8. Management system for potato breeder seeds

Eri Sofiari

Abstract

Seed quality is determined by the quality of seed sources such as nuclear seeds and breeder seeds. It is also affected by the management of a seed production system. Since Indonesian seed regulations require that varieties of certified seed be defined and harmonized, this potato seed system serves as the model that is being evaluated and assessed towards developing standard procedures in maintaining and producing breeder seeds. RIV is mandated by AARD to develop such standard procedures. To improve the system, standard guides and protocols to produce nucleur and breeder seeds are described.

For nucleur seed, pathogen-free plantlets are first produced to serve as the mother plants. The preliminary pathogen-free plantlets are further classified as nuclear seeds and used as sources of single-stem cutting and axillary stem cutting materials to produce the G_0 (generation zero) stock for subsequent propagation.

The management system for potato breeder seeds has four component tasks: (1) to arrange a national standard guideline for producing nuclear and breeder seeds, (2) to harmonize important descriptors for potato following the existing regulations of IPGRI, CIP and UPOV, (3) enable the Unit Production of Breeder Seeds (UPBS) to manage a system of producing and distributing breeder seeds using a standard procedure, and (4) to manage quality control and seed distribution.

Introduction

During the last three decades, new approaches to accelerate and improve the quality of potato seeds have been attempted. Before the invention of pathogen-free (Cole and Wright 1967) and rapid multiplication techniques (Hamman 1974 and Goodwin 1985) for the source of nuclear seeds, producing high-quality potato seeds was considered a difficult and expensive task (Sunarjono et al. 1974 and Sudjoko et al. 1989).

In the mid-70s, the Lembang Research Institute for Horticulture (LEHRI), (later renamed the Research Institute for Vegetables, or RIV) collaborated with the Assistance Technical Agriculture (ATA) 111 Project of the Netherlands in promoting high quality potato seeds in Indonesia. Efforts to improve and maintain potato seed quality through degeneration studies (Dasi and Achiar 1972; Sunarjono and Hadi 1972), haulum (Kusumo and Hikmat 1980), effect of tuber size (Surachmat and Hikmat 1980), seed cutting (Surachmat and Hikmat 1980; Syarifudin and Suryadi 1982), virus eradication (Duriat 1979), and diffuse light storage have been carried out, generating a tremendous amount of information.

In 1991, the Directorate General for Food Crops, the Central Research Institute for Horticulture and the Japanese International Cooperation Agency (JICA) started a project to regulate potato seed quality at the provincial level in West Java. The project aimed to produce and certify high-quality potato seeds. The pathogen-free plantlets were defined as mother plants to generate apical and axillary cuttings from which tubers of generation zero (G_0) could be produced in sterile media under a protected glasshouse. G_0 tubers were propagated in a

glasshouse to produce G_1 and these were classified as the breeder seeds according to the potato certification scheme.

Until now, annual demand for potato seeds in Indonesia can be estimated from total potato planting acreages. In 1998, 975,570 tons of seeds were required for 65,000 hectares of potato-growing areas in Indonesia. Imported seeds constitute only 0.9 percent of total potato seed demand (Anonimous, 2000). The farmers obviously produce large amounts of uncertified seeds. The West Java certified seed program supplied less than 1 percent of the potato seed needs in 1998.

A shortage of high-quality seed supply is caused by the lack of capacity to produce high-quality breeder seeds and possibly subsequent generations. To promote the use of high-quality potato seeds in Indonesia, JICA has extended its project to six provinces (Niino Kenji 2002, personal communication). AARD is mandated to produce the breeder seeds. Self-regulation by AARD is being planned in breeder seed production.

The Seed Act (Anonimous, 1992) provides for the management of the seed system. Operationally, the Seed Act is supported by governmental decrees PP No. 44 (1995), Keputusan Menteri Pertanian No. 902 (1996), and other regulations.

To some extent, AARD realizes that the seed regulations still need defining and harmonizing for these to be implemented. To this effect, the seed system of potato was evaluated and assessed to develop a standardized procedure in maintaining and producing breeder seeds. Hence, RIV, as mandated by AARD, developed a seed system for potato breeder seeds.

Until now, some potato seed growers do not follow standard procedures to ensure seed quality. Total quality management or a national standardization system is not yet implemented, either due to ignorance or neglect. Most probably, the need may not be felt because there are large supplies of uncertified seed potatoes that farmers can afford.

The certification does not imply that the seed produced, following successful completion of the certification procedure, is free of disease. It does, however, provide the farmers with a set of standard tests through which the seed has passed various means of inspection.

A management system for potato breeder seeds has four component tasks: (1) to arrange a national standard guideline for producing nuclear and breeder seeds, (2) to harmonize important descriptors of potato following the existing regulations of IPGRI, CIP, and UPOV, (3) enable the Unit Production of Breeder Seeds (UPBS) to manage a system of producing and distributing breeder seeds using a standard procedure, and (4) to manage quality control and seed distribution. Suitable equipment and infrastructure, and continuous budget allocation will support the UPBS.

Methodology

A management system for potato breeder seeds includes three consecutive activities:

1. Empower the Seed Team (Tim Perbenihan);
2. Set up the organizational structure for managing seed production and quality control; and
3. Refine the nuclear and breeder seed production procedure and distribution system.

1. Empowering the Seed Team

The Seed Team was initiated in 1999. It has the main task of producing and maintaining the breeder seeds. The director of RIV controls distribution. In 2001, the role of the Seed Team was split into two: (1) as internal seed inspector, and (2) as seed producer and distributor. The seed inspectors look after the health of nuclear seeds and of mother plants, protecting them against predetermined disease viruses such as PLRV, PVY, PVX, and PVS. At present, testing for bacterial wilt (*Ralstonia solani)* and nematode pest caused by *Phthorimaea operculella* in the production of G_0 tubers are done in the screenhouse. The 'zero' tolerance-0.0 percent was applied to PLRV, PVY, PVX, PVS, and *R. solani* for nuclear and breeder seed classes.

2. Setting up organizational structure and quality control for managing seed production

Staff and basic infrastructure for UPBS were completed step by step. Its organizational structure is controlled by the RIV director. Daily tasks in UPBS are coordinated by its head, supported by six divisions (Figure 1). Each division was provided with a guide book that contains the standard protocol. The seed quality guidance is part of a qualification required for establishing accredited seed producers. RIV's efforts were supported by staff of the National Accreditation Office and the staff UPBS for rice in Sukamandi.

3. Refining the nuclear and breeder seed production procedure and distribution

3.1. Nuclear seed and breeder seeds

Nuclear seeds of potato can be derived directly from a selected tuber of reference variety and legalized by corresponding breeders. In 2001, emerged shoots from tubers of variety Granola L., Atlantic M. and Merbabu were desiccated for explants. Virus-free plantlets of nuclear seeds were multiplied and cultured on solidified Murashige and Skoog media. First cuttings were defined as the mother plants. Propagation of mother plants were done only on virus-free materials to produce high-quality breeder seeds. An ELISA assay was used to check the virus incidence on materials for nuclear and breeder seeds. All of the nuclear seeds and mother plants used as materials for breeder seeds were tested for viruses (through ELISA test) while breeder seed plants in the plastic screenhouse were tested by systematically sampling every 100 plants that were a month old. Once a sample tests positive on the ELISA test, the source group, where the samples were taken, were retested and sampled for every 10 plants. Monitoring the population of virus vectors inside the screenhouse was accomplished by trapping with a sticky yellow paper.

Single stems and axillary stem cuttings from the mother plants were planted in screenhouse at a density of 200-250 plants/m^2. Granola L. and Atlantic produced an average of four minitubers each while Merbabu produced more than six tubers.

3.2. Distribution of nuclear and breeder seeds

Nuclear and breeder seeds of a released variety can be distributed to anyone based on an agreement between RIV and the users or recipients. Some recipients are charged a fair price to cover production cost.

At present, approximately 15,000 G_0 minitubers of variety Granola L., Atlantic M., and Merbabu are in storage for early April planting. Two potato seed growers already have requested to grow all the three varieties. An agreement for commercialization is under way to maximize benefits to all parties.

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Figure 1. Organization of the unit for the production of breeder seed (UPBS)

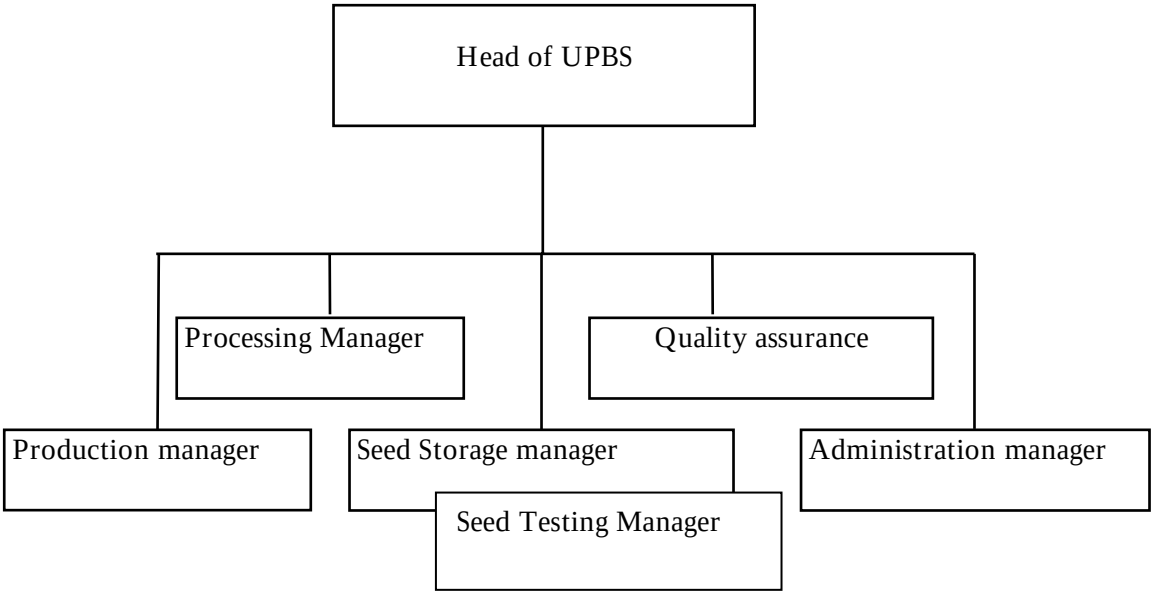

Figure 2. Procedures for producing breeder seeds from *in vitro* nuclear seeds