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Diversification and Commercialization of Upland Agriculture: The Malaysian Experience

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Introduction

The relative importance of agriculture in the Malaysian national economy has declined as a result of diversification and industrialization of the economy. The share of agriculture in GDP, employment and exports has gradually declined and since 1984 the manufacturing sector has overtaken agriculture as the main engine of growth. With the changing structure of the economy, agriculture needs to be viewed in a different perspective. Subsequently the debate on the future desired position of the agriculture sector becomes more urgent with the shift in national policy. Malaysia has recently declared its vision of becoming a fully developed nation by the year 2020. Realizing this vision involves a doubling of real GDP every ten years over the next three decades and a balanced growth in all sectors of the economy. Within this context, accelerated efforts are needed to ensure a reasonably balanced rate of growth in agriculture in relation to other sectors of the economy.

The future performance of the Malaysian agriculture sector will continuously be influenced by the direction of the global economy and the national economy, as well as by the ability to comprehend the issues and challenges facing the agriculture sector itself. Among these challenges, that of technological advancement appears to be the most prominent. In the Malaysian context technological development must be directed towards labour saving, land augmenting, and environmental friendly. With the shrinkage in land available for agriculture due to urbanization and industrialization, greater competition across sectors for other resources including labour and capital, and greater concern for preserving the environment, different strategies to enhance agriculture development are needed. Agriculture on the highlands offers one of several alternatives which address these issues and could help to improve the overall performance of the agriculture sector.

The major objectives of this paper are to review the past performance of highland agriculture in Malaysia and to examine prospects for diversification and commercialization. These two aspects are discussed within the context of sustainable agricultural development.

Upland agriculture in Malaysia: status and recent development

A large part of the mountainous steep lands in Malaysia is kept under forest. However in Peninsular Malaysia about 5,000 hectares of steep mountainous land in the Cameron Highlands have

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been developed for tea, temperate vegetables, floriculture, and fruits. In East Malaysia, cocoa and pepper are planted on steep lands. Another land use type in steep areas is shifting cultivation, mainly found in East Malaysia. In Sarawak this amounts to about 2.7 million ha of which 0.1 million ha are cleared annually for the cultivation of hill rice and other food crops. The other East Malaysian state, Sabah, is dominated by a landscape of hilly and steep land which accounts for over 60% of its total area. The vegetable growing area of Kundasang has a landscape characterized by steep slopes. Primary jungle is being replaced through clearing operations and vegetable production on steep land is gaining popularity.

The district of Cameron Highlands is Malaysia's oldest and single most important area involved in upland agriculture. Extending over an area of 71,255 hectares, about 86% of the district is covered with forest. The terrain of the area is mountainous and highly dissected with slopes varying from 10 to 35 degrees and pockets of broad mountain valley. Soils have been derived from disintegration of granite and are acidic and dark-colored. Their texture ranges from gravel to rich sandy loam. The climate of the Cameron Highlands from 900 meters above sea level is suitable for a wide range of subtropical and temperate crops with low chilling requirements. The temperature ranges from 14 to 24°C, with two indistinct dry seasons, and average monthly rainfall ranges from 104 to 317 mm. The annual rainfall exceeds $_2$,000 mm causing severe erosion on uncovered hill slopes and high pestilence on crops.

Since the Cameron Highlands is the major location for highland agriculture, the discussion will be confined to this area. The major commodities cultivated and the methods of operating agriculture on the highland are discussed below.

Tea

Tea, as a plantation crop, occupies the largest area under cultivation in the Cameron Highlands (Table 1). The crop is being managed by large private companies, but there are also small-holders producing green tea leaves. However the area under tea cultivation has declined and is being replaced by vegetables and floriculture. As far as soil conservation is concerned, the tea cultivators have taken adequate measures to reduce erosion compared to producers of other crops.

Table 1 Crops grown in the Cameron Highlands.

Crop	Area (hectares)
Tea	2,500
Vegetables	2,140
Flowers	300
Fruits	253
Others	63
Total	5,256

Source; Ko et al., MARDI, 1987.

Vegetables

Vegetable cultivation constitutes the most important economic activity, occupying 2,140 hectares, and provides a major source of income to 1,580 families. In opening up new areas for vegetable cultivation, farmers use tractors to level the steep terrain and the top soil removed is used to fill up other areas. In areas where the terrain is steep, terraces are constructed with the width varying according to the gradient of the slope. Except for the use of sandbags in some areas, the farmers are less concerned about soil conservation.

Twenty-five types of vegetables are being cultivated, the five most popular being cabbage, Chinese cabbage, lettuce, tomato, and sweet pea. Intercropping is widely practiced. The main crops are tomatoes and sweet peas which are intercropped with other vegetables such as cabbage, Chinese cabbage, coriander, celery, and lettuce. The vegetables are sold to wholesalers, packed in bamboo baskets and transported to major towns in Peninsular Malaysia and Singapore. Daily production amounts to 440 tons with an annual revenue of about M$ 30 million.

Floriculture

The floriculture industry in the Cameron Highlands is fast expanding with most farms located on the lower reaches of hills or on terraced hill sides. Currently there are more than 40 nurseries covering an area of 300 hectares. Most of the flower growers were formerly vegetable farmers who switched to floriculture due to the volatile prices of vegetables compared to the relatively stable prices for cut flowers. Due to scarcity of flat lands, steep land has to be used for flower production. Most growers flatten the land by

Editorial

Upland Agriculture in Asia

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More than half of the 420 million hectares of arable land of Asia are situated in upland areas. Due to increasing pressure on the limited available cultivated land, the region's agriculture has been expanding for decades into marginal uplands which are often located in remote areas and in physically fragile conditions. There, the transportation and communication infrastructure has not been developed, productivity is low and the choice of crops and activities is limited. Degradation of natural resources, especially soil loss due to erosion, continues at an alarming rate. The result is a higher incidence of rural poverty in uplands than in other agricultural areas.

However, opportunities for development of upland agriculture are emerging. Demand for many upland crops, which have traditionally been grown for subsistence purposes, is now increasing for livestock and poultry feeds, processed foods and industrial materials. New crops and activities have even greater potential as demand increases for high quality vegetables, fruits, and even flowers which are suitable for the physical conditions of uplands. With improvement of infrastructure and other public investments, upland farmers could exploit these new markets by diversifying production and activities. Upland agriculture, which has been largely neglected and bypassed by the mainstream of development, has recently been attracting attention.

In Asia, rice has been for centuries the mainstay of farmers and the staple food of the population. Rice is grown in lowlands, whether irrigated or rainfed, while those crops grown in uplands where rice cannot be cropped are regarded as being of secondary importance. Upland crops, compared to rice, are called secondary crops, subsidiary crops or palawija, depending upon the country or region.

The CGPRT Centre is mandated to address challenging issues and problems of farmers producing upland crops. Against this background, the Centre organized a seminar "Upland Agriculture in Asia" in Bogor, Indonesia last April. At the meeting, participants from member countries together with outside experts discussed the situations, problems and future prospects of upland agriculture in Asia. This edition of ***Palawija News*** contains two papers presented at the seminar. It is hoped that these articles are not only useful for our readers but also underscore the new direction of the Centre's activities.

leveling the steep terrain using heavy machinery. Plastic covers are used extensively to improve the quality of flowers produced. Irrigation and lighting systems are also constructed. The popular flowers grown include chrysanthemum, carnation, roses, statice, gypsophila, aster, golden rod, and anthurium. Average daily production amounts to 240,000 stalks of which about 70% are exported.

Fruits

Fruits, with an area of only 250 hectares, have not been planted on a large scale. This is mainly due to the land tenure system which does not favor the planting of perennial crops, and the lack of technology for the extensive range of fruit choices. Among the fruit trees, citrus is the most popular and it is planted on platforms on hillsides varying from 10 to 35 degrees. Where terraces are constructed on the steep slopes, short term crops are initially planted.

The data on areas planted to each crop, while not detailed, lend support to the reported recent expansion of the floriculture industry in the Cameron Highlands and the trend during the 1980s toward somewhat greater crop diversification.

Sustainable agriculture development

Concept, philosophies, and courses of action

The quest for greater socio-economic prosperity has led to the exploitation of natural resources of the planet Earth. The degree of exploitation is invariably greater in developing countries where there is a strong urge to catch up with the industrialized nations by speeding up the process of development. In the extreme cases in Asia and Africa the rural poor largely depend on agriculture and therefore on the environment for their income and livelihood. As a result, environmental problems are inextricably linked with the problems of growing populations. Exploitation occurs in various forms and dimensions but the sequence of events in badly affected areas is almost similar - the growing population forces a gradual decline in farm size, consequently shrinking the opportunities to increase income. As productivity declines, the land loses its ability to sustain a growing population, and pressure on marginal areas and highlands, increases.

Sustainable development is a broad, multi-faceted concept with no universally accepted definition. In general, however, sustainable development concerns philosophies and courses of action to help ensure the long term environmental, eco-

nomic, and institutional "staying power" of various geographical entities in the world. Sustainable development, applied to agriculture, is essentially the inter-temporal distribution of resources and needs of current versus future generations. To be more specific, sustainable agriculture development involves the substitution of "natural on-farm produced resources" for purchased synthetic fertilizers and agricultural chemicals. The concept of "natural on-farm produced resources" includes (1) integrated pest management practices for biological control of insects; (2) crop rotations, intercropping, and relay cropping to enhance soil fertility, weed control, and maximize use of space and time; (3) livestock wastes, crop residues, and green manures to enhance soil fertility; (4) nitrogen collected from the air and recycled through nitrogen-fixing legumes; (5) minerals released from soil reserves and recycled; (6) water available to crops through enhanced soil moisture retention; (7) selected varieties that are resistant/tolerant to insects and diseases; (8) modified planting dates and other cultural practices; and (9) prudent farm family management.

The sustainable development worldview acknowledges that future generations must be given their shares of economic riches and a sufficiently clean environment as opposed to the traditional scientific worldview which professes only the needs of current generations. Nevertheless, the level of motivation of farmers to follow sustainable practices varies throughout the world agriculture community. These include the desires to (1) be good stewards of natural resources; (2) minimize ecological stress and strains; (3) make the most effective use of fertilizers and chemicals, water resources and the farm's resources; (4) reduce dependence on fossil fuel energy resources; (5) reduce harmful effects of chemicals on the health of farm workers, livestock and consumers; (6) reduce soil erosion; (7) reduce production, prices and income risks; and (8) improve product quality, appearance, and taste.

The philosophies, concepts, and courses of action for sustainable agricultural development, as narrated above, have to some extent been internalized in the development of highland agriculture in Malaysia. In the process of diversification and commercialization of upland agriculture, various efforts towards sustainability had been undertaken, either through government enforcement, private sector initiatives or international development agencies. The salient features of the efforts made and their degrees of effectiveness are discussed below.

Efforts toward sustainability

Despite consistent attempts to adapt temperate vegetables to lowland tropical climates, a substantial proportion of vegetables consumed in tropical countries is produced under more favorable climates in their highlands (e.g. Bandung in Java, Baguio in Luzon, Nuwara Eliya in Sri Lanka, Dalat in Viet Nam, Cameron Highlands in Malaysia). Vegetable production in these areas is highly lucrative and it is unlikely that a shift towards lowland vegetable production will deter highland farmers from continuing with the production of vegetables. Indeed with the greater demand for high quality vegetables, new land areas (inevitably with steeper slopes than presently under cultivation) are being opened in all the above regions despite government restrictions to the contrary. The dissected land morphology of the highlands, often with cultivated slopes of up to 30 degrees, and intense rainfall (2,500-3,000 mm, largely confined to the rainy season), are conducive to serious soil erosion leading to loss of soil fertility, silting of irrigation and hydroelectricity dams, and at times causing landslides.

The Cameron Highlands of Malaysia are no exception, and starting in 1979 the World Bank funded a program to test various technical facets of soil conservation (e.g. terracing, counter slopes, ponds, dams, toe drains, sandbags, wood retainers, plant species to retain soil). This culminated in the establishment of an 8 acre demonstration farm, now managed by the Department of Agriculture. Limited acceptance of these cultural practices has taken place in the 2,000 hectares of vegetable production in the Cameron Highlands. However, if terracing does take place it is with wide terraces, 0.125-1 acre, cut into slopes, and not the narrow 1.0-2.0 m wide terraces advocated by the World Bank research program. After 7-10 years with the wide terraces all clay soil fractions have been eroded, and farmers simply scrape away the top 15-20 cm of soil to expose more soil below.

In 1991 the Asian Vegetable Research and Development Center (AVRDC) commenced research on soil erosion from vegetable areas in the Cameron Highlands of Malaysia in collaboration

with MARDI. The major objective of the study is to determine the extent of adoption of erosion control practices and critically assess the reasons why adoption has or has not taken place (e.g. lack of information on implementation, technical limitations, economic and institutional constraints, indifference to the problem). These will be related to the existing cropping system, soil type, slope, size of holding and land ownership, and history of cultivation. Where practiced, the short term costs of erosion control practices will be assessed, and compared with predicted long-term benefits to farmers, and water and hydroelectricity consumers. The socio-economic component of the project involves a combination of field survey of sample farms and modeling of vegetable production systems to determine those which are cost-effective in controlling erosion. A companion research project studies the incorporation of plant residues, introduction of green manures, relay cropping system, plastic roofing and hydroponic systems which all have potential to reduce erosion.

In 1992 two hundred and twenty-five vegetable farmers in the Cameron Highlands were interviewed for the AVRDC/MARDI study. Preliminary results indicate that farmers do not see soil erosion or fertility problems as being serious for their own properties, but that they are serious for the Cameron Highlands. The variability of vegetable prices, availability of labour, and weeds, pests and diseases were seen as the more important problems. Their observations that soil erosion on their properties was not serious were not generally supported by the enumerators' inspections. The majority of the farms are sited on slopes exceeding 20 degrees. A windscreen survey of the Cameron Highlands showed many farms with serious erosion, particularly those that had been recently developed, of which there were many. While erosion from urban development sites and tea plantations was also observed, its extent was quite limited in relation to that from vegetable farms.

As part of the Malaysian project, computer models will be used to help identify cost-effective methods for controlling erosion. SOILEC (SOIL conservation Economics) is a computer model that uses farm data to quantify the relationships between cropping systems, soil conservation and profitability. Users of the model may choose combinations of crop rotations, tillage methods, and mechanical control practices. The model will then simulate the soil loss and economic outcomes for each combination over a one year (short run) or up to fifty years (long run) planning horizon.

Prospects for diversification and commercialization

In Malaysia vast areas of the highlands have not been fully exploited for agriculture. In the Cameron Highlands alone about 20,000 hectares are still potentially available for cultivation. The government has also announced its intention of developing other highland areas in the country, along with the provision of infrastructural facilities. Obviously the successful development of highland agriculture would depend on diversification and commercialization.

In examining the prospects for diversification and commercialization of highland agriculture we are obviously confronted with very difficult choices. Should we do all and win little, or should we pick up market niches, select potential winners and reap larger benefits? If we adopt the latter strategy, what are the areas that should be emphasized? Based on the major macro-economic parameters, both domestic and global, as well as the prospects for technological advancement and other requirements (technical and economic feasibilities), we have selected three major growth subsectors for commercialization of upland agriculture in Malaysia - vegetables, floriculture, and fruits.

The vegetable industry

It was estimated that current production of vegetables is about 680,000 mt against the estimated demand of 830,000 mt. The domestic demand for vegetables is projected to grow at 3% annually while the export demand is predicted to grow at 3.3% annually reaching 134,000 mt by 1995. Given the projected volume of domestic production and domestic and export demand, the shortage of vegetables is likely to reach 250,000 mt with the total import bill reaching M$ 447 million by 1995. Imports of fresh and chilled vegetables increased from 90,000 mt valued at M$ 25 million (1970) to 296,400 mt valued at M$ 228 million (1990). Potatoes, garlic, and onions accounted for 54% of the total import value of vegetables in 1990. Table 2 shows the import values of potatoes, garlic, and onions during 1970-90. Currently it is neither technically feasible nor economically viable to

produce these vegetables under local conditions due to lack of suitable production technologies. Therefore production research on onions, garlic, potatoes, and shallots on the lowlands, but more so on the highlands, should be accorded high priority. Breakthroughs in technologies for this group of vegetables could potentially save M$ 175 million in foreign exchange earnings by 1995.

Table 2 The import values for potatoes, garlic, and onions, and as % of import value for vegetables, 1970-1990.

Year	Value of import ('000 M$)	% of total import value
1970	17,363	80.0
1972	19,718	83.6
1974	29,946	86.4
1976	38,479	64.7
1978	47,872	87.1
1980	63,566	81.6
1982	104,670	84.3
1984	98,043	75.4
1986	110,220	75.2
1988	153,540	56.1
1990	163,597	53.5

Source: Statistical Department, Kuala Lumpur.

The floriculture industry

The world production of flowers is projected to grow at 17% per annum during the 1991-2010 period, 94% of which are exported. With an expected value of M$ 30 billion in 2010, the expansion of the Malaysian floriculture industry should be seriously considered. The export value of Malaysian floriculture increased from M$ 4 million in 1980 to M$ 25 million in 1990 arising mainly from the growth in production of temperate flowers in the highlands. The area under floriculture in the Cameron Highlands jumped from 100 ha (1984) to 309 ha (1988) with chrysanthemum, roses and carnation being the major types of flowers produced. Production of roses is particularly attractive with the internal rates of return, net present value, and payback period of 19%, M$ 86,000, and 3.5 years, respectively (Table 3).

Table 3 Investment potential for floriculture.

	Internal Rate of Return	Payback Period
Chrysanthemum	>5%	1-2 yrs
Rose	>19%	3-4 yrs
Carnation	>50%	
Orchid	>50%	

Source: Noor Auni, MARDI, 1993.

The highland environment enables year round production of temperate flowers thus taking advantage of the peak demand for such flowers in the European markets during winter. Therefore the future performance of the floriculture industry would certainly be influenced by the orderly development and expansion of highland areas. Another aspect of the floriculture industry is flower preservation. Technologies have been developed for drying and preserving plant materials and flowers, both temperate and local.

The fruit industry

The Malaysian fruit industry is expected to grow at a phenomenal rate judging from the sharp increase in production and exports in recent years. The export value of fresh fruits alone jumped from M$ 83.5 million (1988) to M$ 147 million (1990). However these export figures refer to tropical fruits which are produced in the lowlands. Obviously the production of temperate fruits produced in the highlands would reduce the import bill of temperate fruits which increased from M$ 85 million in 1980 to M$ 204 million in 1991 (Table 4). Consequently our concern here is the prospect of producing temperate fruits on the highlands. Among the temperate fruits identified are persimmon, apple, and strawberry, besides the citrus which is already widely planted; their investment potentials are indicated in Tables 5-7.

Table 4 Imports of fresh temperate fruits, Malaysia, 1980-90.

Year	Quantity (mt)	Value ('000 M$)
1980	58,773	85,175
1982	64,039	117,735
1984	84,036	165,529
1986	76,168	159,039
1988	84,295	160,973
1990	110,727	204,200

Source: Zahari Radi, MARDI, 1993.

Table 5 Projected income from persimmon cultivation.

Year	Yield (kg/acre)	Net Income at M$ 4/kg	M$ 6/kg
0	-	(3,786)	(3,786)
1	-	(168)	(168)
2	-	(217)	(217)
3	-	(324)	(324)
4	-	(455)	(455)
5	1,200	4,107	6,507
6	1,400	4,683	7,483
7	1,600	5,299	8,499
8	2,000	6,884	10,884
9	2,000	6,884	10,884
10	2,500	8,752	13,752
11	2,500	8,752	13,752
12	2,500	8,752	13,752
13	3,000	10,680	16,680
14	3,000	10,680	16,680

Source: Ko and Jamil, MARDI, 1992.

Table 6 Projected income from apple cultivation (per acre, high density planting).

Year	Yield (kg/acre)	Net Income at M$ 0.30/fruit	M$ 0.50/fruit
0	-	(150,453)	(150,453)
1	-	(3,715)	(3,715)
2	120,000	30,654	54,654
3	144,000	19,097	47,897
4	240,000	62,155	110,155
5	360,000	97,922	169,922
6	480,000	117,820	213,820

Source: Ko and Jamil, MARDI, 1992.

Table 7 Projected income from strawberry cultivation (per acre, for six month).

Yield		5,492 kg	
Expected price	M$ 8/kg	M$ 10/kg	M$ 12/kg
Net income	M$ 23,687	M$ 34,671	M$ 45,655

Source: Ko and Jamil, MARDI, 1992.

Strategies for future development

Commercial agricultural activities in the highlands of Malaysia are located in an environmentally sensitive area. The Cameron Highlands is not only a major tourist destination, but is also the catchment area of one of the country's largest hydropower systems. This implies that land use policy and guidelines must be effective and strictly enforced. The guidelines and policy that may contribute towards sustainable development of highland agriculture include the following:

1. Allow agricultural activities only in areas least likely to suffer adverse impacts. This means that high risk areas which are prone to severe erosion and landslides should be preserved;
2. Restict the total land area allocated for agriculture development in the Cameron Highlands and other potential highland areas, thus minimizing the problem of excess supply of commodities, depressed prices and incomes. A stable income level would encourage greater investment in soil and water conservation measures;
3. Set up a marketing information system which would determine seasonal production quotas based on supply-demand considerations;
4. Institute and implement strict land use guidelines covering the choice of crops and conservation practices;
5. Discourage vegetable cultivation on open terrace benches especially on steep slopes which cause instability and soil erosion. Instead vegetable and flower production under rain shelters should be encouraged thus intensifying crop cycles and yields;
6. Extend appropriate cropping systems, efficient use of fertilizers and agro-chemicals with integrated pest management practices to the farmers; and
7. Review the existing land tenancy policy. Giving greater security on land tenure to farmers would

increase their receptiveness to investing in conservation measures as well as to diversifying into perennial crops.

These guidelines, if given serious attention and translated into effective control measures, would ensure a greater success in achieving sustainable development of upland agriculture.

Conclusion

In the process of examining the prospects for highland agriculture in Malaysia, we have considered the likely changes in supply and demand for temperate products, both domestic and global. The issues and challenges facing upland agriculture may be wide ranging, complicated and unpredictable, but careful inferences to the events that are likely to develop would strengthen our ability to restructure and reorganize the highland agriculture sector. The choice of crops may be wide, but the output mix should be balanced between food and non-food, perennials and annuals, those that are not intensive users of limited resources, and lastly meeting the sustainability challenge. Besides vegetable, flower, and fruit cultivation, a range of other crops can be cultivated. Areas that are considered too steep for food crops can be utilized for agro-forestry crops such as bamboo and rattan, without much disturbance to the ecological system of highland forest. Other potential ventures include mushroom culture, apiculture, hydroponics, and rearing of livestock.

Under such circumstances the debate on the future direction of sustainable highland agriculture in Malaysia remains wide open.

CGPRT Crop-Based Small Scale Processing Industries: Their Impact on Employment and Income Generation in Rural Areas of Korea

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The farm labour situation

Korea has been a traditional agricultural country which has experienced drastic changes in agriculture due to rapid industrialization in recent decades. This is reflected in population statistics indicating that in rural areas the population has decreased substantially from 45% of the country total in 1970 to 14% in 1991. Similarly, farm employment's share in total employment has also declined from 49.5% in 1970 to 16.0% in 1991 (Table 1). Effects of the decreasing farm population include lower cropping intensities, increased idle land and decreased food self-sufficiency.

Rapid urbanization accompanied by industrialization in the 1970s caused socio-economic changes in rural societies, including migration to urban centers, and an increase in both age and female proportion of the rural population.

The farm population has decreased at a rate of 4.0% annually since 1970 (Table 2). In 1991, farm population was 6.068 million, a 58% decrease from the 14.422 million in 1970. This trend is expected to continue through the 1990s leading to a shortage of farm labour.

Since the 1970s, the farm population not only has decreased but has aged considerably (Table 2). For instance, the proportion of the farm population 50 years and older has increased from 15.6% of the total farm population in 1970 to 39.0% in 1991. The farm population between ages 15 and 50, however, diminished from 5.901 million to 2.523 million. Both trends are expected to continue.

Since 1975, farm wages have increased 19% annually on average, from 1,467 won/day in 1975 to 24,444 won/day in 1991.

Impact on employment and income of the CGPRT crops processing industry

In Korea, demand for CGPRT products continues to increase with income growth and changes in food consumption behavior. At the same time, relatively low productivity and weak competitiveness caused by reduced farm labour and slow farm mechanization have caused agricultural production to fall (Table 3). Furthermore, most farm labour is getting old.

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Table 1 Employment in agriculture and forestry ('000 persons).

Year	Total	≥ 15 years old	Working	Population Employed (A)	In agri-culture and forest (B)	(B/A) %	Unemploy-ment	Unemploy-ment rate %
1970	32,241	17,468	10,062	9,617	4,756	49.5	445	4.4
1980	38,124	24,463	14,431	13,683	4,429	32.3	748	5.2
1985	40,806	27,553	15,592	14,970	3,554	23.7	622	4.0
1989	42,380	30,217	17,971	17,511	3,272	18.7	460	2.6
1990	42,869	30,801	18,487	18,036	3,152	17.5	451	2.4
1991	43,268	31,367	19,012	18,576	2,970	16.0	536	2.3

Table 2 Farm labour and migration ('000 persons).

Year	Total Popula-tion (A)	Farm popula-tion (B)	(B/A) %	Migration %	Age consumption of farm labour 15-50 years (C)	(C/B) %	50 years and over (D)	(D/B) %
1970	32,241	14,422	44.7	0.0	5,901	40.9	2,250	15.6
1980	38,124	10,827	28.4	24.9	5,385	49.7	2,212	20.4
1985	40,806	8,521	20.9	40.9	4,101	48.1	2,306	27.1
1989	42,380	6,786	16.0	52.9	3,090	45.5	2,382	35.1
1990	42,869	6,661	15.5	53.8	2,993	44.9	2,298	34.5
1991	43,268	6,068	14.0	57.9	2,523	41.6	2,370	39.0

Table 3 Production of pulses, potatoes and sweet potatoes.

Year	Pulses Area ('000ha)	Pulses Production ('000 t)	Potatoes and Sweet Potatoes Area ('000 ha)	Potatoes and Sweet Potatoes Production ('000 t)
1980	244	266	92	1,549
1985	196	275	65	1,362
1989	202	303	54	1,222
1990	188	271	40	802
1991	155	224	38	792

To meet the demand, agricultural imports have grown rapidly since the 1970s.

Soybean production and processing

The soybean processing industry is composed of two sectors: traditional foods such as bean sprouts, tofu, and soy sauce, and processed foods such as soybean milk, soybean oil, and soybean residues. In this paper, our attention will be limited to bean sprouts and tofu which are popular in rural areas for small scale cash-cropping.

In 1991, soybean was planted on 119 thousand hectares, and total production amounted to 183 thousand tons (Table 4). The total production was far below the domestic demand, which must be met by imports. With the recent increase in demand of soybean for animal feed, imports have increased substantially.

Farm income from soybean production in 1991 averaged 126 thousand won per household.

Processing of soybean is undertaken by 520 tofu producers with a production capacity of 1,092,000 tons located in the rural areas (Table 5). A total of 3,650 workers are employed in the tofu production industry, generating a total of 2 billion won in rural income. This works out to an annual income of 548 thousand won per employee.

Table 4 Soybean production, supply and demand.

Year	Area ('000 ha)	Production (A) ('000 t)	Gov't Purchase (B) ('000 t)	B/A (%)	Import ('000 t)	Demand ('000 t) Processing	Feed	Other	Total
1980	188	216	0.04	0.02	417	265	333	135	733
1985	156	234	20.2	8.6	885	282	725	123	1,130
1989	157	251	90.7	36.1	932	265	830	137	1,232
1990	152	233	68.8	29.6	1,092	268	866	120	1,254
1991	119	183	36.0	19.7	912	277	805	145	1,227

Table 5 Tofu production.

Year	Soybean used (t)	Tofu production (t)
1980	52,015	145,642
1985	98,710	276,388
1989	111,600	312,480
1990	111,600	312,480
1991	111,456	312,076

Soybeans are also processed into bean sprouts which are usually grown from soybeans in wet pots. There are 2,450 bean sprout producers in the country, employing 18,050 persons. They produce approximately 8 tons of bean sprouts out of each ton of soybean (Table 6).

Table 6 Bean sprouts production.

Year	Soybean use for bean sprouts (t)	Bean sprouts production (t)
1980	56,000	392,000
1985	55,500	416,250
1989	55,000	385,000
1990	48,600	340,200
1991	38,900	311,200

The industry generates a net income of 52.4 billion won, which is equivalent to a per farm household income of 2.903 million won.

White potato and sweet potato processing industries

At present, 11 % and 53% of total production of white potatoes and sweet potatoes, respectively, go through processing. However, there will be a greater demand for processed potatoes in the future. Potatoes are processed to make starch, snacks, fast foods, as well as liquors. In this paper, attention will be focused mainly on processing for starch, snacks, and fast foods.

In 1991, white potatoes were planted on 21.1 thousand hectares, and the total production was 416 thousand tons. Of this total, 44 thousand tons were supplied for use in the processing industry, primarily for starch, French fries, chips and confectioneries.

In the same year, sweet potatoes were planted on 17.3 thousand hectares and the total production was 376 thousand tons, of which 200 thousand tons were supplied for use in the processing industry, primarily for starch and liquors.

The average farm household income from production of white potatoes was 80 thousand won, and that from production of sweet potatoes, 56 thousand won.

The sweet potato starch industries are conveniently located in sweet potato production areas and manufacturing of the starch usually begins after harvest. There are 41 manufacturers throughout the country employing 1,103 people and generating 2.94 billion won in non-farm income. Per capita income from the industry is thus 2.665 million won.

Between 1985 and 1991, demand for white potatoes for processing increased by almost 100 percent. White potatoes are processed for starch, fast foods, and snacks such as French fries and chips. About 10.6% of white potato production is used for processing, still a very low figure compared to the United States or Japan where 60% to 70% is processed. With further changes in food consumption behavior of Korean consumers, the demand for processed white potatoes is expected to continue to increase.

There are 20 white potato processors in the country. A total of 858 employees generate a net income of 2.797 billion won, which works out to 3.26 million won per capita.

Impact of CGPRT crop processing industries on farm household income

Farm household income from soybean, white potatoes and sweet potatoes is 56 to 126 thousand won, constituting about 0.8% to 1.8% of farm income (7.035 million won), but these crops also generate non-farm income through the processing industries, which are mostly located in rural areas. The non-farm income from these crops is between 548 thousand and 3.26 million won.

This non-farm income is 9.0% to 53.7% of the total non-farm income. Thus it is apparent that the processing industries for CGPRT crops are a very important source of rural employment and non-farm income.

Problems in the CGPRT crop processing industries

There are limits to increasing the planted areas and production of CGPRT crops. For production, good quality seeds are not always provided, resulting in products that vary in size and quality. Thus, the marketability of products is diminished.

On the other hand, farm labour is scarce due to urbanization following the rapid industrialization. Farm mechanization for CGPRT crops has been slowly pushing up production costs. In addition, with price fluctuations accompanied by unstable harvest conditions and a high domestic-to-international price ratio (soybean, 4.9; white potatoes, 4.4; sweet potatoes, 4.0 in 1991) domestic products cannot compete in the world market. If imports of the CGPRT crops are liberalized, farmers will probably no longer plant them. If this were to be the case, processing industries would also collapse or relocate near urban centres, either of which would result in significant adverse effects on farm income. Since white potatoes and sweet potatoes tend to be marketed at the same time, industrial producers inevitably will have to purchase them in a short period of time, thus having to endure financial pressures.

'Furthermore, the CGPRT crops require considerable storage space but cannot be stored for a long time as they are perishable. They should be stored in cold storage facilities. Supply difficulties will cause producers to operate for a short period during the year, making it difficult to satisfy demands for labour.

A rural employment policy related to the CGPRT crops processing industry

To utilize the surplus farm labour after the harvest season, the government has fostered the establishment of small scale production sites in rural industrial complexes (Table 7).

Table 7 Rural industrial complex establishment program.

	Plan 1984-1991	1992	after 1993
Number of complexes	350	249	45	56
Area ('000 pyong)	17,500	11,074	2,500	3,926
Number of plants	4,500	3,248	700	552

1 pyong = 3.3 m^2

These sites provide non-farm income opportunities for farmers and contribute to a balanced growth between urban and rural regions. The government supports the producers with various forms of financial assistance, subsidies, and also tax exemptions.

The types (and number) of items produced by these rural industrial complexes in 1991 ranged from electronic (593), machinery (762), textiles (585) to food processing (262) and other (1,006).

Financial support specifically for the CGPRT crops processing industry was provided for building plant facilities and purchasing raw materials for white potato processing (starch and snacks). The main purpose of this project was to increase rural income and provide rural employment.

During the period between 1985 and 1991, seven such plants were built with government assistance. Budgetary outlays on these projects were 6.5 billion won, which was 35% of total investments (18.57 billion won).

Direction of development of CGPRT crops for increasing farm income

In Korea, demand for CGPRT crops such as soybean, white potato, and sweet potato is limited, their profitability low, and the production base weak.

Therefore, it is expected that the following policies will be supported in the future:

1. Quality improvement and the establishment of production systems according to consumer preferences.
2. Continual and expanded supply of superior seeds that form the basis of heightened productivity.
3. At present, the average plot of farmland is less than 1 hectare. Thus the average farm size will be increased to 2 to 3 hectares.
4. Reducing the cost of production through readjustment of arable land and mechanization.
5. Active developing and supporting of agri-processing industries related to CGPRT crops.
6. Production of contaminant free CGPRT crops by following standards for usage of agricultural chemicals and protecting agricultural products from contaminants.
7. Development of agri-industrial sites and industrial complexes for auxiliary products to help farms earn higher levels of non-farm income.

CGPRT Centre News and Activities

Training in Marketing and Farming Systems Research

June 14 - July 3, 1993
Study Tour for Economic Assistants from Sri Lanka

From June 14 to July 3 training on research methods applicable to markets and agriculture was provided at the Centre to participants from Sri Lanka.

The course emphasized a geographical approach towards the identification of local and external markets for agricultural produce in conjunction with the pinpointing of a variety of biophysical zones at the district level. Attention was given to price formation of agricultural products and the factors responsible for different production and marketing costs of agricultural products and inputs.

The participants visited a number of locations in Java for comparison with the Sri Lankan situation.

The course was considered highly useful by the participants.

In-country Course on Database Management and Agricultural Planning

June 24 - July 1, 1993
Myanmar

From June 24 to July 1, 1993 a team of economists and specialists from the Centre conducted an initial in-country course on database management and agricultural planning in Myanmar.

Thirty staff from a number of departments and agencies participated. The course emphasized issues of specific relevance to the Union of Myanmar, such as:

1. There is a need to monitor price development of major agricultural goods following the introduction of policy changes pertaining to price liberation and liberation of trade in agricultural inputs.

2. Simple cost effective techniques for database management and agricultural planning, which require an easily achievable level of technical expertise, are available.

3. Knowledge of price formation and variable transaction costs is indispensible in adjusting torecent changes in tasks and policy tools of the Government of Myanmar.

Two-tier training was conducted. One course was directed at senior level planners and the other was directed at medium and junior level staff. Field research confirmed the need for recognition of different price levels as well as variable productivity.

Workshop on Marketing and Processing of Food Legumes and Coarse Grains: Their Effects on Expanding Rural Employment in Asia

From 24 to 27 May 1993 a workshop took place at MARDI, Kuala Lumpur sponsored by UNDP/FAO-RAS/89/040 Project, organized by MARDI and the CGPRT Centre. The purpose of the workshop was to present in a regional meeting actual research and analysis of sub-sector and commodity specific processing activities and their relation to employment. The meeting was structured into three parts, i.e. (a) research and country reports, (b) resource papers, and (c) discussions.

Research papers from eight countries, namely, China, Indonesia, Malaysia, Pakistan, the Philippines, Sri Lanka, Thailand and Viet Nam, and three country reports from India, Lao P.D.R. and Myanmar were presented. Studies included input-output type modelling exercises in China, processing of soybean in Indonesia, Malaysia and the Philippines, marketing and processing of soybean in Thailand, maize in Pakistan, a general survey of the economy of FLCG crops in Sri Lanka and soybean in Viet Nam. The studies explored the extent of employment and income generated by the respective crops.

Resource papers highlighted marketing and processing from different angles.

The resource paper presented by Dr. Gordon Prain introduced the philosophy of a regional project (UPWARD) seeking to contribute to rural welfare. It argues that sound knowledge of the whole system surrounding farmers and transactions is necessary to flexibly shift from a production to market improvement approach.

A resource paper by Mr. Prakarn Virakul described the great complexity and dynamism of intra-regional trade in major FLCG commodities. Mr. Dave Santos of Nestle introduced a successful tripartite contractual scheme in soybean growing between Nestle, a bank and farmers.

During discussions, a number of issues were raised and addressed. Pertaining to the successful contractual scheme introduced by Nestle, a number of unsuccessful arrangements were cited which suggest that governments might need to play a role in such contractual arrangements. Cooperatives were regarded as a possible mechanism for business involvement of the rural population. Preprocessing was considered as an alternative way for the improvement of rural income and employment.

It was generally agreed that marketing and employment of a wide range of FLCG crops contribute to additional employment and income. Furthermore, since women are usually heavily involved in processing and marketing, the effect of increased income could contribute to the enhancement of the role of women in development.

The Asian Regional Center of AVRDC in Thailand

Prepared by
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Bangkok, Thailand

As stipulated in the Asian Vegetable Research and Development Center's (AVRDC) long-term strategic development plan, regionalization is envisaged in order to bring the Center closer to its partners and their problems and to enable it to respond more effectively to differences in need and the capabilities of regions with distinct characteristics.

The Government of Thailand has approved for 25 years the establishment of the Asian Regional Center of AVRDC, marking the conversion and expansion of the AVRDC-Thailand Regional Training and the Outreach Program (AVRDC-TOP), a tripartite program established in 1982 by AVRDC, ADB, and the Government of Thailand.

The Asian Regional Center (ARC) will serve three subregions: Southeast Asia and South Asia from Thailand, and China, also from Thailand but with a functioning office in Beijing. The Center will serve 17 countries, including Thailand, Laos, Cambodia, Viet Nam, the Philippines, Indonesia, Malaysia, Singapore, Brunei, Myanmar, China, Bangladesh, Nepal, Bhutan, Pakistan, Sri Lanka, and India.

According to AVR DC's five-year action plan which commenced in 1993, research activities at its headquarters are expected to increasingly shift to mission-oriented strategic research to give support to more applied research in regional centers.

In the division of functions among headquarters, research units, and the regional center, the Asian Regional Center (ARC) will:

* assume primary responsibility for improvement of Asian regional vegetable crops and production systems;
* conduct applied and adaptive research on AVRDC and ARC principal vegetable crops as appropriate to regional needs;
* coordinate the ARC subregional networks and provide them with scientific, administrative, and logistic support;
* link regional programs with activities at headquarters and elsewhere, and provide feedback for AVRDC's program planning;
* organize training, with emphasis both on research and production training, the development of specific training information and materials, translation of publications into local languages; and
- develop and administer country projects within the region.

The AVRDC Regional Center in Asia (ARC) is based at Kasetsart University, Thailand, which has a strong agricultural tradition. Thailand with its fast growing agro-industry has served as the hub of the region's agro-industrial activities.

The Asia Regional Center's crops of responsibility are:

1) soybean *(Glycine max)*
2) mungbean (Vigna *radiata)*
3) yard-long bean *(Vigna unguiculata subsp. sesquipedalis)*
4) amaranth *(Amaranthus tricolor, or A. mangostanus)*
5) snap bean *(Phaseolus vulgaris)*
6) water convolvulus *(lpomoea aquatica)*
7) okra *(Hibiscus esculentus, or Abelmoschus esculentus)*
8) other crops of specific importance to the countries covered by ARC.

International Meeting on Cassava Flour and Starch

11-15 January 1994
CIAT
Cali, Colombia

Combining: International meeting on cassava flour, financed by IDRC, and the first annual meeting of the cassava transformation project for Latin America, financed by EEC.

Sessions will be held on:

1. Cassava flour for human consumption
2. Research results of EEC cassava project
3. Links between research and development

This meeting provides an opportunity to present research and development project results to an audience of similar background drawn from the major cassava-producing regions of the tropical and sub-tropical world.

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International Ag-Sieve

Rodele's International Ag-Sieve is a bimonthly collection of gleanings of the latest and most applicable information in the field of sustainable agriculture in the tropics. Written for people working in the field in the developing world, the Ag-Sieve contains the technical information that the scientific community needs, and the practical information the field worker can use but does not require a Ph.D. or a dictionary to understand.

We link the work of the major agricultural centers, the insights of the farmer, the experience of the multidisciplinary development team, and the individual researcher into an eight page newsletter that highlights breakthroughs in sustainable agriculture.

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For readers interested in regenerative agriculture in West Africa, **Entre Nous** is published in French by Rodale International,

Contact: Rodale International, B.P. A237, Thiès, Sénégal.

University of New England Development Studies Program

1. Annual Short Course on Planning for Sustainable Rural Development
   Dates: 11 October to 3 December 1993
   (8 weeks)

2. Management of Agricultural Research
   Dates: 3 January to 18 February 1994 (7 weeks)

3. Annual Short Course on the Economics of Resource and Environmental Management
   Dates: 11 April to 3 June 1994 (8 weeks)

4. Computers In Development Planning
   Dates: 20 June to 15 July 1994 (4 weeks)

5. Annual Short Course on Planning for Sustainable Rural Development
   Dates: 10 October to 2 December 1994
   (8 weeks)

Further information can be obtained from:

Course Director, Professor J. Brian Hardaker
Head, Department of Agricultural Economics and Business Management
University of New England, Armidale NSW 2351, AUSTRALIA
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Fax: (6167) 71 1531, Telex: AA166050

CGPRT Centre

The Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT Centre) was established in 1981 as a subsidiary body of UN/ESCAP.

Objectives

In co-operation with ESCAP member countries, the Centre will initiate and promote research, training and dissemination of information on socio-economic and related aspects of CGPRT crops in Asia and the Pacific. In its activities, the Centre aims to serve the needs of institutions concerned with planning, research, extension and development in relation to CGPRT crop production, marketing and use.

Programmes

In pursuit of its objectives, the Centre has three programmes which are mutually supportive:

1. Research, which entails the preparation and implementation of studies covering production, utilization and trade of CGPRT crops in the countries of Asia and the South Pacific.
2. Training of national research and extension workers,
3. Information and documentation which encompasses the collection, processing and dissemination of relevant information for use by researchers, policy makers, and extension workers.

Palawija News

Contributors are invited to submit concise summaries of significant social research related to CGPRT crops for publication. Submissions should be limited to two to four double-spaced typewritten text. Two figures (graphs or tables) may accompany the article. Include only references cited. All articles are subject to editing to meet space limitations.

Please send all queries relating to articles in *Palawija News* to Publications Section, CGPRT Centre, Jalan Merdeka 145, Bogor 16111, Indonesia.

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