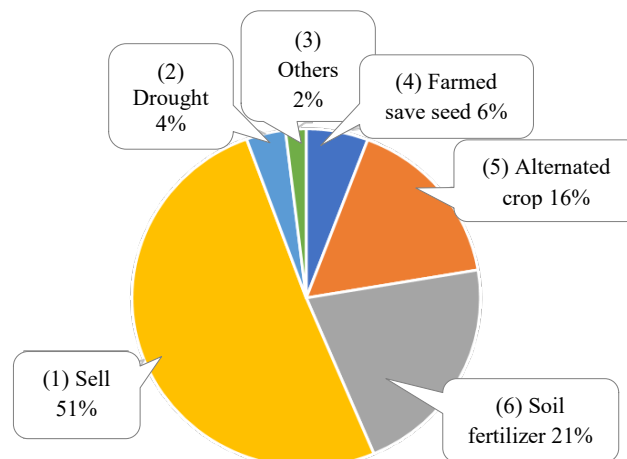


Figure 3. The purposes of mungbean seeds used by growers (%); (1) produce in term of grain and sell, (2) using for drought situation, (3) other purposes (4) using for farmed save seed, (5) applying for alternate crop and (6) applying for soil fertilizer.

Table 2. The satisfaction of mungbean seed producers participating in this project

Lists of satisfaction	Satisfaction level of mungbean seed producers	
	Rating	Percent
1. Seed production rate per rai	3.38	67.6
2. Rhizobium application	3.29	65.8
3. Pre-emergence herbicides application	3.08	61.6
4. Roughing	4.87	97.4
5. Plant protection by pesticides application	3.71	74.2
6. Fertilization application	3.25	65.0
7. Harvesting method	4.01	80.2
8. Recommendation of DOA's researchers or staffs	4.11	82.2
9. Seed knowledge or technology gain	3.76	75.2
10. Seed yield	3.57	71.4
11. Seed production cost	3.37	67.4
12. Incomes	3.79	75.8
13. Could farm saved seed reduce production cost?	3.62	72.4
14. Are you satisfy to participate in this project?	4.07	81.4
15. Do you recommend other farmers to be seed producer?	3.83	76.6

Remark; Rating scale, 1 = Not satisfied, 2 = Slightly satisfied, 3 = Fair, 4 = Satisfied, 5 = Very satisfied

Besides building up seed networks and transfer seed production technology, farmer saved seed is also essential channel to enhance seed security. Farmer seed networks play an important role in moving seed through farmer-to-farmer, local markets, national seed agencies, research stations, agro dealer, and agribusiness to farmer (Cooms *et al.*, 2015). Farm saved seed also a vital safety net for farmers under the risk of unexpected situations; crop seed loss or disaster, and important complement to physical storage in community seed bank. The government has to encourage and educate farmers to raise awareness of important seed storage in community, support them for managing seed

quality in term of local systems (FAO, 2006), and provide necessary infrastructures or equipment. In case of developed countries, e.g. Europe and North America, farmers have acted to strengthen existing farmer networks and/or develop new networks. Their purposes to preserve varietal diversity and farmer control over seed convey for both commercial and non-commercial crops (Thomas *et al.*, 2012; Phillips, 2013). Moreover, the policy innovation, e.g. seed legislation or plant variety protection (Aistara, 2014; Winge, 2014) directly responds to contest restrictive commercialization and alternative agrarian futures (Aistara, 2012; Demeulenaere, 2014).

To be strengthening seed system in our country, the government may be considerable effort to assist farmers to be farmer seed enterprises for business and farmer seed village for sharing. Furthermore, amending related policies, improving legislation and regulation, providing various

provisioning channels, recognizing local identity and ownership (Graddy, 2013), supporting new partnership and foundation would be benefit to enhance sustainable seed system, food security and well-being of farmers from now to future.

Table 3. The satisfaction level of mungbean growers using mungbean seeds from this project

Evaluation details	Satisfaction level of mungbean growers	
	Rating	Percent
1. Seed price	3.82	76.42
2. Seed quality	4.10	81.98
3. Yield	3.85	77.04
4. Production cost	3.79	75.71
5. Incomes	3.90	77.98
6. Does this crop help in case of drought situation?	4.07	81.36
7. Do you willingly continuous growing this crop?	4.21	84.16
8. Do you recommend this crop to other farmers?	4.03	80.64

Remark; Rating scale, 1 = Not satisfied, 2 = Slightly satisfied, 3 = Fair, 4 = Satisfied, 5 = Very satisfied

CONCLUSIONS

This project could imply that seed security links to food security and sustainability. Multiplied seed networks together with encouraged farm saved seeds are a vital role to strengthen seed networks in community that would help to accumulate and circulate seed and grain production systems, and food availability in our country.

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