CONSTRAINTS ON AND OPPORTUNITIES IN THE PRODUCTION OF VEGETABLES IN INDONESIA

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ABSTRACT

Production of vegetables in Indonesia increased significantly during the period 1975-1985. This achievement may be attributed to the improvement of genetic materials through greater adaptability, resistance or tolerance to pests, more stable and higher yields and improved technology. Improvements in production systems have enhanced income potential for small vegetable growers.

In an effort to maximize the potential yielding ability of new varieties, seed production technology and seed flow system will be developed and implemented.

The future is promising and challenging. Efforts will be concentrated on the collection and utilization of a wider array of adaptive genetic materials for crop improvement. Pest management will be based on the best use of natural agents, proper cropping systems, tolerant varieties, monitoring of insect populations and the use of chemicals which are not harmful to the environment and produce minimum contamination. Efficient import reduction in the case of seeds, wherever possible to allow profit maximization will be a major objective.

To ensure minimum loss and improved quality of produce, serious consideration must also be given to post-harvest technology development and adoption, especially proper handling of fresh vegetables.

To achieve sustainability, serious efforts must be made to promote vegetable production using adequate but not excessive inputs such as fertilizers, pesticides in order to minimize damage to the environment and yet still maintain profitability.

Introduction

The production of vegetables contributes substantially to the national economy. It has in the last decade, also contributed to the export earnings of the country. In 1985, the export of vegetables reached 57,820 tons accounting for about 1.64% of the total production, which amounted to about 3,519 million tons.

Vegetables are an important and nutritious supplement to the Indonesian diet. They provide essential nutrients and their content in minerals and vitamins is generally high. The average annual per capita intake of vegetables was 39.1 kg based on the results of a social and economic survey carried out in 1978. The Joint Workshop of LIPI (The Indonesian Council of Science) and the NAS (The National Academy of Science, U.S.A.) for Food and Nutrition in 1968 recommended that the consumption of vegetables by the Indonesian people should reach 65.7 kg/capita/year.

It was apparent, that the consumption of vegetables in 1978 was relatively low, being only 59.6% of the recommended rate. In the people's diet in Indonesia, a serious shortage of vitamin A was identified. Xerophtalmia cases in Indonesia are estimated at around 4 -14% and cause blindness in children. Vegetables contribute to a significant percentage of the vitamin A needed.

The cultivation and production of fresh vegetables is an important source of income, especially for small growers. Vegetable growers are generally small operators. In addition

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to fresh vegetable consumption, there are diverse ways of utilizing vegetables. Their potential for primary and secondary processing is high and could be developed into large and small industries. The processing industries could also generate job opportunities for the people.

Beside providing food and income, vegetables also offer significant opportunities for crop diversification, which reduces the risk of crop failure, provides better protection against pests and diseases, and enables a more efficient utilization of available resources for additional income and job opportunities.

Production statistics of major vegetables

Trends in production

In Indonesia, potato, garlic, shallot, tomato, red pepper and cabbage are considered to be the major vegetable crops, because they lead in terms of production and therefore, contribute substantially to the national economy. Other vegetables classified as minor, but many have a high potential for promotion and development.

Chilli or red pepper surpassed other vegetables in terms of production area and volume of production in 1985 (Table 1). From 105,884 ha in 1975, the area expanded to 256, 134 ha in 1985. The total production of chilli in 1985 was about 511,043 tons.

Beans rank second among major vegetables in terms of harvested area. In 1975 the area planted to beans covered 157,767 ha, which increased to 251,905 ha in 1985. Production which totalled 254,355 tons in 1975 increased to 368,410 tons in 1985.

Shallot is the third most important vegetable in Indonesia. Area planted to shallot increased significantly from 38,956 ha in 1975 to 76,897 ha in 1985. The volume of production increased from 136,045 tons in 1975 to 379,837 tons in 1985. Current productivity level is at 4.94 t/ha, a significant increase from 3.49 t/ha level in 1975. Production area is concentrated in the northern part of Central Java Province.

Cabbage is another important vegetable. Area devoted to this crop was highest in 1985, at 35,772 ha. Total production was highest in 1985, amounting to 520,457 tons, with a productivity level of 14.55 t/ha compared to 10.72 t/ha in 1975.

Potato is one of the major vegetables. In terms of hectarage potato area increased from 17,501 ha in 1975 to 29,360 ha in 1985. Production also increased form 123,875 tons in 1975 to 283,318 tons in 1985. The productivity level increased from 7.08 t/ha in 1975 to 9. 65 t/ha in 1985.

Tomato which is a major vegetable covered an area of 47,796 ha in 1985, compared to

Table 1 Harvested area and production of vegetables in 1975, 1982 and 1985

Commodity	Harvested area (ha)			Production (t)		
	1975	1982	1985	1975	1982	1985
Vegetables						
Potato	17,501	20,996	29,360	123,875	164,801	283,318
Cabbage	23,968	28,920	35,772	257,027	317,118	520,457
Tomato	14,968	26,942	47,796	68,732	119,393	151,041
Chilli	105,884	138,356	256,134	251,976	175,092	511,043
Beans	157,767	168,442	251,905	254,355	163,110	368,410
Shallot	38,956	47,249	76,897	136,045	159,379	379,837
Garlic	4,178	4,748	12,451	11,788	13,801	59,220
Others	167,665	198,466	333,283	895,265	850,693	1,245,995
Total	530,792	634,009	1,043,598	1,889,063	1,963,387	3,519,321
Index	100	120	194	100	104	186

Source : Directorate of Horticulture (1986).

14,968 ha in 1975. Production also increased from 68,732 tons in 1975 to 151,041 tons in 1985. The productivity level decreased from 4.59 t/ha in 1975 to 3.16 t/ha in 1985. The decrease was partly due to the increase in the area planted to tomato in the lowlands.

Garlic is an important major vegetable. The area under garlic increased significantly from 4.178 ha in 1978 to 12,451 ha in 1985. The production also increased from 11.788 tons in 1975 to 59.220 tons in 1985. The productivity level increased from 2.82 t/ha in 1975 to 4. 76 t/ha in 1985.

Collectively the other minor vegetables which reached a production level of 1,245,995 tons in 1985 include lowland vegetables : amaranthus, eggplant, yard long bean, kang-kung, and highland vegetables : carrots, cucumbers, radish.

Constraints on vegetable production

During the last ten years, although efforts to increase the production of vegetables have given significant results the increase in the demand could not be fulfilled. To promote the intensification of vegetable production, several constraints were identified, including seed quality, pests and diseases, weeds, soil conditions, crop nutrition and environmental conditions.

1 Seed quality. It was estimated, that only about 5% of the total area of commercial vegetables was planted with improved high-yielding varieties. The remaining 95% of the area was planted with low-yielding varieties. High-yielding varieties of vegetables are mostly hybrids, which can not be produced in the country and should be imported. Therefore the price is relatively high. Small farmers prefer to purchase cheaper low-yielding local varieties. The absence of a professional seed industry does not enable to improve the quality of vegetable seeds produced by local farmers which remains inferior to that of imported seeds.

2 Pests and diseases in vegetable crops are other principal factors limiting the productivity of vegetables. The present emphasis on the control of pests and diseases in commercial vegetables relies on excessive chemical control. The development of new biotypes or strains of pathogens further stimulates farmers to use a larger amount of pesticides more frequently, resulting in the pollution of the produce and the environment by pesticide residues.

Vegetables grown in upland areas are exposed to weed competition which causes a significant loss of crop yield.

3 The physical properties of the soils are an important factor for the water economy and nutrient uptake. Vegetables grown on steep slopes cause soil erosion. The soil structure, pH, drainage and aeration in the highlands and in the lowlands vary greatly. To boost yield, farmers often use an excessive amount of fertilizers, especially urea which may induce the incidence of pests and diseases.

4 In the production centers of vegetables, the climate is hot and humid in the lowlands, and warm or cool and humid in the highlands. The imported high-yielding varieties are suited to highland areas. In the lowlands, farmers grow low-yielding varieties. In areas with a pronounced dry season, vegetables are often irrigated, if the water supply is sufficient, and grown on a year round basis. This condition stimulates the continuous reproduction of pathogens.

5 As vegetables are generally perishable products, post-harvest losses are significant. The lack of post-harvest technology adoption for specific produce prevents the decrease in crop losses and improvement of quality. Inferior infrastructure, e.g. roads, increases the transportation cost of vegetables to the market, and causes higher crop losses.

Improved production technology

The Lembang Research Institute for Horticulture was designated as the national

Table 2 Farmers' yield and research plot yield of vegetables

Commodity	Yield (t/ha) in 1985	
	Farmer	Research plot
Vegetables		
Potato	9.6	35.0
Garlic	4.7	8.0
Shallot	4.9	10.0
Tomato	3.2	25.0
Red pepper	2.0	6.0
Cabbage	14.5	30.0

Source : DFC (1986).

Table 3 List of recommended varieties of vegetables

Commodity	Variety and characteristics
Potato	1 Cipanas, yield 25 t/ha, tolerant to leaf blight (*Phytophtora infestans*) and susceptible to bacterial wilt (*Pseudomonas solanacearum*).
	2 Cosima, yield 29 t/ha tolerant to leaf blight, susceptible to bacterial wilt.
Tomato	1 Intan, 130 days, yield 13 t/ha, tolerant to bacterial wilt, susceptible to leaf blight, lowland/highlands.
	2 Ratna, 130 days, yield 12 t/ha tolerant to bacterial wilt, susceptible to leaf blight, lowlands/highlands.
	3 Berlian, 130 days, yield 13 t/ha, tolerant to bacterial wilt, susceptible to leaf blight, lowlands/highlands.
Shallot	1 Bima Brebes, 60 days, 10 t/ha, tolerant to rot (*Botrytis alii*), susceptible to leaf tip rot *Phytophtora pari* ; lowlands.
	2 Medan, 70 days, 7.5 t/ha, tolerant to rot, susceptible to leaf tip rot, lowlands, high lands.
Garlic	1 Lumbu hijau, 10 t/ha, 120 days, highlands.
	2 Lumbu kuning, 8 t/ha, 110 days, mid-lowlands.
	3 Lumbu putih, 5 t/ha, 100 days, lowlands.
Cabbage	1 Gloria ocena, 30 t/ha.
	2 KK cross, 20 t/ha lowlands.
	3 KY cross, 20 t/ha lowlands.
Beans	1 Hawaian Wonder, climbing, snap beans, 20 t/ha, highlands.
	2 Surakarta, climbing, highlands, snap beans, 15 t/ha.
Chilli	1 Keriting 5 t/ha tolerant to Alternaria, Podospora, highlands, lowlands.
	2 Plumpung, 7 t/ha, highlands, lowlands.
	3 Prisen, 71 t/ha, highlands, lowlands.

research institute for both vegetable crops and ornamentals. The Institute concentrates its research efforts on 6 priority vegetables : Irish potato, tomato, cabbage, beans, garlic and pepper.

Generally the average yield of vegetables is low. Table 2 indicates the difference between average national crop yield and research crop yields. Vegetable yield could be significantly increased depending on the amount of research and development work invested.

High-yielding improved varieties of vegetables have been developed including : potato, tomato, shallot, garlic cabbage, Chinese cabbage, amaranthus and kangkung. The varieties and characteristics are presented in Table 3.

A significant part of seed potato, new technology to produce virus-free seed potato has been developed and adopted by seed producers, using meristem culture and rapid multiplication techniques. To improve the storage of seed potato, potato storage using diffuse light system has been introduced and adopted by potato growers. To expand potato areas the development of technology packages for growing potato in the mid-elevation zone (300-700 m above sea level), is estimated at about 250,000 ha. Farmers are now able to grow potato after harvesting rice in the rice fields. Potato intercropped with sugarcane yielded 20-30 tons of potato/ha in addition to the sugar produced.

Efforts have been made to reduce the excessive use of pesticides. Technology has been developed for implementing integrated pest control for *Plutella xylostella* attacking cabbage. Biological control by using the parasite *Diadegma eucerophage* has been introduced. Intercropping of cabbage with corn or tomato was also able to reduce the population of the larvae of *Plutella*. If considered necessary, pesticide containing *Bacillus thuringiensis* could be used selectively.

Improved varieties of tomato which were found to be high-yielding and tolerant to bacterial wilt have been developed and adopted in the mid-lowland areas.

Two varieties of garlic have been developed and adopted which can produce 10-13 t/ha, compared to the average national yield of 5.2 t/ha.

Four varieties of shallots with a yield potential of 7-11 t/ha, compared to the national average yield of 5.1 t/ha have also been released.

Agronomic packages for red pepper increased the production significantly in the range of 37.0~84.2%.

The use of a package of trace elements, i.e. Fe, Mn, Bo and Na increased the yield of garlic by 30%, equivalent to about 2.5 t/ha.

Research and development to achieve stability of production

During the Fourth Five Year Plan, 1984-1989, agricultural development aimed at stabilizing rice production to increase farmers' income, to improve the nutritional level of the people, to increase employment opportunities, to increase export earnings and reduce the import of agricultural commodities, to support industries, to optimize the productive utilization of natural resources while protecting environmental quality and stimulating harmonious rural development.

To meet these objectives, vegetable crops play a very important role not only as a source of food with high nutritional value but also in promoting agricultural industries, minimizing import, increasing farmers' income and creating job opportunities.

Research has been concentrated on priority crops like : shallot, garlic, red pepper, beans, tomato, potato and crucifers. More emphasis has been placed on yield increase and production of lowland vegetables with a high economic value like shallot and red pepper. Research has also aimed at expanding the adaptation potential of highland vegetables to lowland areas, like garlic and potatoes. Table 4 gives a classification of vegetable cultivation depending on the altitude.

The expansion of the production centers of vegetables to lowland areas could limit

Table 4 Classification of vegetables by altitude

	Lowlands 0-200m	Mid/Low 200-450m	Mid/High 450-700m	Highlands 700-up
Kangkung	79%	12%	7%	2%
Amaranth	72%	16%	7%	5%
Eggplants	70%	15%	8%	7%
Cucumbers	72%	14%	8%	6%
Yard long beans	69%	18%	8%	5%
Hot peppers	69%	10%	11%	10%
Shallots	71%	6%	10%	13%
Chayote, luffa, etc.	47%	11%	9%	33%
Red beans	43%	7%	12%	38%
Tomatoes	28%	15%	24%	33%
Snap beans	8%	17%	24%	51%
Japanese radish	23%	8%	9%	60%
Chinese cabbage	16%	7%	19%	58%
Japanese boncing onions	4%	13%	22%	61%
Garlic	3%	4%	25%	67%
Cabbage	2%	4%	14%	80%
Potatoes	0%	5%	13%	82%
Carrots	0%	3%	5%	92%

the danger of erosion in the highlands and bring the produce closer to the market and consumption centers, resulting in a more efficient marketing system and increase of farmers' income. Development of vegetables in lowland areas could also promote crop diversification in order to reduce the loss caused by pests and diseases.

Research in the highlands is directed toward the improvement of varieties of vegetables for highland and lowland areas, seed production technology and environmental quality. Research on varietal improvement is concentrated on the development of varieties for industrial use, and varieties which can produce seeds in the country, like cabbage, to reduce seed import. Research is also aimed at producing botanical seeds of cabbage and shallot, which can produce seed only in the highlands and at using seeds instead of bulbs as planting materials of potato and shallot.

Research on agronomy aims at developing a technology for highland vegetable cultivation, which can limit erosion.

Emphasis has been placed on the reduction of pollution associated with the excessive use of pesticides by promoting research on the efficient and effective use of pesticides and technology for Integrated Pest Management of vegetables.

To promote the export of vegetables, research is also directed to the reduction of post-harvest loss and increase of the quality of the produce. More efforts have been made to intensify research on handling of fresh vegetables.

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