

2. Research priorities for potato in Indonesia

Ahmad Dimiyati

Introduction

Agriculture remains the key sector to accelerate economic development in many developing countries including Indonesia. It ensures food security, alleviates poverty, and conserves the natural resources for the survival and well-being of the present and future generations. The world's population will double by the middle of the 21st century and will consequently put immense pressure on agriculture, and thus also on land, water, and the biological resources of the globe.

When a monetary and economic crisis hit Indonesia in the last four years, the agriculture sector still managed to register a positive growth, although at less than 5 percent per year. Agriculture kept the country afloat even as other sectors had negative or slow growth. This situation all the more emphasized the significant role of the sector in economic development.

The horticulture subsector plays an important part in agriculture. In the last decade, the government of Indonesia positioned the horticultural subsector as a promising alternative for supporting food security. The broad variability of horticultural commodities including vegetables, fruits and ornamental plants revealed the wide range of possibilities to explore potential sources to further improve the economy.

The increase of domestic market demand on vegetables has emphasized the importance of these commodities. From 1995 to 2000, the average value of net trade (exports minus imports) in Indonesian for horticultural crops reached more than -\$55 million with the highest in 1997 at -\$82.8 million. It was dominated by the importation of garlic.

Constraints have emerged in some technical aspects of vegetable production in Indonesia, such as unavailability of new superior varieties grown by farmers, lack of good quality seeds, problems of pests and diseases, improper cultural practices, and yield losses caused by improper postharvest handling. In general, research activities in vegetable crops are focused on these aspects.

The Growth of Potato Production in Indonesia: A Review

Potato is one of the major vegetable crops grown by farmers in highland areas. Potato production has rapidly grown over the past decades and the country has become the largest potato producer in Southeast Asia. Between 1969 and 1995, potato production grew by an average of 13 percent per year; and by the mid 1990s, total annual production exceeded 1 million tons. Most of the production growth resulted primarily from the expansion of planting areas and, to a lesser extent, from yield improvement (Adiyoga, 1999).

Exports of fresh table potato to other Southeast Asian countries, mainly to Malaysia and Singapore, grew considerably throughout the 1980s and early 1990s, but declined after reaching the peak in 1995 with the value of \$17.69 million. Meanwhile, imports of potato products also increased over this period, but declined severely after 1997. On the other hand, potato tubers as planting materials were predominantly imported from other countries,

reaching the highest value of \$ 0.99 million in 1996. These developments show that Indonesia's potato markets have increasingly integrated at the regional and global levels. The principal reason for the decline in potato exports from Indonesia in 1995 to 1998 was the rapid growth of domestic demand and the increase in competition from other exporters, especially China and The Netherlands. The devaluation of the Rupiah during the economic crisis reduced domestic demand for potato and consecutively improved Indonesia's export competitiveness (Adiyoga, Fuglie and Rachman. 2001).

The potato variety that is widely grown by farmers is Granola. In general, potato growers are still dependent upon imported tubers for their potato cultivation. This is mainly due to unavailability of potato varieties acceptable to potato growers in Indonesia. Granola, which is imported from European countries such as Germany and The Netherlands, is planted in approximately 80 percent of the current potato areas (Sahat and Asandhi, 1994), with the yields averaging 15,3 t ha⁻¹ in 1998 (Direktorat Bina Program, 1999). In the last two decades, the Research Institute for Vegetables (RIV) has released several potato varieties such as Thung, Rapan, Cipanas, and Segunung. However, potato growers no longer use these varieties. The need for new superior potato varieties is the main reason for the importance of the potato breeding program.

Highlights of Research Results on Potato

In the year 2000, RIV released a new potato variety called Merbabu 17 which is now being processed for commercialization through a joint cooperation between RIV and a private company. The release of two new potato varieties proposed by RIV is still in progress. Field trials are being established to evaluate promising clones for both fresh table potato and processing potato.

Techniques of potato seed production through meristem culture and rapid multiplication, which are widely practiced by private and state-own seed companies, have also been developed by RIV. A management system for potato breeder seeds has also been developed to support the National Seed Management System.

Potato cultivation in highland areas is blamed for the worsening erosion of soil in the area. Some techniques have been introduced to the farmers to solve the problem of erosion such as arranging beddings parallel to the contour or diagonal to the contour. However, the farmers have not adopted the technology, since the techniques will result in water logging and consequently higher humidity in the beds. This condition will cause heavy disease infestation such as bacterial wilt and late blight, which will entail additional expenses for disease management. Integrated Pest Management (IPM) was introduced to the farmers in 1993 starting with trainings attended by extension staff and pest observers, followed by field schools in several provinces.

Some pests, such as the leaf miner (*Liriomyza huidobrenses*), which was classified as secondary pests, have become important ones. Other pests that should be carefully studied are *Bemisia tabaci* and nematode (*Meloidogyne* sp.). Research results recently indicated that *Liriomyza* sp. spread out of 1,000 meters to 2,200 meters above sea level (Setiawati and Uhan, 1997) with different infestation levels depending on location and plant age. Plant damage caused by *Liriomyza* sp. in the growing period may cause mortality, early senescence and may reduce photosynthetic process and yield (Chandler and Gilstrap, 1987). The highest plant damage occurred at 63 days old as a result of accumulation of plant damage starting from 28 days old. Plant damage may reach 56-59 % with yield loss of 34% (Soeriaatmadja and Udiarto,

1997). *Liriomyza* sp. starts to infest potato plants at 21 days old and reaches the peak at 63 days (Setiawati and Uhan, 1997).

Potato Research Priorities

Under the supervision of Central Research Institute for Horticulture (CRIH), the mandate of RIV is to conduct research on vegetable crops in varietal improvement, germplasm management, seed and crop management, plant protection, and post harvest management. The main aim of the research program for 2001 to 2004 is to acquire modern and strategic technologies to support the development of the agribusiness system in vegetables (Balai Penelitian Tanaman Sayuran, 2001). The main vegetable crops with high priority for research include potato, shallot, hot pepper, tomato, common bean, cabbage and mushroom. Among these priority crops, potato and hot pepper, have gained special attention, with comprehensive and integrated experiments conducted to create significant contributions towards development of these crops. Other prospective vegetable crops to be investigated are long bean, cucumber, and eggplant. Indigenous vegetables are also included in the research program to anticipate future needs categorically designed as part of demand-driven research strategy.

Based on the main constraints in the development of a sustainable agribusiness system for potato, the program of potato research and development in 2001-2004 covers the area of varietal improvement, seed management, cultural practices, pest and disease management, and postharvest management.

Varietal improvement

The objective of the research is to obtain varieties of fresh table potatoes that are better than Granola in terms of yield capacity, resistance to key pests, and adaptation to many potato-growing areas. Other desirable characteristics of processing varieties are high starch content (> 20%), low sugar content (< 0.5%), high specific gravity (> 1.07), and water content of less than 80%.

Conventional breeding of potato was established in RIV with the use of selected parental sources. To strengthen and accelerate the production of new superior potato varieties, RIV has established research collaboration with international research institutes such as CIP, other governmental institutions, and some private companies. The research collaboration with private companies is being conducted through the program of participatory breeding. The program was first incorporated in 2001 for hot pepper, and for the year 2002, expanded to cover some other vegetable crops i.e. potato, tomato, and cucumber.

Seed management

As one of research institutes under the Agency for Agriculture Research and Development (AARD), RIV is responsible to carry out research on the improvement of seed technologies, and to develop the management system of breeder's seeds of released vegetable varieties. The arrangement of breeder seed management system for potato was conducted in 2001. Reference seeds and breeder seeds of released vegetable varieties are gradually produced and maintained as source seeds to fulfill the market demand for vegetable seeds.

Cultural practices

Research on cultural practices of potato plants will be concentrated on land conservation to overcome erosion and fertility degradation in highland areas. Land preparation by using minimum tillage instead of full tillage will also be studied. The use of mulching to maintain water-holding capacity, to suppress weed and to protect from pests will be promoted. Some inorganic fertilizers will be replaced by natural substances, organic matters and biofertilizers. Clean and healthy vegetable products will be in demand in the near future. Research activities, therefore, will be oriented to optimize the use of organic matter instead of synthetic materials.

Pest and disease management

Research and development in integrated pest management on potato will be continued especially on new key pests. The use of natural enemies and bio-pesticides will be the main focus for controlling pests and diseases. The purpose of this research is not only to minimize the yield losses due to pests and diseases, but also to reduce the use of synthetic pesticides. Clean products are the final objective.

Postharvest handling

Research on postharvest will focus on processing potato. Determination of the harvest period of processing potatoes is important to gain the best processing characters of the varieties. Tuber storage of processing potato should also be studied because storage conditions will influence the quality of products such as content of sugar and starch. Research on potato frying such as thickness of slices for chips, length of frying time and kinds of frying oil will also be carried out. In the developmental aspect, good potato seed storage by using diffuse light storage (DLS) needs to be disseminated to seed producers. Seed storage is very important because it will involve not only the quality of tuber seeds, but also the storage period.

Socio-economic aspects

Socio-economic aspects of potato production and marketing are also very important. The areas of research within this field include global and domestic market information, farmers' responses towards market situation, farmers' behavior towards technology innovation, and institutional set up for agribusiness development. Policy analysis to formulate policy recommendations will be a special need and will continue to be a major part of the activities of sociologists and economists of the institute.

Conclusions

1. Potato is one of the vegetable crops that have strong potential for local and export markets.
2. New superior varieties of potato are needed to fulfill the demand of both markets.

3. Research priorities in potato are established with integrated approaches to support the development of the agribusiness system of the commodity, i.e. varietal improvement, seed management, cultural practices, control of pests and diseases, and post harvest management.

References

Adiyoga, Witono. 1999. Pola pertumbuhan produksi beberapa jenis sayuran di Indonesia. *Jurnal Hortikultura* 9(3).

Adiyoga, W., K.O. Fuglie, and R. Suherman. 2001. Potato marketing in North Sumatera and assessment of Indonesian potato trade. UPWARD Working paper series no. 7. CIP-UPWARD, Los Banos, Laguna, Philippines. 31p.

Direktorat Bina Program. 1999. Luas panen, rata-rata hasil, dan produksi hortikultura: sayuran dan buah-buahan. Direktorat Bina Program, Dirjen. Pertanian Tanaman Pangan dan Hortikultura. Jakarta.

Balai Penelitian Tanaman Sayuran. 2001. Program balai penelitian tanaman sayuran 2001-2004. Balai Penelitian Tanaman Sayuran, Lembang. Bandung.

Chandler, L.D. and F.E. Gilstrap. 1987. Seasonal fluctuation and age structure of *Liriomyza trifolii* (Diptera : Agromyzidae) larva population on Bell Peppers. *J. Econ. Entomol.* 80(1): 102-104.

Sahat, S. and A.A. Asandhi. 1994. Hasil-hasil penelitian kentang Pelita V. Evaluasi hasil penelitian hortikultura dalam Pelita V. Segunung, 27-29 Juni 1994. Puslitbang Hortikultura. Badan Litbang Pertanian. Jakarta.

Setiawati, W. and T.S. Uhan. 1997. Pendayagunaan beberapa jenis insektisida untuk pengendalian *Liriomyza sp.* pada tanaman kentang. Laporan Hasil Penelitian Perbaikan Varietas dan Budidaya Kentang Menunjang Kelestarian Lingkungan dan Industri. hal. 176-181.