Assessing the national seed production system of potato, shallot, and garlic

B Sayaka*, D K S Swastika and Sunarsih

Indonesian Center for Agricultural Socio Economic and Policy Studies, Jln. Tentara Pelajar No. 3B Bogor, West Java, Indonesia

*bambangsayaka@gmail.com

Abstract. A good seed production system results in quality seed. Subsequently, quality seed produces high yield, good quality, and uniform crop performance. This paper aims to assess the national vegetable seed system, especially those seeds produced using vegetative propagation, i.e. potato, shallot, and garlic. The study was conducted in 2019 in West Sumatera, West Java, Central Java, and Northern Sulawesi Provinces. Using primary data from the respondents and secondary data from related institutions, both data were analyzed descriptively. Indonesian Vegetable Research Institute (IVEGRI), universities, and seed companies produce various vegetable seeds. Community in groups or personals as well as regional governments may register their varieties to the Center for Crop Variety Protection and Agriculture Permit (PVTPP). Potato seed producers deal with higher production cost and the farmers have to pay more expensive seed since the Ministry of Agriculture (MoA) implemented the policy on shifting extension potato seed from G4 (fourth generation) to G2 (second generation). The farmers cope with quality and volume of garlic seed supply. Shallot seed adopted by the farmers are generally not certified. Farmers usually adopt certified shallot seed if they receive the government seed assistance. TSS (true shallot seed) has been introduced but farmers’ adoption is limited. Garlic seed certification through post-harvest observation in the seed warehouse without field supervision was valid until the end of 2019 leading to low garlic yield. MoA should facilitate farmers with quality seed of improved vegetable varieties to enhance vegetable production as well as to improve farmers’ profit.

1. Introduction

Modern agribusiness needs quality seed of improved varieties as one of production inputs. Besides high yield, modern agribusiness needs quality seed for commercial outputs according to the consumers’ demand. Quality seed should be available sufficiently at the right time and affordable. Farmers grow quality seed and it is subject to four requirements, i.e. acceptable, accessible, affordable, and attractive [1].

Regulation of Minister of Agriculture (Permentan) No. 116/2013 on production, certification, and control on horticulture vegetative seed produced conventionally for seasonal crops decides that G2 is the extension seed in which it was G4 previously, especially potato seed. Bulb seeds, e.g. shallot and garlic, and root seeds, e.g. carrot, may be propagated into quality seed based on purified seed.

It will affect horticulture seed producers especially those producing tuber seed such as potato and bulb seeds such as those of shallot and garlic. Those seed producers will spend more production cost for producing extension seed. Besides using bulb, shallot could be propagated using True Shallot Seed (TSS) but it deals with constraints since seedling to crop growing. Garlic seed producers are still allowed
to produce the seed without field inspection (TDL) approved by the Seed Control and Certification Agency for Food and Horticulture Crops Seed (BPSBTPH). Those seed of potato, shallot and garlic are highly-economic values and usually produced by local seed producers rather than the multinational ones. However, integrating formal and nonformal seed systems will produce better policy [2]. This paper aims to assess the national seed production system of potato, shallot, and garlic.

2. Materials and Methods
The study was conducted from January to December 2019 in four provinces for collecting primary data. Potato seed study was conducted in Bandung and Bogor Regencies (West Java Province) and Minahasa Selatan District (North Sulawesi Province), garlic seed study was carried out in Temanggung, Magelang, and Karanganyar Regencies (Central Java Province), and shallot seed study was implemented in Solok District (West Sumatera Province), Brebes and Tegal Regencies (Central Java Province).

For the purpose of collecting secondary data and other information, the study was also conducted in Jakarta especially in the Ministry of Agriculture, i.e. the Center for Protection of Crop Varieties and Agriculture Permit (PPVTPP) and the Directorate of Horticulture Seed. Secondary data were also collected from the Seed Control and Certification Agency for Food and Horticulture Crops (BPSBTPH). Secondary data on seed certification were collected from BPSBTPH in each research province. The potato, garlic, and shallot seed producers were interviewed for their seed production process including all of the formal procedures they have to abide with.

Overall respondents of the study were seed producers (19), seed growers (12), seed traders (6), BPSBTPH (6), Agricultural Service Offices (6), Directorate General of Horticulture, and PPVTPP. In addition the respondents included research agencies (3), AIAT (4). The number of respondents were purposively chosen in each province based on their jobs for individual respondents and on their functions for institutional respondents.

All of the secondary data on the seed production and information on seed control and certification procedures as well as seed regulations collected were analyzed descriptively. The formal procedure of the seed production was compared with practices carried out by the seed producers.

3. Results and Discussion
IVEGRI in Lembang, West Java, produces various vegetable seeds including those of potato, garlic, and shallot. Vegetable varieties are also produced by Universities, among others. Community in groups or personals as well as provincial and district/municipality governments may register their varieties to PPVTPP. The registered and released varieties may be propagated according to the existing rules.

3.1. Horticulture seed release procedure
The Law on Sustainable Farm Practice [3] rules that commercial seed distribution is subject to official variety release from PPVTPP, except the variety invented by domestic small farmers. Administrative registration for horticulture varieties are: (i) applicants submit application the stamped letter; (ii) variety description is attached on the application letter; (iii) attaching variety improvement test results; (iv) attaching variety authenticity test results; (v) a statement letter of distributing authentic variety according to the description; (vi) a letter stating that seed producer guarantees the authenticity of the variety distributed in accordance with its description; (vii) a letter stating the seed producers’ willingness to maintain the seed archive or the crop registered as the authentic variety; (viii) a letter stating to stop distributing the seed if its seed variety registration is cancelled; (ix) naming the variety in accordance with existing rules; (x) crop or crop part(s) photo indicating the uniqueness put side by side in one photo frame (minimal size of 500 kb); (xi) softcopy of improved test results, variety description, and crop photo; and (xii) specifically for introduced variety the added requirements are as follow: (a) the guarantee letter stating that after two years of registration, the seed should be produced domestically if the variety is possible to grow in the country; (b) the authorization letter of the variety owner for registering and distributing the seed if the variety registered does not belong to the seed producer; (c) seed import permit of adaptation test.
BPSBTPH is authorized to control and certify commercially distributed horticulture seed. BPSBTPH authorization includes: (a) controlling validity of seed production or seed distribution; (b) controlling seed facility and infrastructure seed storage; (c) checking the documents or notes related with seed production, supply and distribution; (d) seed sampling for laboratory test or storage test; (e) allowed to stop seed distribution if the document or seed distributed is suspicious; (f) giving opportunity to seed distributors to approve authenticity of the distributed seed document as long as seven days after the seed distribution is stopped; (g) temporarily halting seed distribution under investigation for not more than 25 working days; (h) investigating the suspicious seed; (i) cancelling temporary halt of seed distribution if no violation is found; (j) halting seed distribution if the distribution document is not valid and/or seed quality is below standard. Horticulture seed to be distributed commercially, such as other crop seed, should be certified if the seed producer does not own Quality Management System Certificate (SSM) issued by SSM Institution (LSSM).

Seed certification process since at the field, storehouse, labeling, up to marketing is monitored by Crop Seed Controller (PBT). PBT collects seed distribution data from producers to seed distributors. PBT may monitor commercial seed is any time. PBT reports their task to their supervisor every last week of the month. PBT report the monitoring results to the center every first week of the month.

Labeled seed, especially those of potato, shallot, and garlic, are relatively less produced due to limited demand. Labeled seed is more expensive than those of no label due to quality assurance of labeled seed such as higher yield potential, more resistant to pests and diseases, and better viability. Thus, certified seed is early step of the farmers to get higher and better yield [4].

3.2. Potato seed system

Latest potato seed system refers to Permentan No. 116/Permentan/SR 120/11/2013 on Horticulture Seed Production, Certification, and Distribution Monitoring stating that Extension Seed (ES) which was previously G4 is changed into G2. This is followed up by Kepmentan No. 20/KPTs./SR 130/IV/2014 signed by Director General of Horticulture on 7 April 2014. Principally, there is different potato seed classification between current and previous rules. Based on Kepmentan No. 20/2014, the seed class consists of BS (Breeder Seed), FS (Foundation Seed) or G0, SS (Stock Seed) or G1 and ES (Extension Seed) or G2. In the previous period, potato seed was classified into G0, G1, G2, G3, and G4. Potato ES changed from G4 into G2 was implemented on December 2015.

Potato G2 seed becomes ES because previously G4 as ES was considered as less quality. Traditionally farmers grow G4 for several times before repurchasing G4 to grow. To improve quality and to control potato disease, Ministry of Agriculture changes potato extension seed from G4 to G2. The potato seed producers do not agree with this new rule. ES production cost becomes higher, potato seed selling prices is more expensive, and demand for the seed gets lower. Higher seed cost will result in lower farmers’ income [5].

IVEGRI is one of main research centers producing potato varieties. As many as 33 potato varieties, either Granola or Atlantic and crosses of both varieties have been released by IVEGRI since 2000 to 2018 [6]. Those varieties are subject to farmers’ preference tests [7-9]. IVEGRI distributes plantlets to the seed producers. Subsequently, the potato seed producers grow plantlets into G0, G1, and G2. The seed producers usually sell G2 as extension seed to farmers. Some seed producers produce G1 sold to other seed producers for G2 production (Figure 1).

Up to 2019 IVEGRI authorizes 16 seed producers in many regencies to produce potato seed legally. IVEGRI delegates of plantlets to the seed producers and intensively supervise them. Those potato seed producers include the central government institution, local governments, private and individual companies. Given the potato seed quality produced by the seed producers, the farmers may get higher yield [10]. Improved production technology of potato seed technology will result in better seed quality including resistance to some disease [11].

BPSBTPH is a Regional Technical Implementing Unit (UPTD) in West Sumatera, West Java, Central Java, and North Sulawesi Provinces controlling and certificating food and horticulture crops seed. Potato seed classes, i.e. G0, G1, and G2, produced by the potato seed producers consisting of BBPP (Agriculture Training Agency), BBK (Potato Seed Agency), both national and international
private companies. Potato seed is certified by BPSBTPH except those produced by the seed producers holding a certificate issued by LSSM.

In 2017 cropping season, for example, BPSBTPH in West Java Province certified as many as 62,627 kgs of G0, 40,644 kgs of G1, and 191,350 kgs of G2. Total potato seed certified kept increasing until 2017-2018 second cropping season, but it decreased in 2018 first cropping season. In 2017 and 2018 cropping seasons IVEGRI distributed free G2 potato seed as many as 360 tons to the farmers affecting decreased demand for commercial potato seed in 2018 cropping season.

Figure 1. National potato seed system

UPTD BBK in Pangalengan Subdistrict produces potato seed sold to seed producers, growers, and farmers. UPTD BBK functions based on Permentan No. 116/2014 on Text Order of Ministry of Agriculture. Operating budget of UPTD BBK is that of West Java Province Regional Budget. UPTD BBK purchases plantlet from IVEGRI and produces it into G0, G1 and G2. To some extent, UPTD BBK function for producing potato seed overlaps with the other seed producers as this agency uses the same potato varieties produced by IVEGRI.

There is no official potato seed producer in North Sulawesi Province, so far. The seed potato project involving the seed growers was not successful. Local potato seed producers are dominant in West Java Province. They produce potato seed for farmers or regional government projects inside and outside the province such as PD Nugraha Putra and Makihi Tani in Pangalengan Subdistrict. Multinational companies, such as PT East West Seed Indonesia also produces potato seed. PT BISI International in East Java Province recently also becomes a potato seed producer. Government agencies also produce potato seed, i.e. UPTD BBK and BBPP.

3.3. Garlic seed system

In 2015 Ministry of Agriculture launches a program of national garlic seed production expansion through self-sufficiency program to achieve in 2021. Garlic production is carried out by independent farmers, garlic growing obligatory conducted by garlic importers, and APBN (national budget program). So far, there is garlic breeding to get high-yield varieties suitable with the existing environment in Indonesia. Garlic breeding is essential to get improved varieties well adjusted with the local farmland environment [12].
Quality (vigor and uniformity) and volume of garlic seed supply is the main constraint in achieving garlic self-sufficiency. Ministry of Agriculture issued Permentan No. 70/2017 on garlic seed certification through postharvest control in the seed warehouse or called as TDL (no field supervision) valid until end of 2019.

Garlic seed production, such as those of vegetable seeds, certified and supervised by BPSBTPH. To some extent, supply of BS, FS, and SS for ES seed production is limited. Garlic variety purification is carried out by AIAT and IVEGRI in limited areas (Figure 2), i.e. only 20 has, producing ES of 18 tons.

Certified garlic seed is one of components for garlic production increasing program implemented by Directorate General of Horticulture using APBN. However, Agricultural Service Offices at district level and garlic importers have to deal with scarce supply of certified garlic seed. Both uncertified and TDL garlic seeds are lack of quality due to lower vigor, less growing rate, and mixed varieties. There some new technologies to improve garlic seed quality [13,14].

3.4. Shallot seed system
Shallot seed adopted by farmers are generally not certified, produced by farmers themselves, other farmers, or shallot seed producers. Farmers adopt certified shallot seed are those receive government assistance. Thus, to some extent the shallot farmers minimize production cost through subsidized seed.

Shallot seed producers along with growers produce shallot ES based on the Agricultural Services Offices’ order. The seed producers also produce and sell uncertified shallot seed to self-reliance farmers at lower price but the quality is equal to the certified one. Shallot farmers used to produce seed by themselves [15].

True shallot seed (TSS) is imported by the private companies and produced by IVEGRI. TSS imported by private companies is commercially sold as hybrid seed with brand names of Tuk-Tuk, Lokananta, Sanren, and Maserati F1. TSS varieties produced by IVEGRI, i.e. Agrihort 1 and Agrihort 2, have not been produced as commercial seed. Some composite TSS varieties are also produced by IVEGRI. Shallot seed certification refers to Minister of Agriculture Decree (Kepmentan) No. 131/Kpts/SR.130/D/11/2015 on Technical Guidance on Shallot Seed Certification. There is no local company or institution producing TSS, but IVEGRI (Figure 3). Currently, TSS produced by the private companies is still imported as it is cheaper rather than locally produced. Even though there is some
promising results such as smaller quantity, easier transportation, longer-term storage, free-disease and larger bulbs, and higher yield [16], but domestic TSS producers still deal with some constraints for producing locally [17-19] regardless some studies that have been implemented [20-22].

**Figure 3.** National shallot seed system

4. **Conclusions**
IVEGRI offered legal license exclusively to potato seed producers in which supervision fee was burdened to the seed producers. Potato seed import was dominantly by Atlantic variety which is intended for food processing industry. This potato seed variety should have not been imported because it had been imported for more than two years or even more than two decades. MoA must implement law enforcement to the potato seed importer that it should be produced locally or no more import. Policy on changing potato ES from G4 to G2 should be cancelled and changed it into G4 or G3. MoA’s certified vegetable ES assistance to farmers should involve local seed producers as it competes with vegetable seed free market. Certified potato-seed adopted by farmers was still relatively low indicating that informal potato seed grown by farmers was still significant. MoA, specifically DG of Horticulture, needs to empower informal seed stakeholders.

It is urgent to implement garlic variety purification in larger areas for garlic seed supply enhancement. TDL seed certification was valid until the end of 2019 according to the official rule. MoA needs to encourage adoption of shallot bulb seed rather than TSS. Certified shallot seed adoption should not only be boosted by program assistance but also by farmers’ awareness and farmers’ benefit of using certified seed. It is necessary to encourage farmers adopt quality seed and not only the certified seed.
Acknowledgement
The authors thank Mr. Arfan (UPTD BPSBTPH in West Sumatera Province), Mr. Suryadilaga (BPSBTPH Central Java Province in Pekalongan District), and Mr. Iwan Ruswandi (BPSBTPH West Java Province) for their kind assistance of providing data and information during the research implementation.

References
[1] Miheretu F B 2019 Challenges and opportunities of vegetable quality seed production and seed system in Ethiopia. Int. J. of Res. Stud. in Agric. Sci. 5 15-25
[2] Louwaars N P and de Boef W S 2012 Integrated seed sector development in Africa: a conceptual framework for creating coherence between practices, programs, and policies J. of Crop Improvement 26 39-59
[3] Kementerian Sekretariat Negara Republik Indonesia 2019 Undang-Undang No. 12 Tahun 2019 tentang Sistem Budi Daya Pertanian Berkelanjutan (Jakarta: Kementerian Sekretariat Negara Republik Indonesia)
[4] Bogdanović S, Mradanov V and Turić S B 2015 The importance of using certified seed. Selekcija I Semenarstvo 21 63-7.
[5] Singh A, Singh R, Anurag and Ranjana 2014 Economic management and analysis of potato cultivation: a case study of Agra District (U.P), India. Int. J. Curr. Microbiol. App. Sci. 8 525-30.
[6] BALITSA 2019 Varietas Kentang, Balai Penelitian Tanaman Sayuran (Lembang: Badan Penelitian dan Pengembangan Pertanian, Kementerian Pertanian)
[7] Sembiring A and Adiyoga W 2020 Preferensi petani terhadap klon kentang Balitsa bahan baku olahan french fries J. of Soc. Econ. on Tropical Agric. 2 54-60.
[8] Manik F, Widayianti S and Saragih J 2012 Evaluasi enam varietas kentang di dataran tinggi Karo – Sumatera Utara Agrin 16 117-24
[9] Kusandriani Y 2014 Uji daya hasil dan kualitas delapan genotip kentang untuk industri keripik kentang nasional berbahan baku lokal J. Hort. 24 283-8
[10] Ayalew T 2014 Anaysis of seed potato (solanum tuberosum l.) system with special focus on Ethiopia review Asian J. of Agric. Res. 8 122-35
[11] Kawakami T, Oohori H and Tajima K. 2015. Seed potato production system in Japan, starting from foundation seed of potato. Breed. Sci. 65 17–25
[12] Zheng S J, Kamenetsky R, Féréol L, Barandiaran X, Rabinowitch H and Tajima K. 2015. Seed potato production system in Japan, starting from foundation seed of potato. Breed. Sci. 65 17–25
[13] Adelia K A C, Pasangka B and Bukit M 2016 Penerapan radiasi multigamma untuk pengendalian bawang putih lokal Timor J. Fis Sains dan Apl. 1 66–71
[14] Anwar S and Sobir S 2020 Sosialisasi upaya menyeragamkan pertumbuhan bibit bawang putih (Allium sativum L.) di Kecamatan Bojong, Kabupaten Tegal J. Pus. Inov. Masy. 2 7–11
[15] Basuki R S 2010 Sistem pengadaan dan distribusi benih bawang merah pada tingkat petani di Kabupaten Brebes J. Hort. 20 186-95
[16] Askari-Khorasgani O and Pessarakli M 2019 Agricultural management and environmental requirements for production of true shallot seeds – a review Advances in Plants & Agric. Res. 9 18-322
[17] Prahardini P E R and Sudaryono T 2018 The true seed of shallot (TSS) technology production on Trisula variety in East Java j-pal 9 27-32
[18] Nurjanani and Djufry F 2018 Uji Varietas beberapa varietas bawang merah untuk menghasilkan biji botani di dataran tinggi Sulawesi Selatan J. Hort. 28 201-08
[19] Rosliani R, Hilman Y, Sulastrini I, Yufdy M P, Sinaga R dan Hidayat I M 2018 Evaluasi paket teknologi produksi benih TSS bawang merah varietas Bima Brebes di Dataran Tinggi J. Hort. 28 67-76
[20] Palupi E R, Manik F dan Suhartanto M R 2017 Can we produce true seed of shallot (TSS) from small size shallot sets? *J. of Tropical Crop Sci.* **4** 26-31

[21] Kurniasari L, Palupi E R, Hilman Y and Rosliani R 2017 Peningkatan produksi benih botani bawang merah *allium cepa var. ascalonium* di dataran rendah Subang melalui aplikasi BAP dan introduksi *Apis cerana* *J. Hort.* **27** 201-08

[22] Nurjanani and Djufry F 2018 Uji varietas beberapa varietas bawang merah untuk menghasilkan biji botani di dataran tinggi Sulawesi Selatan *J. Hort.* **28** 201-08