DEVELOPING SUSTAINABLE HORTICULTURAL PRODUCTION SYSTEMS FOR SOCIOECONOMIC AND NUTRITIONAL DEVELOPMENT IN ASIA

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Contents

Summary

The stage is set for rapid expansion of vegetable production in Asia, which is currently insufficient to meet per capita requirements. The forces for expansion emerge both from the rapid growth of Asian economies and from within the agriculture sector. Increased income, population growth, and fast urbanization have created additional demand for vegetables. On the other hand, the need to diversify production, make cereal-based systems sustainable, and improve water use efficiency are factors that have generated additional opportunities for vegetable cultivation to expand. These forces are reinforced by consumer demand for a diversified diet.

Both production- and trade-oriented strategies should be used to overcome shortage and seasonality in vegetable supplies. Production-oriented strategies should focus on developing high yielding and stress tolerant varieties and management technologies, so that more farmers can produce more vegetables at lower per-unit cost while maintaining

long-term resource productivity. Although many technologies are available to ameliorate stresses and reduce production risks, they are expensive, can be environmentally unfriendly, and adoption is limited. Making these technologies economically viable and more environmentally friendly for a wider range of environments is a continuing challenge to vegetable researchers. The international and national vegetable research and development partners, including private seed companies and NGOs, are playing a critical role in overcoming vegetable constraints and lowering the cost of vegetable technologies, especially for the hot-wet tropics. Important technological breakthroughs have been achieved in major vegetable crops, and in developing low-cost technologies. These technologies are being tested at different sites in collaboration with NARS.

Trade-oriented strategies should promote national and international trade in vegetables, taking advantage of higher production and lower costs in favorable growing areas. The success of such strategies are most likely for long- and medium-storage-life crops, and would require a sufficiently developed marketing system to allow cheap and rapid transport of vegetables with minimal storage losses. Such a strategy should look more towards favorable regions within the country, as importation is relatively more expensive for the developing economies. For this purpose, favorable vegetable growing regions need to be identified and trade should be promoted with these regions. However, trade oriented policies are successful only in the case of those vegetables having less localized preferences.

Successful production of sufficient, good quality vegetables leads to good health, more jobs, diversified and higher incomes for producers, and long-term sustainability of the agricultural resource base. With current vegetable production technologies, the area under production for vegetables in South and Southeast Asia needs to be tripled to make per capita vegetable availability equal to that in East Asia. This expansion would require 14 million additional hectares for vegetable cultivation. Assuming this area comes from cereals, and each hectare creates a minimum of one year-round job when such substitution is made, this would generate an additional 14 million jobs. At current yields, this implies additional vegetable output of 128 million t. An additional 14 million jobs would be expected in post-harvest handling of this output. With the present average value of vegetables at US$300 per t, this would generate an additional income of US$37 billion for poor Asia farmers. About the same income is expected to be generated for brokers.

To achieve all these, however, some minimum level of farmers' education, field-market linking infrastructure, and favorable government policies to encourage and stabilize vegetable production are required. Under this scenario, technological innovation can act as a catalyst to expand vegetable production. The enhanced management capability of vegetable-growing farmers would then enable them to actively participate in the economic development process of the whole economy.

1. Introduction

The first round of the Green Revolution in the 1970s and 1980s in Asia focused on cereals and neglected other food crops, such as legumes and vegetables, which had traditionally been an integral part of the cereal-based system. Farmers dropped legumes and vegetables out of crop rotations in favor of continuous cereal production. The sustainability of the continuous cereal cropping system is in question in light of the reduced soil fertility and build-up of the insect-pest complex in these systems. Growing evidence points to slowed productivity growth and increasing degradation of the resource base of these systems. While advances in cereal production have supplied ample carbohydrate, micronutrient deficiency has surfaced more prominently as a result of the neglect of micronutrient rich foods.

There is a relationship between horticultural production and overall socioeconomic development. Horticulture encourages agricultural business development in the rural economy, and generates employment and income. Growers learn to manage multiple cropping systems and deliver quality outputs on time by fulfilling contractual arrangements and dealing with sophisticated marketing systems. The management skills needed for successful horticulture are the very skills required for socioeconomic development to take off. These skills enable farmers to run other kinds of businesses. Horticultural production improves availability of micronutrient rich foods. Consumption of sufficient micronutrients improves health, learning capability, and working capacity of the population. All these factors enhance working efficiency, thus facilitate and stimulate socioeconomic development (Figure 1).

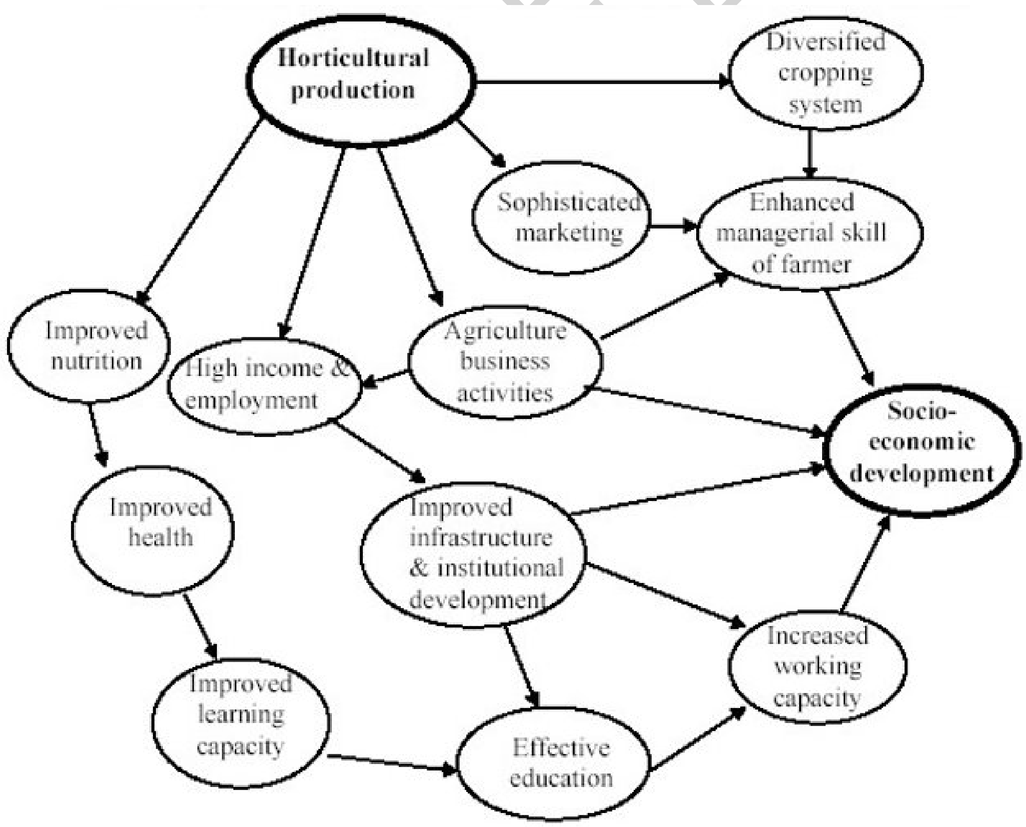

Figure 1. Horticultural production and socioeconomic development

This paper explores possibilities, constraints, achievements, and recent trends in developing vegetable-based cropping systems to induce socioeconomic development and enhance nutritional well-being in developing countries. Due to the access of the author to the relevant data, the focus of this paper is mainly Asia, but many of the conclusions arrived at here are also relevant to other regions of the world. Current vegetable status, general problems and constraints in vegetable supply, vegetable groups and ecoregions are explained in the next section. Section 3 defines vegetable cropping systems according to different criteria. The possibilities for and limitations on diversification of the existing cropping systems with vegetables are discussed in Section 4. The roles of national and international research in mitigating constraints on the development of horticultural systems are defined in Section 5. Section 6 provides some examples of successful horticultural systems developed for income and nutritional well-being.

2. General Information

2.1. Current Status of Vegetables in Asia

Vegetables are rich in vitamins, protein, and minerals, especially iron and calcium. They are the most economically efficient source of micronutrients, considering both per unit land required and per unit production cost. In Taiwan, for example, Chinese cabbage, onion, cabbage, tomato, and sweet pepper produce respectively 13, 3, 3, 3, and 2 times more iron than do cereals per unit land per production day. Similarly, Chinese cabbage, cabbage, sweet pepper, mung bean sprouts, and tomato are respectively 11.4, 3.8, 3.1, 4.8, and 2.8 times more cost-efficient than chicken in supplying iron. The nutritive efficiency, defined as nutritive value divided by market price, is also far higher in vegetables compared to other food items (Table 1).

Despite the nutritive advantages of vegetables, per capita vegetable consumption in many developing economies is far below the recommended level in terms of required micronutrients (Figure 2). The increase in real vegetable prices observed during the 1970s and 1990s in most developing countries of Asia (Figure 3) raises serious concerns about the future increase in vegetable consumption. Increase in real vegetable prices, however, did not induce production enough to make significant improvements in per capita consumption, due to serious constraints on vegetable production.

Food group	Bangladesh		Philippines		South Vietnam	
	Nutritive value (US$/100g)	Nutritive efficiency (ratio)	Nutritive value (US$/100g)	Nutritive efficiency (ratio)	Nutritive value (US$/100g)	Nutritive efficiency (ratio)
Cereals	0.030	1.07	0.078	1.64	0.044	1.25
Meat	0.106	0.71	0.161	0.72	0.097	0.52
Seafood	0.058	0.45	0.066	0.39	0.059	0.64
Vegetables and pulses	0.036	2.57	0.067	1.42	0.039	2.38

Fruit	0.022	0.58	0.022	0.45	0.023	0.54
Eggs & milk	0.034	0.55	0.171	1.02	0.069	0.66
Others (sugar, oil, etc.)	0.138	2.09	0.096	0.53	0.078	1.58
Whole diet	0.040	1.05	0.081	1.01	0.047	1.02

[1] Nutritive value is defined as the dollar value of all nutrients present in a commodity evaluated at the respective average nutrient cost of each nutrient divided by the number of nutrients considered. The average nutrient cost of each individual nutrient was estimated as total expenditure on all commodities containing a particular nutrient divided by the amount of nutrient supplied from all these commodities. These values were estimated from the household consumption survey data collected by the Socioeconomic Unit of Asian Vegetable Research and Development Center (AVRDC).

Table 1. Nutritive efficiency of major food groups in selected countries in Asia

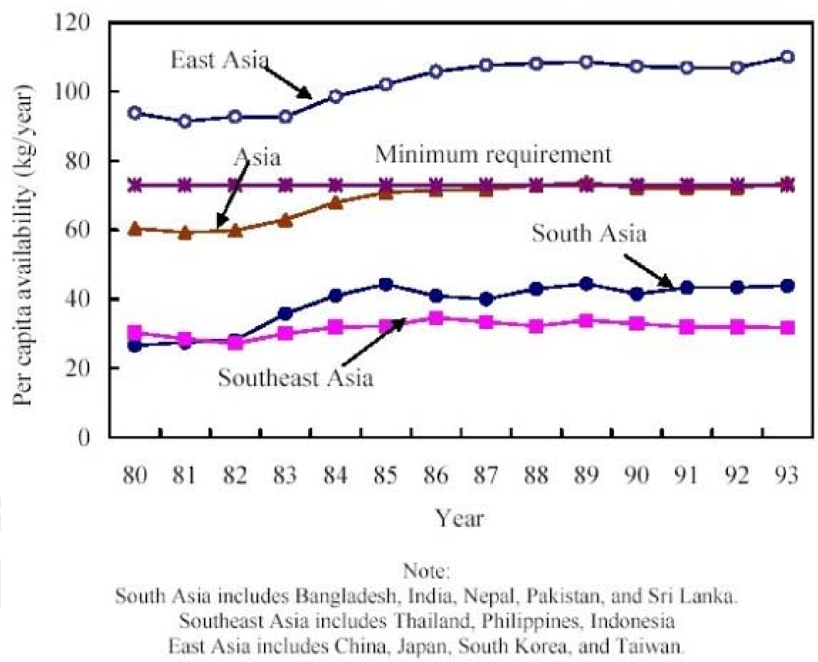

Figure 2. Per capital vegetable availability in Asia

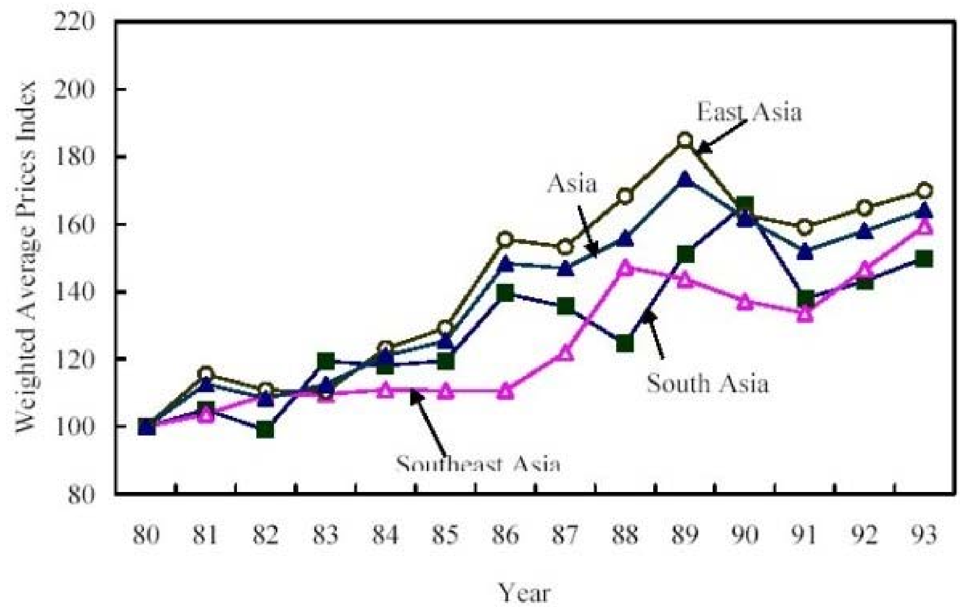

Figure 3. Deflated average vegetable prices in Asia during 1980-93

2.2. Problems in Vegetable Production

2.2.1. Irregular Supply

Annual supply of vegetables is quite irregular as reflected in the coefficient of variation for individual as well as total vegetable area, production, and yield compared with rice, a dominant crop in Asia. Vegetables, even as a group, have higher yearly variations than cereals. Therefore, efforts should focus on stabilizing vegetable production through yield stabilizing technologies, such as stress tolerant varieties and protected cultivation, and government policies, such as ensured vegetable prices.

2.2.2. Seasonal Supply

Vegetable production not only varies from year to year, but also from season to season. Taken as a group, vegetables show seasonality, both in price and availability. In the tropics, high temperatures and humidity, frequent and intensive flooding, and poor field drainage reduce yield and vegetable supplies during the wet summer. However, this pattern does not prevail everywhere. In temperate areas of China, Japan, and Korea, and in northern Pakistan and India, supplies in winter are reduced because of frost and cold temperatures.

It was thought that the short supply of vegetables is compensated by an abundant supply of fruits, another cheap source of micronutrients. This is not true. In Taiwan, for example, vegetables and fruits are both in short supply in September–October, and their prices are high (Figure 4). A similar situation occurs in Indonesia and Nepal.

The income-induced demand is expected to concentrate more during the off-season, as vegetables are relatively abundant during the peak supply period. However, enhancing vegetable production during the summer months is more difficult than during the winter months. This, combined with the fact that most Asian cities are located in the lowland tropics, creates a high demand for summer production technologies.

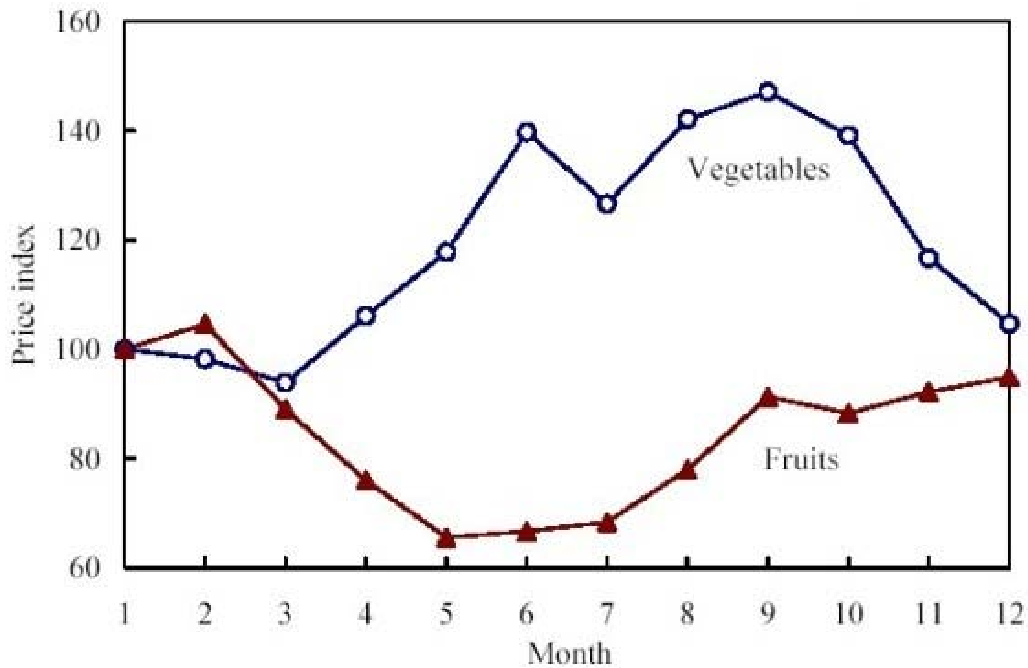

Figure 4. Seasonality in fruit and vegetable prices in Taiwan, average of 1974-92

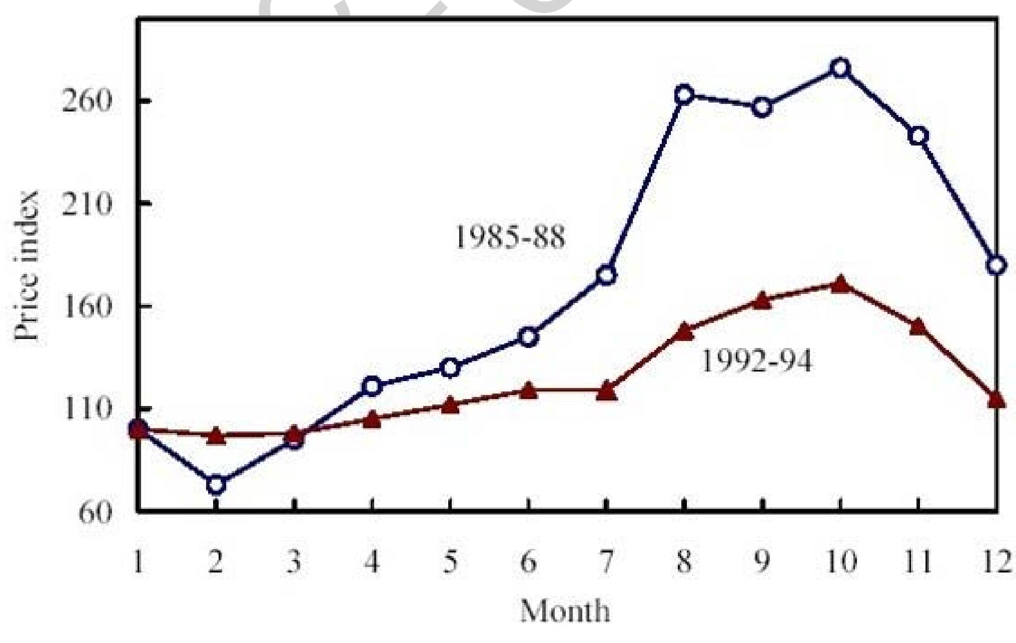

Figure 5. Reduction in seasonal tomato prices at the retail level in Taiwan

Most Asian countries have, however, highland areas where environmental conditions are favorable for vegetable cultivation when it is very hot and humid in the lowlands. For example, summer vegetable supply for Bangkok mainly comes from Chiang Mai, for Manila from Baguio, and for Kuala Lumpur from the Cameron Highlands. Maintaining good trade and transportation links with these areas within a country can reduce seasonality. Despite recent increases in supply from these areas, such sites can meet only a small proportion of the total potential summer-vegetable demand, and seasonality in vegetable supply remains a big issue.

The introduction of modern vegetable technologies along with government policy support for summer vegetable production has proven to be a sustainable way to reduce seasonality. In Taiwan, for example, introduction of summer tomato varieties from the Asian Vegetable Research and Development Center (AVRDC) has reduced seasonality in prices, especially during the summer months of August–November (Figure 5).

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Biographical Sketch

Dr. Mubarik Ali was born in Faisalabad, Pakistan in 1952. He is married and has three children. He earned his M.Sc. and Ph.D. degrees in agricultural economics from the University of the Philippines, Los Baneos in 1982 and 1986, respectively.

He has been with the Asian Vegetable Research and Development Center since 1994 as the head of the Socioeconomic and Nutrition project, and the Socioeconomic Unit. His main responsibilities are to characterize vegetable based farming and marketing systems, conduct ex-ante and ex-post evaluation of AVRDC technologies and government policies for economic viability, poverty alleviation, and sustainability; advise governments and AVRDC on rational economic and research policies to enhance vegetable production and consumption throughout the year; develop and participate in development projects to eradicate poverty through vegetables; and to set up a regional data base on vegetable production, marketing, and consumption.

Before joining AVRDC, Dr. Ali worked with International Rice Research Institutes as a Visiting Scientist during 1991 to 1993. His main responsibilities were to evaluate the interface between macro-economic policies and technologies that affect sustainability of the rice-wheat system, and to evaluate policies and other factors affecting innovation and adoption of biofertilizer technologies.

After completing his studies, Dr. Ali worked in USAID projects, Islamabad. There, his duties were to develop models to understand the inter-linkages in the performance of different food and fiber sub-sectors and to evaluate policy alternatives for the efficient performance of these sub-sectors.

The main professional interests of Dr. Ali are the quantification of the ex-ante and ex-post impact of agricultural technologies; analyzing the production and marketing constraints; specifying the cropping, farming, and marketing systems and consumption patterns; analyzing the role of human nutrients in health and economic development; and looking the inter-linkages of various sectors of the economy.

Dr. Ali has published 27 papers in international journals, one book, and 30 in-house reports and seminar papers. He has traveled extensively in South and Southeast Asia, Africa, and Europe, which has given him flexibility to adjust to cross culture environments.