Economic and Social Commission for Asia and the Pacific

CAPSA WORKING PAPER No. 85

Enhancing the Sustainable Development of Diverse Agriculture Through CGPRT Crops in Myanmar:

Current Status of CGPRT Crop Agriculture and Identification of its Development Constraints

Aung Kyi

United Nations
ESCAP

UNESCAP-CAPSA

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2. Networking and partnership with other international organizations and key stakeholders.
3. Research and analysis of trends and opportunities with regard to improving the economic status of rural populations.
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through Secondary Crops' Development
in Asia and the Pacific

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List of Abbreviations

ADB	Asian Development Bank
AED	Agricultural Extension Division
AFTA	ASEAN Free Trade Area
AMD	Agricultural Mechanization Department
ASEAN	Association of South East Asian Nation
ASR	Agricultural Sector Review
CARI	Central Agricultural Research Institute
CARTC	Central Agricultural Research and Training Centre
CEC	Central Economic Committee
CEPT	Common Effective Preferential Tariff
CGPRT	Coarse Grain, Pulses, Roots and Tuber
CPO	Crude Palm Oil
CSO	Central Statistical Organization
DAP	Department of Agricultural Planning
DRC	Domestic Resource Cost
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
FAOSTAT	Database developed by FAO
FAQ	Fair Average Quality
FDI	Foreign Direct Investment
FFA	Free Fatty Acid
FFB	Fresh Fruit Bunch
f.o.b.	Free on Board
FQ	First Quality
FY	Financial Year
GDP	Gross Domestic Product
GEL	General Exception List
GOM	Government of Myanmar
HQV	High Quality Variety
HYV	High Yielding Variety
IL	Inclusion List
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
MADB	Myanmar Agricultural Development Bank
MAPT	Myanmar Agricultural Produce Trading
MAS	Myanma Agriculture Service
MCCI	Myanmar Chamber of Commerce and Industry
MCSE	Myanma Cotton and Sericulture Enterprise
MFE	Myanma Farms Enterprise
MFN	Most Favored Nation
MJI	Myanma Jute Industries
MOAI	Ministry of Agriculture and Irrigation
MOP	Muriate of Potash
MPCE	Myanma Perennial Crops Enterprise
MSE	Myanma Sugarcane Enterprise
MSTAT	Statistical software developed by Michigan State University

NCEA	National Commission for Environmental Affair
NRP	National Rice Policy
NT	National Treatment
NTB	Non Tariff Barriers
OQ	Ordinary Quality
QR	Quantative Restriction
R&D	Research and Development
RAPA	Regional Office for Asia and the Pacific, FAO
RC	Ready Cargo
RS	Rainfall and Soil
RTOP	Reaching Towards Optimum Productivity
SCB	Social Cost Benefit
SEE	State-owned Economic Enterprise
SHY	Special High Yield
SID	Simpson Index of Diversity
SL	Sensitive List
SLORC	State Law and Order Restoration Council
SLRD	Settlement and Land Record Department
SPDC	State Peace and Development Council
SQ	Special Quality
TEL	Temporary
TSP	Triple Super Phosphate
UNDP	United Nations Development Programme
VFRDC	Vegetable and Fruit Research Development Centre
WTO	World Trade Organization
kg	kilogram
mt	metric ton

Foreword

Most Asian countries succeeded in multiplying major cereal production through the green revolution. This was made possible by the introduction of high yielding varieties and policy support which promoted the construction of irrigation facilities and the use of modern inputs such as chemical fertilizers and pesticides. However, recently the growth in productivity of major cereals has reached a plateau. Agricultural diversification has a number of positive effects, among others, food security, risk mitigation, labour absorption and conservation of biodiversity. It is crucial to be aware of the driving forces and constraints to agricultural diversification to formulate policy options which realize the coexistence of sustainable agricultural development and poverty reduction in rural areas.

Responding to this vital need, UNESCAP-CAPSA conducted a three-year research project, "Identification of Pulling Factors for Enhancing Sustainable Development of Diverse Agriculture in Selected Asian Countries (AGRIDIV)", from April 2003, in collaboration with eight participating countries, namely Bangladesh, India, Indonesia, Lao People's Democratic Republic, Myanmar, Sri Lanka, Thailand and Viet Nam.

It is my pleasure to publish "**Enhancing the Sustainable Development of Diverse Agriculture Through CGPRT Crops in Myanmar: Current Status of CGPRT Crop Agriculture and Identification of its Development Constraints**" as a result of the first phase of the Myanmar country study of the project. This volume presents a descriptive and quantitative analysis of the current secondary crop agriculture and development constraints and options. This study focuses on policy recommendations, as well as areas of/for farther study.

I thank Aung Kyi for his efforts. Continuous support from the Department of Agricultural Planning, Ministry of Agriculture and Irrigation, is highly appreciated. Prof. Hitoshi Yonekura, Graduate School of Agricultural Science, Tohoku University, Mr. Tomohide Sugino and Dr. Parulian Hutagaol provided useful guidance at every stage of the study as regional advisor, project leader and associate project leader respectively. I extend thanks to Mr. Matthew Burrows for his English editing. Finally I would like to express my sincere appreciation to the Japanese Government for its financial support of the project.

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J.W. Taco Bottema
Director
UNESCAP-CAPSA

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Executive Summary

Myanmar is an agro-based country and agriculture is still the most important economic sector as the main source of livelihood for about 75 per cent of the people living on agriculture-related activities. Agricultural diversification could contribute as an effective strategy or tool in environmental protection, slow the depletion of forests, assist the creation of a social safety net and risk mitigation for the rural poor. Moreover, diversification of agriculture is one of the ways to sustain rural development, especially in areas with a fragile eco-system where high levels of agricultural inputs can still not provide good economic returns. It could especially reduce the risks of resource-poor farmers. At the same time, a diverse agricultural system could also contribute to environmental protection from the viewpoint of resource conservation.

In this study, complimentary national level and field level studies were conducted to explore the potentials, prospects and constraints of both horizontal and vertical agricultural diversification to forge the congruence of enhanced productivity, sustainability and profitability. The data and information on key CGPRT crops in Myanmar namely maize, pulses including soybean, and potato are focused and collected.

The Simpson Index of Diversity (SID), ranging between zero and one, was used to measure horizontal diversification at the national level. The more diversified a country, the index is closer to one. SID for Myanmar ranged from 0.62 to 0.69 between 1998 to 2000. This indicates that there is still enough room to promote crop diversification in Myanmar.

In Myanmar, more than 60 different crops, in eight groups: cereal crops, oilseeds crops, pulses, industrial crops, culinary crops, vegetables, fruits and other crops, are grown based on the prevalence of different agro-ecological zones. The total crop area including both seasonal and perennial crops amounts to 15.85 million hectares with a cropping intensity index of 149 in 2001-2002. Cereal crops constitute the largest share with 46 per cent of the multiple crop sown area followed by pulses and oilseeds.

Pulses are one of the most important crops from the viewpoint of the national economy, ecologically and socially. They are major foreign exchange earners for Myanmar and can slow forest depletion and enrich soil fertility where a low level of fertilizers is used due to the poverty of the poor farmers. At the same time, it is a stable income generator for poor farmers especially in the dry zone.

From the viewpoint of the cost and return ratio of rice versus pulses, it varies depending upon the production area. For instance, the cost and return ratio of irrigated summer rice and non-irrigated black gram in the delta area (rice surplus area) are 1.15 and 1.97 but in the dry zone (rice deficit area), 1.77 and 1.79 respectively. This is due to the difference in price in respective areas.

Myanmar agriculture is still production-oriented agriculture and not yet a rural welfare-oriented one. Rice is a national priority crop and the government accords top priority to increasing rice production to achieve self-sufficiency not only at the national level but also at regional levels which could lead to environmental consequences. In terms of trade, there are two types of foreign trade in Myanmar namely normal trade from Yangon Port and border areas' trade, which account for 85 per cent and 15 per cent of the total trade respectively. Myanmar is actively participating in ASEAN Free Trade Area (AFTA) and is a member of WTO. As a result of trade liberalization, production of key CGPRT crops has significantly increased as export commodities. In future, Myanmar will have to depend on its processing and manufacturing industries, mainly labour-intensive and resource-based manufacturing.

Improving or stabilizing the income of the farmers or rural people could be achieved through the diversification of farming activities and the freedom of choice to choose the line of

activities for their betterment of life. Increasing production would only be pursued if it is consistent with the improvement in income under the given condition that food shortage is not a critical problem.

CGPRT crops, generally secondary crops after rice in Myanmar, are important farming resources particularly for the poor in upland marginal areas like the central dry zone of Myanmar where other agricultural resources and employment opportunities are limited. In general, CGPRT crops cannot contribute directly to substantial increases in rural income but they can significantly secure or stabilize the income level of the poor in particular.

There are many constraints and accelerators linking policy, socio-economic and technical factors. Land policy, insufficient credit, regional zoning of specific crops based on agro-ecological suitability, rice-bias policy, unavailability of agricultural mechanization for timely land preparation for poor farmers, weakness in research and extension for technology transfer and inadequate input supply are constraints to the promotion of crop production and diversification including CGPRT crops. Low rainfall, supplementary rural energy supply, liberal agricultural policy and market demand, risk mitigation and stabilization of income in marginal areas are the accelerators to CGPRT crop production and diversification.

It is necessary to improve research capacity and human resource development (HRD) programmes on CGPRT crops, investment in agriculture**,** distribution of fertilizers and seeds, land policy and land resources development, stability of the financial sector, involvement of the private sector in agricultural credit and activities, and diversified farming systems for the welfare of farmers.

1. Introduction

Myanmar is an agro-based country and agriculture is still the most important economic sector as the main source of livelihood for about 75 per cent of the rural population. It contributes about 51 per cent of export earnings and 42 per cent of the GDP. The agricultural sector also provides inputs for agro-industries. As a result, the Government of Myanmar gives high priority to the development of this important sector as the base for sustainable economic growth.

Myanmar is endowed with bountiful resources of land, water, fauna, flora and a favourable climate, which forms the basis for developing the agricultural sector. Since 1988, the state has laid down 12 political, economic and social objectives in its endeavors to establish a peaceful, developed nation. One of the major economic objectives is "*development of agriculture as a base and all round development of other sectors of the economy as well*".

Food and nutritional security, income growth, poverty alleviation, employment generation, judicious use of land, water and other resources, sustainable agricultural development, and environmental and ecological management/improvement have assumed high priority in the various countries of Asia and the Pacific. Crop diversification could contribute as an effective strategy or tool in environmental protection, creation of a social safety net and risk mitigation for the rural poor. Every effort, therefore, needs to be made to explore fully the potential and prospects of crop diversification to forge the congruence of enhanced productivity, sustainability and profitability.

The Ministry of Agriculture and Irrigation in Myanmar, which is responsible for the development of agriculture, has laid down three main objectives:

- To achieve surplus of paddy
- To achieve self-sufficiency in edible oil
- To step up the production of exportable pulses and industrial crops

As previously mentioned, rice is the national priority crop and there has been success in increasing production of rice and some other crops too. Even though rice is the national priority crop and the staple food for Myanmar, this type of approach can result in some difficulties, such as inefficient use of irrigation water and land, sub-optimal agricultural production and a high cost on farmers welfare.

In line with trends of other Asian countries and for the benefit of the state and the farmers, it would be better if the present crop-production oriented agriculture could be changed to be more rural welfare or farmers' welfare oriented. This could also be considered as a one stone-two birds approach, because at the same time, aforementioned weaknesses could be corrected and the living standards of rural people could be improved.

Diversification of agriculture is one of the ways to ensure sustainable rural development, especially in areas with a fragile eco-system where high levels of agricultural inputs cannot provide good economic returns. It could especially reduce the risks of resource-poor farmers. For them, once they loose something, it can take many years to recover, if they can recover at all. At the same time, a diverse agricultural system could also contribute to environmental protection from the viewpoint of resource conservation.

It noteworthy that even though crop diversification through CGPRT crops is an important instrument for economic growth and it can generate and stabilize the income of farmers, the ability of a country to diversify in order to attain various goals will depend upon the policy, opportunity, attitudes and responsiveness of farmers and agro-ecological conditions, which also influence crop diversification at a farm level.

2. Approach (Framework) and Methodology

Crop diversification can be a useful means to increase crop output under different situations, covering both horizontal crop diversification, the addition of more crops to the existing cropping system and vertical crop diversification, in which various downstream activities such as post-harvest processing are undertaken. Vertical crop diversification reflects the extent and stage of industrialization of the crop. It has to be noted that crop diversification takes into account the economic returns from different crops. This is different to the concept of multiple cropping on a given piece of land in a given period.

This study comprises of two main parts, a national level study and a field survey, for the successful implementation of the project. Both the data and information on key CGPRT crops in Myanmar, namely *maize, pulses including soybean, and potato* are focused and extensively collected. Maize and pulses are major export items for Myanmar, which was the third largest exporter of pulses in the world in 1998 after France and Canada. Data collected covers sown and harvested area, yield, imports, exports, consumption, marketing, constraints and promoting factors etc. Based on secondary data and information mainly received from the national level study, questionnaires for a semi-structured survey were tailored and designed appropriately.

At the national level study, Time Trend Analysis and Simple Welfare Analysis were used to determine the impact of trade liberalization on CGPRT crops. Detailed analysis, mentioned in Chapter 6 was conducted by Daw Than Than Win, study group member-cum-planning officer of the Department of Agricultural Planning. The comparative advantage on economic efficiency in producing CGPRT crops was determined by Domestic Resource Cost (DRC) analysis. In order to find key points of production, utilization, consumption and marketing for most CGPRT crops and some major crops, a field survey team, mainly focusing on marketing, was formed under the management of U Kyaw Myint, Deputy General Manager of the Myanmar Agriculture Service.

During respondent selection for the field survey, *random purposive selection* of CGPRT crops growers was used instead of using a probabilistic method of selection. The reason is that as CGPRT crops are the focus, more attention was paid to CGPRT crop growers. Representative samples were drawn and some samples were discarded because of their erratic answers or responses. Apart from interviews, the field supervisors also conducted group discussions with community leaders, village elders, brokers-cum-farmers, traders and informed villagers during the field surveys. The information from secondary data (national level data) and from site reconnaissance were incorporated and considered in the implementation of key informant interviews during the field survey. The answers given by the respondents were compared and crosschecked to assess reliability. Whenever there were some discrepancies, checking by another source was undertaken.

Samples were selected in Mandalay, Ayeyarwady and Magway division, and southern Shan state, the main surplus-producing areas of CGPRT crops. During the survey period, 34 farmers, 19 wholesalers, three pulses' millers and five exporters, altogether 61 respondents, were interviewed. Field surveys were conducted in October and November 2003.

Statistical tools were used for the analysis and evaluation of collected data and information. Information on the diversification index at the national level, comparative advantages and, cost and benefit analysis were collected. For the data entry, editing, tabulation and calculation, Microsoft Excel and MSTAT packages were used.

3. Natural and Administrative Settings

3.1 Location

Myanmar is located between 10° and 29° N latitude and 92° and 101° E longitude. The total area is 676,577 sq km, with a length of 2,052 km, extending from North to South and 937 km from East to West. In addition, it shares border with Thailand, Lao People's Democratic Republic, China, India and Bangladesh and has a long coastline of 2,234 km along the Bay of Bengal, Gulf of Mottama and the Andaman sea. Administratively, the country has **seven states and seven divisions** which are Kachin, Kayah, Kayin, Chin, Mon, Yakhine, Shan state and Sagaing, Tanintharyi, Bago, Magway, Mandalay, Yangon and Ayeyarwady division.

The country not only has different levels of altitude but also a wide range of agro-ecological zones so that the same crop can be produced in different seasons in different regions. One of the best-known examples is that green gram can be grown as a rainy season crop in Central Myanmar and as a cool season crop in Lower Myanmar. However, pigeonpea is grown as a rainy season crop in Central Myanmar and sown once a year. Another example is that tomato, cabbage and cauliflower are produced in the monsoon season in the highland areas of Shan state and in the cool season in lowland areas. Thus, major crops are available in the market year round.

3.2 Climate and source of water

The Tropic of Cancer, passing through the ancient city of the Tagaung in upper Myanmar, divides the country into the temperate north and tropical south. Thus, most of Myanmar lies in the tropical monsoon zone with the exception of the temperate northern-most parts of the country. There are three seasons: the summer season lasting from mid-February to mid-May, the rainy season from mid-May to mid-October and the cool season from mid-October to mid-February.

The rainfall precipitated by the southwest monsoon is the major source of water for crop production in the country. Normally, the monsoon moves from the southern part of the country to the delta region from where it gradually moves to the central part of the country and then the northern part. Precipitation in the various parts of the country is classified into three groups according to Dr. C.R. Panbokker's method[1].

(1) **R3:** There is sufficient rainfall for crop production during the rainy season and the rainfall pattern is normally **uni-modal**. There is no dry spell during the rainy season. This pattern occurs in Yakhine, Mon, northern part of Kachin state, Ayeyarwady and Tanintharyi division and receives 2,538 mm of rainfall.

(2) **R4:** There is sufficient rainfall for crop production during the rainy season and a three-month period of continuous summer or at least three months of no rain during a year. During the rainy season, a dry spell may occur, but also excessive rainfall and flooding. The rainfall pattern is normally **uni-modal**. This pattern occurs in Chin, Kachin, Kayah, Shan state and Bago-Yoma Hill, which receive from 1,015 mm to 2,538 mm of annual rainfall.

[1] Land use Division, MAS, MOAI.

(3) **R5:** The amount of rainfall varies year by year and the rainfall pattern is in most years **bi-modal**. It means that the rainfall pattern shows upward trends from May to June and declines in July. Afterwards, it rises again in August and September. If precipitation becomes less and the occurrence of dry spells are long during July, the success of rainy season crops, especially sesame, is uncertain. This pattern occurs in the dry zone region including Magway, Mandalay and the lower part of Sagaing division which receive less than 1,015 mm of rainfall.

For crop cultivation, the country's four prominent major rivers are important for pump irrigation. These rivers are the Ayeyarwady, the Chindwin, the Sittaung and the Thanlwin flowing to North to South into the Andaman Sea. Particularly, the Ayeyarwady and its major tributary, the Chindwin are navigable through the centre of the country and many smaller rivers of the Ayeyarwady create a vast fertile region before flowing into the Andaman sea. Thus, the delta region has better opportunities for pump irrigation due to the abundance of water sources. In addition, irrigation systems such as large-scale tank or reservoir type irrigation, small reservoirs or tanks and tube wells are established as another water source for crop production. At present more than 20 per cent of net sown area in Myanmar is under irrigation.

3.3 Soil type

Myanmar is unique for its forest-clad mountains, plateaus, valleys and vast plains. The parallel chains of mountains have altitudes ranging from 914 meters to 2,132 meters above sea level. The soil classification system in use recognizes 24 different soil types, which are classified into five groups based on the method of FAO-UNESCO. Each soil group consists of one or more soil units.

Soil group	**Soil type included in each group**
S1	Fluvisol, Gleysol, Gleysol-Humic, Gleysol (Calcaric), Gley-Gleysol, Solonchak and Arenosol
S3	Cambisol (Histric), Cambisol (Chromic), Cambisol (Orthic), Cambisol (Gelic), Andosol and Lithosol
S4	Vertisol
S5	Cambisol and Catena of Luvisol
S6	Ferrasol (Plinthic), Ferrasol (Rhodic), Ferrasol (Xinthic), and Acrisol (Fe)

Land utilization of classification is based on traditional terms used by farmers. The Settlement and Land Record Department (SLRD) under the Ministry of Agriculture and Irrigation (MOAI) originally introduced it in 1911, under British rule for land tax purposes. SLRD distinguished **seven types of land use**, namely (1) Le land, (2) Ya land[2], (3) Mayin land, (4) Kaing land[3], (5) Garden land[4], (6) Taungyar and (7) Dani land[5] among which Mayin land is a special kind of Le land which is suitable for paddy cultivation. Taungyar is known as upland, which is favourable for the cultivation of upland rice.

Generally, the country can be divided into **four major regions**: delta region, coastal region, central dry zone region and hilly region. Le land is mainly found not only in delta and

[2] Ya land is the second most widely used cropland. It may be best defined as unsuitable for paddy. Most of Ya land is situated in the central dry zone.

[3] Kaing land is the land near rivers, which is flooded during the rainy season including patches that fall dry in the riverbed.

[4] Garden land is commonly used for horticultural crops.

[5] Dani land is land with the nipa plant, which is widely grown for stitched nipa palm leaf flaps to be used for roofing in rural areas of delta and coastal regions.

coastal regions in Lower Myanmar, but also in Central Myanmar and in the valleys of Shan state and other hilly areas. It is flat and bunded, most often with impermeable heavy soil. **Eleven agro-ecological zones (RS)** are recognized based on the amount of rainfall (R) and soil type (S).

3.4 Population, farm family and land utilization

A population census of Myanmar was taken in 1973 and 1983. The country's population was estimated to be 51.14 million in 2001 with an annual growth rate of 2.02 per cent. Thus, the total population increased by 15.48 million from 35.66 million in 1983 to 51.14 million in 2001. Due to a continuously increasing population, the population density per sq km has increased from 53 in 1983 to 75 in 2001. The sex ratio in 2000 was 98.85 and the sex ratio of the 65+ age group and the 5-9 age group were 81.81 and 99.98 respectively. In the 1999-2000 fiscal year, total labour force was 14.69 million and the unemployment rate was 3.62.

In Myanmar, there are 4.8 million farm families involved in agriculture and livestock farming. Of which, 63 per cent own less than 2 hectares (5 acres) of land. The total land area of Myanmar is 67.7 million hectares of which 9.9 million hectares is utilized for crop cultivation. The forest area constitutes 50 per cent of the total land area. The present land utilization, number of farm families and distribution of farmland holdings are set out in Table 3.1.

Table 3.1 Land utilization, number of farm families by size of holding (2001-2002)

Type of land	Area ('000 ha)	%	Size of holding	Farm families ('000)	%
Net sown area	9,990	15	Below 2 ha	3,015	63
Current fallow land	622	1	2 to 4 ha	1,201	25
Cultivable waste land	6,664	9	4 to 8 ha	495	10
Reserved forest	1,3975	21	8 to 20 ha	112	2
Other forest	1,9327	29	20 to 40 ha	3	*
Unclassified land not to suitable for crops	1,7081	25	40 ha and above	2	*
Total	67,659	100	**Total**	4,828	100

Source: Settlement and Land Record Department, MOAI, 2001-2002.

3.5 Crop diversification index

There are quite a few methods, which explain the concentration (specialization) or diversification of commodities or activities in a given time and space by a single indicator. Each method has limitations for measuring diversification. Considering our objective of assessing the extent of horizontal diversification, the Simpson Index of Diversity (SID) which is easy to compute and interpret was used:

$$SID = 1 - \sum_{i=1}^{n} Pi^2$$

Where SID is the Simpson Index of Diversity and Pi is the proportionate area of the i^{th} crop with total cropped area. The index ranges between zero and one. If there is complete specialization, the index moves towards zero. In other words the more diverse the country's agriculture, the closer to one the result.

In order to make meaningful and uniform comparisons among the participating countries in this study, using FAOSTAT data, SID was calculated based on the area harvested of nine crop groups, namely 1) major cereals (rice and wheat), 2) coarse grains, 3) roots and tuber crops, 4) pulses, 5) oilseed crops, 6) vegetables, 7) fruits and nuts, 8) spices and amenities of life (coffee, tea and tobacco etc.) and, 9) rubber and textiles. According to the calculation, SID of

Myanmar for the years 1980, 1985, 1990, 1995 and 2000 are 0.62, 0.65, 0.63, 0.65 and 0.69 respectively. In this calculation, a three-year average was used to avoid the affect of annual harvest change caused by crop failure. For example, SID in 1980 is calculated based on the average area harvested in 1979, 1980 and 1981.

There are many factors affecting crop diversification such as crop price, market access, technology, climatic conditions, income level and policy. SID at the country level is just an indication for understanding horizontal diversification. Crop diversification is very site specific within a country. For example, SID of Myaung Mya township in the delta area could be close to zero because of its intensive monsoon rice after the summer rice programme under government policy but SID in the dry zone may be more than 0.7 because of the low and irregular rainfall pattern and risk mitigation. Again in the same delta area, SID of Myaung Mya township (irrigated) and Thone Gwa township (rainfed) are totally different even though the cropping intensity of both townships is nearly 200 per cent.

3.6 Environmental problems

In order to address environmental problems, the National Commission for Environmental Affairs (NCEA) was formed under the Ministry of Foreign Affairs. The various ministries have been cooperating with NCEA, which is acting as a coordination agency and has no executive power. At the moment, the agricultural sector is paying much attention to increasing production and therefore has not paid enough attention to agriculture-related environmental problems such as deforestation and the depletion of wet lands leading to the loss of biodiversity and soil erosion even though the government has launched highland soil conservation programmes for soil erosion control and a gene bank for ex-situ conservation of crop varieties. At the same time, more powerful organizations such as a Ministry of the Environment should be created to handle all environmental affairs with the proper enactment of environmental protection law. Without such an organization and law, it will be very difficult to implement Environmental Impact Assessment (EIA).

According to the estimates, deforestation in Myanmar is about 500,000 acres per annum even though replanting of new trees does occur. Whatever the exact depletion rate, the current trend of deforestation is not good for a population growing at 2.02 per cent per annum with almost total reliance on wood fuel for cooking. The main contributor to deforestation is poverty. Generally, forests are encroached for wood fuel extraction and for the expansion of agricultural land to increase production horizontally. Whenever the environment is discussed, the depletion of forests leading to the loss of bio-diversity comes first. In this regard, we should not forget about the loss of biodiversity of existing local crop cultivars, which may have been grown for hundreds of years. With the introduction of HYVs, farmers gradually forget to conserve their land race varieties leading to the genetic erosion.

3.7 Summary

Myanmar has diverse agro-ecological conditions and a good land-man ratio, which is suitable and has the potential for growing many different kinds of crop. Even though the country has a relatively high SID, there is room to promote diversification in the country. Since the roots or main cause of environmental problems is poverty, sustainable income generation through crop/agriculture diversification could be used to alleviate poverty.

4. Historical and Current Status of CGPRT and Other Crops

4.1 Crop production

In Myanmar, more than 60 different crops are grown based on the prevalence of different agro-ecological zones. The total crop area including both seasonal and perennial crops amounted to 15.85 million hectares in 2001-2002. Thus, the country's cropping intensity was 149 per cent. These crops can be generally grouped into the following categories, as presented in Table 4.1.

Table 4.1 Different crops' sown area in Myanmar (2001-2002)

Crop group	Major crops	Sown area ('000 hectare)	%
Cereal crops	Rice, wheat, maize, sorghum	7,233	46
Oilseed crops	Groundnut, sesame, sunflower, mustard, niger, oil palm	2,635	17
Pulses	Black gram, green gram, pigeonpea, soybean, cowpea, other pulses	3,196	20
Industrial crops	Cotton, jute, sugarcane, rubber, coffee, mulberry	826	5
Culinary crops	Onion, garlic, dried chili, potato	219	1
Vegetables	Green chili, lowland and highland produce of vegetables	318	2
Fruits	Banana, coconut, lowland and highland produce of fruits	481	3
Other crops	Medicinal, non-edible plants such as nipa plant	937	6
Multiple crop sown area		15,845	100
Net sown area		10,615	-

Source: Settlement and Land Record Department, MOAI.
Note: Net sown area including other areas on which crops are cultivated.

As can be seen, cereal crops constitute the largest share with 46 per cent of the multiple crop sown area followed by pulses and oilseeds. Out of the 7.23 million hectares for cereal crops, the area planted to paddy accounts for 6.45 million hectares.

Based on seasonal planting, the area cultivated in the monsoon (or) rainy season accounts for over 10.68 million hectares, 67 per cent of the total multiple crop sown area. After that, crop cultivation during the cool season is second, followed by the area cultivated during the pre-monsoon or summer season. The success of the country's crop production, therefore, relies on the cultivated area during monsoon season.

As mentioned in the previous chapter, crop cultivation in Myanmar depends on two different sources of water, namely rainfall including residual soil moisture and irrigation. The southwest monsoon is the major source of rainfall. An area of over 10.68 million hectares in 2001-2002 relied on rainfall while the irrigated crop area was 2.52 million hectares, of which paddy constituted 73 per cent of total irrigated area, followed by sesame, industrial crops and other major crops in that order. For small plots of high-value vegetables in the cool and summer season, farmers often practice hand watering and use irrigation water from tube well.

4.2 CGPRT crops

Based on domestic market demand and opportunities of external trade, the most important CGPRT crops in the country are maize, pulses and potato. The basic, important facts of prominent CGPRT crops are summarized as follows:

Maize is the most important feed grain in the country. It is in demand from the local feed industry and is one of the exportable commodities.

Pulses are considered as a vegetable protein source for domestic consumption. In addition, it is a prominent export commodity for the country, and accounted for over 1 million metric tons in 2001-2002. Thus, it has the lion's share of export volume in the agricultural sector. Among the different pulses, black gram, green gram, pigeonpea and soybean are the most important crops. The first three play a vital role due to their largest share of the pulses' sown area and export volume. After that, soybean, soybean cake and soybean oil are important commodities due to rising demand in the domestic market.

Potato is known as a culinary crop in Myanmar. It is grown for domestic utilization and consumed as different types of meal such as chicken with potato, beef with potato and, vegetables and potato mixture. Both fresh and processed potatoes are widely consumed among consumers. Particularly, potato consumption in urban areas is on the rise due to an increased acceptance of western-style food such as French fries and potato chips etc.

The final main CGPRT crops are sorghum and cassava, which are relatively insignificant compared to maize, pulses and potato. With regards to sorghum, the country's main producing area is the central dry zone region. At the young plant stage, it is used as an animal feed and at times sorghum grain is used as food in rural areas. The area planted to sorghum in 2001-2002 was 0.230 million hectares and total production was estimated to be 0.159 million metric tons. The country's cassava sown area accounts for 11 thousand hectares, with total production at 0.13 million metric tons. It is mainly marketed as tapioca and glue in the local market. In addition, fresh cassava root or the tuber is consumed as a snacks.

4.2.1 Maize

In Myanmar, demand for maize can be classified into domestic feed grain and exports. On the production side, it is an important crop for poultry farms to supply an increasing demand of meat consumption. Put another way, consumers in the country do not buy maize grain, but instead, the products made from the maize, namely chicken meat. For this reason, some economists stress that the demand of maize, therefore, is called derived demand. Due to changes in consumption patterns, meat consumption such as fish, seafood, chicken, beef etc. is growing in urban and rural areas depending on household income, preference and available meat source.

4.2.1.1 Production

As mentioned above, demand for maize in the country is on the increase. The increasing trend of the country's maize production can be found during one decade from 1992-1993 to 2001-2002. The area planted to maize in 1992-1993 accounted for 0.156 million hectares. It increased by 60 per cent, or 0.095 million hectares, to 0.251 million hectares in 2001-2002. Maize is cultivated in both the rainy and the cool season. The area planted to maize in 2001-2002 accounted for 0.251 million hectares. The rainy season crop contributes 86 per cent of the country's total sown area. During the rainy season, planting starts in May and harvesting begins in September. Thus, the first harvest comes to market from September. As regards the cool season crop, sowing is from November to December and harvesting starts in February.

Table 4.2 Maize cultivation by season in Myanmar

Season	Main producing area	Importance (High/middle/low)	Time of sowing	Time of harvesting
Rainy season	Central dry zone region	H	May-Jun	Sep-Oct
	Southern Shan state in hilly region	H	May-Jun	Sep-Oct
Cool season	Lower Myanmar	H	Nov-Dec	Feb-Mar

Note: 1) Rainy season maize is mainly grown on Ya land.
2) After harvesting maize, pulses are grown as a second crop.

The average yield of maize increased from 1,518 kg per hectare in 1992-1993 to 2,124 kg per hectare in 2001-2002. Due to increasing maize sown area and yield per hectare, the country's aggregate production reached 0.532 million metric tons in 2001-2002.

Table 4.3 Changes in the country's maize area, yield and production (1992-1993 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)
1992-1993	156	137	1,518	208
1993-1994	150	133	1,534	205
1994-1995	171	167	1,706	284
1995-1996	167	162	1,700	275
1996-1997	167	165	1,732	286
1997-1998	162	161	1,919	308
1998-1999	188	183	1,650	303
1999-2000	210	203	1,716	349
2000-2001	217	211	1,730	365
2001-2002	251	250	2,124	532

Source: Settlement and Land Record Department, MOAI.

Considering the maize sown area by region, the hilly region has the largest share in Myanmar. The hilly region constitutes 55 per cent of the national sown area and the central dry zone region has the second largest sown area at 41 per cent. Maize cultivation in the coastal region is negligible.

Table 4.4 Maize production by region (2001-2002)

Region	Sown area ('000 ha)			Yield (kg/ha)	Production ('000 mt)
	Monsoon season	Cool season	Total		
Delta region	1	11	12	3,069	37
Central dry zone region	80	22	102	2,142	217
Hilly region	136	1	137	2,026	278
Coastal region	*	-	*	375	*
Total	**217**	**34**	**251**	**2,124**	**532**

Source: Settlement and Land Record Department (MOAI).
* less than 500 ha.

In order to increase maize production, hybrid maize research and development was initiated in the Central Agricultural Research Institute (CARI) in Yezin, located near Pyinmana Township in Mandalay division and four hybrid varieties were released in 1990-1991, 1993-1994 and 1996-1997. These four hybrid varieties have a yielding advantage of 35-40 per cent over existing open pollinated varieties. These varieties are called Yezin hybrid 1, 2, 3 and 4, of which hybrid variety 1, 2 and 4 are of medium-early maturity, high yielding and adapt excellently to lowland areas and Yezin hybrid 3 is fit for highland areas. The last hybrid variety is called Yezin 5. Based on the survey results, Yezin hybrid variety 2, 3, 4 and 5 are widely grown in the main producing areas.

National researchers and extension workers organize the maize farmers in main surplus-producing areas to adopt hybrid varieties instead of open-pollinated varieties (High Yielding Variety-HYV). For the purpose of seed multiplication, CARI provides inbred lines and hybrid

maize seed production technology to contract farmers who collaborate with national researchers. This hybrid seed production programme is conducted in the surrounding areas of Pyinmana Township, which is not far from CARI so researchers can assist contract farmers.

Apart from CARI's hybrid seed, CHAROEN POKPHAND group (CP group), a private company based in Thailand supplies hybrid seeds to maize farmers on a contract farming basis. The farmers are assured through local authorized agents to buy back their quality product at market price. Thus, the area planted to hybrid variety in 2001-2002 accounted for **30 per cent** of the country's total.

4.2.1.2 Production and marketing cost of maize (central dry zone)

As mentioned, CARI distributes its hybrid seeds to maize farmers for the production of grain and also collaborates with contract farmers to produce hybrid seeds. For this study production costs and profit margin returns of hybrid seed producing farmers and hybrid grain producing farmers were selected as samples in Pyinmana Township located in the southern part of Mandalay division known as the central dry zone region.

The sample farmers grew hybrid maize in the monsoon season 2003. The survey results show that hybrid seed producing farmers make more profit than the hybrid maize grain producing farmers. The reason is that the price of hybrid seed is higher than that of hybrid grain. Hybrid seed is purchased by CARI at a price of 160 kyat/kg and the marketing price of maize grain was 65 kyat/kg at the time of survey. Based on the survey results, farmers in Pyinmana Township sold their maize at the nearest market town of Pyinmana. For this, horse cart drivers deliver the maize to wholesalers and received 100 kyats/basket (18 viss = 29 kg) for commission fees, which are paid by maize farmers. To be clear of the facts, the profit margin returns of two sample farmers are presented in Table 4.5.

Table 4.5 Production and marketing costs of hybrid maize seed production and hybrid grain production during the monsoon season

Particular	Unit	Sample farmer who produces hybrid seed (Yezin hybrid-4)	Sample farmer who uses hybrid seed for grain production (Yezin hybrid-4)
1. Labour cost	Kyat/ha	154,190	112,208
2. Buying value of agro-input	Kyat/ha	36,941	41,389
3. Transport and handling cost of agro-input	Kyat/ha	3,830	3,978
4. Land tax	Kyat/ha	9	9
5. Interest of loan	Kyat/ha	-	-
6. Production costs	Kyat/ha	194,970	157,584
7. Marketing costs for selling maize	Kyat/ha	3,707	11,367
8. Production and marketing costs (6) + (7)	Kyat/ha	**198,677**	**168,951**
9. Yield and returns			
a) Yield	Kg/ha	2,322	3,340
b) By-product of maize husk	Kg/ha	343	442
c) Selling price			
Seed purpose	Kyat/kg	160	-
Grain purpose	Kyat/kg	64	65
Husk	Kyat/kg	31	28
d) Returns		**277,609**	**229,476**
Seed purpose	Kyat/ha	197,280 (1,233 kg x 160)	-
Grain purpose	Kyat/ha	69,696 (1,089 kg x 64)	217,100 (3,340 kg x 65)
Husk	Kyat/ha	10,633 (31 kg x 343)	12,376 (442 kg x 28)
10. Profit margin (9-d) - (8)	Kyat/ha	**78,932**	**60,525**
	US$/ha	87.70	67.25

Source: Market survey team.

Note: 1) At the time of survey in October 2003, 900 kyats = US$ 1.
2) This survey was conducted in Pyinmana Township during October 2003, the main surplus-producing area located in Mandalay division.
3) Labour cost includes family labour and hired labour. Family labour is calculated as an opportunity cost.
4) Production cost is referred to as variable cost.
5) Sample farmers use their own working capital to buy agro-inputs or hired labour which is not calculated as an opportunity cost.
6) For selling the crop, sample farmers incurred marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There is no marketing cost if sample farmers sell their crop directly from their farms.

Based on the survey results, sample farmers who produced hybrid seed, obtained 18,407 kyats/hectare (78,932-60,525) which equals US$ 20.45 more than the profit farmers who grew hybrid grain made. The most important thing is that the hybrid seed producing farmers invest more compared to hybrid grain producing farmers. In this case, the following points are considered for the net profit margin:

- Hybrid seed producing farmers spend 29,726 kyats (198,677-168,591) more than hybrid grain producing farmers.
- At the same time, the added return accounts for 48,133 kyats (277,609-229,476).
- Thus, the profit margin of hybrid seed producing farmers is **18,407 kyats** (48,133-29,726).
- An added cost of 29,726 kyats (198,677-168,951) is incurred if the hybrid seed producing farmer borrows money from a moneylender. The opportunity cost of interest is 4,459 kyats (29,726 x 5 per cent/month x 3 months).
- The opportunity cost is an important issue. Thus, added cost is considered as an opportunity cost.
- From the standpoint of the opportunity cost of interest, net margin returns of the hybrid seed producing farmers account for 13,948 kyats (18,407-4,459), which is equal to (US$ 15.50) per hectare[1].

Table 4.6 Profit margin for hybrid seed production sample farmers

	Particular	Sample farmer who produces hybrid seed (kyat/hectare)
1.	Added cost (198,677-168,951)	29,726
2.	Added return (277,609-229,476)	48,133
3.	Profit margin (2)-(1)	18,407 (US$ 20.05)
4.	Opportunity cost of interest for added cost (29,726 x 5 % per month x 3 months)	4,459 (US$ 4.95)
5.	Net margin return to hybrid seed producing farmer (18,407-44,59)	13,948 (US$ 15.5)

Note: At the time of survey in October 2003, 900 kyats= US$ 1.

4.2.1.3 Production and marketing cost of maize (hilly region)

Contract farming of maize is practiced in the main surplus-producing area of Taunggyi and Aungban located in southern Shan, one of the hilly region areas. According to market reconnaissance, CP Company provides not only hybrid maize seed (CP888 variety) but also chemical fertilizer such as urea and Triple Super Phosphate (TSP) to farmers. All agro-inputs are sold to the contract farmers on credit which is repaid to CP Company at the time of harvest. At the same time, company staff assist the maize farmers with the adoption of hybrid seed production technology.

After maize harvest, farmers sell their produce to the company at prevailing market prices. CP Company established shelling machines and dryers in the main surplus producing area. Profit margin returns of maize farmers in southern Shan state is presented in Table 4.7.

[1] This calculation is referred to as partial budget analysis.

Table 4.7 Production and marketing costs of sample farmers in southern Shan state

Particulars	Unit	Yezin hybrid-3	High yielding variety	Hybrid variety CP-888
Labour cost	Kyat/ha	66,099	70,510	78,607
Buying value of agro-input	Kyat/ha	43,860	72,425	155,507
Transport and handling cost of agro-input	Kyat/ha	2,595	7,215	541
Land tax	Kyat/ha	3	3	3
Interest of loan	Kyat/ha	25,945	-	-
Production cost	Kyat/ha	**138,502**	**150,153**	**234,658**
Marketing cost	Kyat/ha	11,317	618	At the farm
Production and marketing cost	Kyat/ha	**149,819**	**150,771**	**234,658**
Yield	Kg/ha	3,631	3,026	4,841
Selling price	Kyat/kg			
- Grain purpose	Kyat/kg	**52**	58	58
Returns	**Kyat**	**188,812**	**175,508**	**280,778**
- Seed purpose		-	-	-
- Grain purpose		188,812	175,508	280,778
Profit margin	Kyat/ha	38,993	24,737	46,120
	US$	43	27	51

Source: Market survey team.

Note: 1) Survey data refers to rainy season production.
2) At the time of survey in October 2003, 900 kyats = US$ 1.
3) 1 hectare = 2.471 acres
4) Labour cost includes family labour and hired labour. Family labour is calculated as an opportunity cost.
5) Production cost is referred to as variable cost.
6) Sample farmers borrowed working capital from moneylenders at an interest rate of 7 per cent per month.
7) Sample farmers use their own working capital to buy agro-inputs or hired labour which is not calculated as an opportunity cost.
8) For selling the crop, sample farmers incur marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There is no marketing cost if sample farmers sell their crop directly from their farms.

As already established, hybrid seed producing farmers gain better profit margins compared to grain producing farmers. On the basis of the survey data, the application of urea fertilizer shows that sample farmers who grow Yezin hybrid variety 3 for grain production use one bag (50 kg) of urea fertilizer. In this case, the output-to-input price ratio is important to maize farmers.

In Table 4.7, the sample farmer who grows Yezin hybrid variety 3 received 38,993 kyats/hectare (US$ 43). At the time of survey, the selling price of maize for farmers was 52 kyats/kg and urea fertilizer price was 12,000 kyats/50 kg bag or 240 kyats/kg, which was the buying price for sample farmers during the maize planting time. Thus, the output-to-input price ratio is **0.22**. Put another way, the selling price of maize is **1** kyat/kg while urea price is **4.6** kyats/kg (240/52 = 4.6). Therefore, the price of urea is higher than that of maize.

Thus, some farmers in the survey area cannot use sufficient amounts of urea fertilizer due to insufficient working capital. Based on maize price and urea price, the amount of fertilizer to be used for profit maximization for the farmers was calculated in this analysis. For this, CARI calculated the relationship between urea fertilizer in terms of nitrogen and maize yield. The fertilizer responsive curve for hybrid maize is $Y = 1521.6 + 45.092\ N - 0.1222\ N^2$. From this equation, 75 kg of urea fertilizer[2] (1.5 bags of urea per acre) is the maximum profit return for farmers who grow Yezin hybrid variety-3 based on urea fertilizer price and maize price.

[2] *$Y = 1521.6 + 45.092\ N - 0.1222\ N^2$*
P_F = urea price = 240 kyats/kg = 108.84 kyats/lb
P_M = maize price = 52 kyats/kg = 23.58 kyats/lb
$Y = (P_F/P_M - a)/2b$
= (108.84/23.58 – 45.092)/ 2(-0.1222)
= 165.6 lb = 75 kg = 1.5 bag (1 bag of urea = 50 kg)

4.2.1.4 Consumption

As we discussed earlier, maize is not used for direct human consumption and consumers purchase products made from maize such as chicken and chicken eggs etc. Consequently, maize is an important feed grain in the country. Consumption levels of meat in urban and rural households can be observed in Table 4.8.

Table 4.8 Per capita consumption of meat in urban and rural households (2001)

Commodity	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	(viss/month)		(kg/month)		(viss/year)		(kg/year)	
Meat	**0.71**	**0.48**	**1.16**	**0.78**	**8.52**	**5.76**	**13.92**	9.36
Chicken	0.30	0.15	0.49	0.24	3.60	1.80	5.88	2.88
Duck	0.01	0.02	0.02	0.03	0.12	0.24	0.24	0.36
Beef	0.16	0.16	0.26	0.26	1.92	1.92	3.12	3.12
Pork	0.19	0.12	0.31	0.20	2.28	1.44	3.72	2.40
Mutton	0.03	0.01	0.05	0.02	0.36	0.12	0.60	0.24
Others	0.02	0.02	0.03	0.03	0.24	0.24	0.36	0.36
Eggs	**8.39**	**5.26**	-	-	**101**	**63**	**-**	-
Fish	0.60	0.62	0.98	1.01	7.20	7.44	11.76	12.12
Fish products	0.16	0.19	0.26	0.31	1.92	2.28	3.12	3.72

Source: Central Statistical Organization (CSO), 2002, Statistical Yearbook.
Note: 1 viss = 3.6 lb, 1 kg = 2.205 lb.

As can be seen, consumption levels of chicken meat are higher than that of other meats in urban households. It is also found that consumption of fish is more than that of meat. The reason is that consumers in delta and coastal regions have more availability of fish compared to inland areas. For the long-term, it is expected that meat consumption will increase due to the growing population. Put another way, demand for maize in the country will be on the increase.

In Myanmar, maize mixed with rice is consumed in some areas in Chin state located in the northern part of the country, which is known as the hilly region. The reason is that Chin state is a rice deficit area of the country. In addition, the area planted to green maize in 2001-2002 amounted to 0.19 million hectares of which 53 per cent of the country's total is mainly grown in the cool season. It is widely consumed as snacks. Nowadays, some people in the country avoid smoking, which is harmful to health. However, some people in urban and rural areas are used to smoking cheroot, which normally use leaves of the *sebestern* tree (*thanafat* in Burmese) as wrapping. The husk of maize could be used as a replacement to sebestern leaves. In addition, maize husk is used as a filter tip for producing cheroot. Maize farmers, therefore, can obtain income from the by-products of maize husk. At the time of survey, the farm gate price of maize husk was 28-31 kyats/kg in Pyinmana Township, the main surplus-producing area.

4.2.1.5 Marketing system

In the domestic marketing system, the actors are the farmers, traders, the local feed industry and the commercial poultry farms and are in finely tuned cooperation. Maize from the main surplus-producing area is supplied to the urban wholesale market.

Product variety. On the production side, there are two types of maize variety: open pollinated variety and hybrid variety (HYV). However, maize grain price makes no reference to variety in the domestic market. Regarding maize seed marketing, the price of the hybrid variety is expensive compared to the open pollinated variety.

Product quality. The most important quality factors in determining the price paid by collectors and large-scale wholesalers in the main surplus-producing area are moisture content and black kernel. The survey results show that if maize to be purchased has a 15 per cent moisture content, wholesalers try to sun-dry it. By doing this, 10 per cent of the weight is reduced. The first harvest of maize in September has an 18-20 per cent moisture content. The main objective of drying maize is to reduce the moisture content so that spoilage will not occur before storing or marketing. To cover the reduction in weight and the handling costs, collectors

and large-scale wholesalers in the main producing areas purchase the maize at a low price from farmers depending on the moisture content. The buyers prefer a yellowish colour in the domestic market. Moisture content is the major concern in the local market, especially in the harvesting season. It is found that moisture content is not measured by mechanical devices. The experienced collectors and wholesalers can determine the moisture content by grabbing some maize grains from the polypropylene bags, which are to be delivered to traders, just as accurately as using a device for measuring. In the domestic market, maize is called yellow maize by local exporters. According to market reconnaissance, the specification of Fair Average Quality (FAQ) adopted by local exporters is presented in Table 4.9.

Table 4.9 Specification of maize quality (%)

Foreign matter	1.00 Max.
Weevil seeds	5.00 Max.
Damage otherwise	6.00 Max.
Other coloured seeds	6.00 Max.
Broken seeds	2.00 Max.
Moisture content	14.00 Max.

Source: MAS, trade section
Note: Max. = maximum.

Marketing unit. In Myanmar, non-metric measures such as lb, ton, mile, yard and gallon etc. are familiar with traders; it was adopted before the country's independence[3] era. Besides, Myanmar's measures of weight are based on the viss (1 viss = 3.6 lb = 1.63 kg) and volume is based on the basket. These are applied in the present agricultural marketing system. Normally, most farmers in rural areas sell their produce such as paddy, maize, oilseeds and pulses based on volume at the farm. Primary collectors (village brokers) and agents use volume basis for their crop purchasing. Small- and large-scale wholesalers apply the amount of maize per basket. Put another way, wholesalers in the local market and urban market refer to an imperial weight basis. For the long-term, a metric system should be applied for high-value crops. For exports, local exporters apply a metric system.

Table 4.10 Wholesale price quotation of maize in different local markets

Market	Price quotation of maize	
	(viss)	(kg)
Yangon wholesale market	54	88
Mandalay wholesale market	54	88
Taunggyi market in southern Shan state	1	1.63
Aungban market in southern Shan state	1	1.63
Pakokku market in Magway division	18	29
Monywa market in Sagaing division	18	29

Source: MIS price bulletin, DAP, MOAI.

Packaging material. Collectors and large-scale wholesalers normally use polypropylene bags for packing maize. At the time of survey, price of PP bags was in the range of 57 to 85 kyats per bag.

Intermediaries. The marketing channel of maize in the country involves different actors such as farmers, collectors, small- and large-scale wholesalers, exporters, the feed industry and commercial poultry farms, all dependant on the main surplus-producing area, local markets, urban markets and transit markets. Transporters play a vital role in delivering maize from one place to another or from the local market to the urban market. In the domestic market, the transport cost is influenced by the availability of trucks, number of commodities to be transported and fuel cost. If the number of commodities to be transported is more than the capacity of trucks, transport costs become high. In addition, transport costs vary depending on

[3] Myanmar (Burma) was under the British rule lasting over 100 years but gained independence in 1948.

the type of commodity to be transported: bulky or dense. Cotton, maize husk and snacks etc. are bulky commodities and rice, maize, pulses and onion etc. are dense commodities. The transporter applies more charges for bulky commodities. In the Mandalay market, the large-scale wholesaler interviewed was involved in normal trading and commission basis buying. For the Yangon exporter, the wholesalers purchase maize and receive 1 per cent commission on the buying value.

Inter-state/Division trade. As noted earlier, 86 per cent of maize is grown in the rainy season. Maize from the main surplus-producing area is marketed to Mandalay and Yangon wholesale markets. The biggest inter-state/division trade flows observed are:

- Pyinmana Township in Mandalay division to Yangon and Mandalay market
- Sagaing division to Mandalay market
- Northern Shan state to Mandalay market
- Mandalay market to Yangon market
- Pakokku market in the northern part of Magway division to Yangon market
- Southern Shan state to Yangon market

Market information. The country's MIS under MOAI disseminates market information by means of the weekly Agri-Business News and a monthly price bulletin. Put another way, 4.8 million farm families cannot receive up-to-date market information. If farmers knew up-to-date, accurate information, they could:

- Negotiate with traders
- Know when to sell
- Know where to sell
- Plan crop production in line with market demand

The present dissemination system for market information cannot fully assist farmers. Thus, farmers rely on neighbouring farmers who have returned from the nearest town, transporters such as bus drivers, boat drivers, the Agri-Business News and extension staff. However, traders have good advantage compared to farmers. The reasons being:

- Local traders find out market information from the Traders' Association (Crop Exchange Centre).
- Traders in urban markets or large towns exchange market information with small-scale wholesalers or collectors in main producing areas by telephone.
- Some Traders' Associations collate the wholesale price of agricultural commodities which are marketed in the compound of the association and distribute market information sheets to their members at a cost.
- Traders who have internet or e-mail facilities can find out local market information and export market information from www.eTradeMyanmar.com.

Thus, transparency of market information is essential for every one who is involved in production and marketing in order to know the market price, supply volume and export market demand.

Marketing channel. Based on market reconnaissance, the maize marketing chain from farmer to feed industry or local exporter is mentioned in Annex A.

Maize exports. According to market reconnaissance, exporters from Mandalay market deliver maize to Muse town located on the Chinese border and it is sold to trading partners in China by means of border trade. Yangon exporters are involved in overseas trade, mainly to Bangladesh, Singapore and Malaysia. The country's maize production and export volume during one decade is presented in Table 4.11.

Table 4.11 The country's maize production and exports ('000 mt)

Year	Production	Exports	Percentage of exports
1992-1993	208	44	21
1993-1994	205	40	19
1994-1995	284	70	25
1995-1996	275	62	23
1996-1997	286	103	36
1997-1998	308	50	16
1998-1999	303	174	57
1999-2000	349	89	26
2000-2001	365	148	41
2001-2002 (provisional)	532	90	17

Source: Maize export figure based on Selected Monthly Indicators, CSO.
Maize production is referred to SLRD, MOAI.

Feed requirement of poultry farms: As previously mentioned, 72 per cent of the country's population lives in rural areas and their income is mainly derived from agriculture and livestock farming. The country's animal population has increased over a short-term period and is presented in Table 4.12.

Table 4.12 The country's animal population (Number in millions)

Species	1996-1997	2001-2002	Average growth rate*	2002-2003
Cattle	10.31	11.22	1.7	11.55
Buffalo	2.30	2.51	1.8	2.55
Sheep and goat	1.64	1.84	2.3	1.97
Pig	3.40	4.14	4.0	4.50
Poultry	33.37	48.27	7.7	57.13
Duck	5.63	6.83	3.9	7.29

Source: Prepared by Dr. Tin Maung Oo, LBVD, Livestock Breeding and Veterinary Department.
Note: * This calculation based on $Pn=P0\ (1+r)^n$

As shown in Table 4.12, poultry growth shows the highest level in total animal population. The feed requirement for poultry for 2002-2003 is estimated to be 500 thousand metric tons, as can be seen in Table 4.13.

Table 4.13 Estimated feed requirement for poultry for 2002-2003 (mt)

Name of feedstuff	Feed ratio (%)	Total requirement
Broken rice	37	262,680
Rice bran	13	35,760
Maize (yellow maize)	14	107,280
Oil cake	20	64,920
Dry fish and shell	16	29,160
Total	**100**	**499,800**

Source: Prepared by Dr. Tin Maung Oo, LBVD, Livestock Breeding and Veterinary Department.
Note: Of the total 31 feed mills, the government owns 5 mills, the private sector owns 19 mills and foreign companies are invested in 7 mills.

Regarding compound feed production, there are 20 compound feed mills, of which 12 mills are in Yangon, 5 mills in Mandalay and 3 mills in other towns. A number of small-scale feed mills which can produce 1 to 2 tons per day have been established in livestock populated areas. In Yangon, the average capacity of production of these mills is 60 tons per day. Five feed mills in Mandalay have the capacity to produce 50 tons of feed per day. The total production of feed is estimated to be 0.26 million metric tons per year. About 70 per cent of feed produced in Yangon City is for fish meal and the rest is for pig and poultry. Most of the small-scale farmers feed their animals with home mixed feed or feed compound from the feed mills in accordance

with their own preferred ration formula[4]. Compound feed mills and capacity are mentioned in Table 4.14.

Table 4.14 Compound feed mills

Location	Name of feed mill	Capacity		Remark
		ton/day	ton/year	
Yangon City	Thein Than Win	40	9,600	Private
	CP company	100	24,000	Private
	May Kha	80	19,200	Private
	Sein Pan	30	7,200	Private
	Anawarmon	60	14,400	Private
	Golden Flower	80	19,200	Private
	Top	30	7,200	Private
	Nay La	20	4,800	Private
	B & B	30	7,200	Private
	Super power	50	12,000	Private
	Moon Light	30	7,200	Private
	LFME	133	31,920	Government
	Total (12)	**683**	**163,920**	
Mandalay	Sampya	50	12,000	Private
	Thein Gabar	50	12,000	Private
	CP company	40	9,600	Private
	May Kha	32	7,680	Private
	Shwe Win Oo	60	14,400	Private
	Total (5)	**232**	**55,680**	
Other cities				
Shwe Bo	KT	100	24,000	Private
Taunggyi	Techaung	60	14,400	Private
Loikaw	Nyein Chan Ye	20	4,800	Private
	Total (3)	**180**	**43,200**	
	Grand total	**1,095**	**262,800**	

Source: Prepared by Dr. Tin Maung Oo, LBVD, Livestock Breeding and Veterinary Department.

4.2.2 Pulses

People consume food for their health, growth and normal life. In Myanmar pulses are a good source of vegetable protein for consumers after meat, eggs and fish. Because of this, pulses are considered an important crop for domestic consumption. From an economic standpoint, pulses' production and marketing play a vital role in the country. The reason is that pulses makes up the lion's share of export value in the agricultural sector. In addition, farmers, traders, transporters, local exporters and pulses' millers are all involved in the marketing chain. On the whole, pulses are important to the country to supply the demand for domestic consumption and the rising demand of exports.

As discussed earlier, a centrally-planned economic system was adopted in Myanmar, lasting about a quarter of century. During this period, some pulses[5] to be exported were purchased from farmers at a fixed price by the state marketing board and exports of pulses were monopolized by the government.

In 1988, the government reformed its economic policy, transforming from a centrally-planned economy to a market-oriented economy. At the same time, the government abolished its direct involvement in pulses' production and marketing and encouraged the private sector to play a larger role. From then on, the country's exports of pulses showed an increasing trend during the trade liberalization period.

[4] Prepared by Dr. Tin Maung Oo, LBVD, Livestock Breeding and Veterinary Department.
[5] Black gram, green gram, pigeonpea, butter bean, rice bean and sultani/sultapya are purchased by the state.

4.2.2.1 Production

Based on the time-series data from 1962-1963 to 1987-1988, the sown area of pulses was in the range of 0.69 million to 0.82 million hectares. After reforming the national economic policy, it increased dramatically due to trade liberalization and strong demand for export. Thus, the area planted to pulses increased from 0.73 million hectares in 1987-1988 to 3.2 million hectares in 2001-2002.

With regard to the cultivation of pulses, the most productive area is located in the central dry zone region, followed by the delta region, the hilly region and then the coastal region. The pulses' sown in different regions are presented in Table 4.15.

Table 4.15 The country's production of pulses by region in 2001-2002

Region	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)
Central dry zone region	**1,779**	**1,766**	**810**	**1,430**
Magway division	666	665	737	490
Mandalay division	463	457	760	347
Sagaing division	650	644	920	593
Delta region	**1,192**	**1,189**	**871**	**1,035**
Ayeyarwady division	532	530	870	461
Yangon division	124	124	759	94
Bago division				
- Eastern part	290	290	974	282
-Western part	213	212	798	168
Mon state	33	33	907	30
Hilly region	**186**	**185**	**876**	**162**
Kachin state	16	16	1174	19
Kayah state	13	13	624	8
Kayin state	26	25	793	20
Chin state	14	14	678	10
Shan state				
-Southern	58	58	896	52
-Northern	45	45	866	39
-Eastern	14	14	915	14
Coastal region	**39**	**39**	**744**	**29**
Yakhine state	38	38	745	29
Tanintharyi division	1	1	433	*
Total	**3,196**	**3,179**	**835**	**2,656**

Source: Settlement and Land Record Department (MOAI).
Note: * in trace.

According to seasonal production statistics, the area sown to pulses in the cool season accounts for 64 per cent of national production and the rest is grown in the rainy season, mainly in the central dry zone region. The reason is that this region has less precipitation in the rainy season compared to other regions and pulses are grown on most Ya land which is widely located in this region. As noted earlier, the country has a wide range of agro-ecological zones. Because of this, the same crop can be produced in different seasons. The best known example is that of green gram which can be grown as a rainy season crop in Central Myanmar and as a cool season crop in Lower Myanmar. The pulses sown in different seasons can be observed in Table 4.16.

Table 4.16 Pulses sown area in different seasons (2001-2002)

Pulses	Sown area ('000 ha)			Yield (kg/ha)	Production ('000 ha)	Percentage on total production
	Rainy season	Cool season	Total			
Green gram	408	339	747	779	578	21.8
Black gram	2	720	722	884	635	23.9
Pigeonpea	484	-	484	964	466	17.5
Chickpea	-	196	196	995	194	7.3
Bocake	*	138	138	838	115	4.3
Cowpea	21	108	129	804	104	3.9
Soybean	51	67	118	1023	121	4.6
Lablab bean	16	69	85	743	63	2.4
Sultapya	4	53	57	875	50	1.9
Garden pea	-	42	42	801	34	1.3
Others	162	316	478	628	296	11.1
Total	**1,148**	**2,048**	**3,196**	**835**	**2,656**	-
%	36	64	100			100

Source: Settlement and Land Record Department (MOAI).
Note: * in trace.

4.2.2.2 Consumption

According to the Statistical Yearbook 2002, monthly per capita consumption of pulses is 0.41 kg (0.25 viss) in urban households and 0.34 kg (0.21 viss) in rural households. Based on per capita consumption, Chin state in the hilly region located near the Indian border consumes more pulses, followed by southern and eastern Shan state, the central dry zone region and then the western part of Bago division in that order. Per capita consumption of pulses was 4.92 kg/year (3 viss) in urban households and 4.08 kg/year (2.52 viss) in rural households.

Table 4.17 Per capita consumption of pulses in urban and rural households (2001)

Region	Population	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	('000)	(viss/month)		(kg/month)		(viss/year)		(kg/year)	
Central dry zone region									
Magway division	4,675	0.26	0.23	0.42	0.37	3.12	2.76	5.04	4.44
Mandalay division	6,935	0.30	0.29	0.49	0.47	3.60	3.48	5.88	5.64
Sagaing division	5,418	0.30	0.31	0.49	0.51	3.60	3.72	5.88	6.12
Delta region									
Ayeyarwady division	6,921	0.21	0.13	0.34	0.21	2.52	1.56	4.08	2.52
Yangon division	5,801	0.23	0.16	0.37	0.26	2.76	1.92	4.44	3.12
Bago division	5,146								
- Eastern part		0.29	0.19	0.47	0.31	3.48	2.28	5.64	3.72
- Western part		0.38	0.21	0.62	0.34	4.56	2.52	7.44	4.08
Mon state	2,548	0.23	0.12	0.37	0.20	2.76	1.44	4.44	2.40
Hilly region									
Kachin state	1,308	0.26	0.15	0.42	0.24	3.12	1.80	5.04	2.88
Kayah state	277	0.18	0.10	0.29	0.16	2.16	1.20	3.48	1.92
Kayin state	1,512	0.17	0.15	0.28	0.24	2.04	1.80	3.36	2.88
Chin state	480	0.75	1.29	1.22	2.10	9.00	15.48	14.64	25.20
Shan state	4,904								
- Southern		0.48	0.35	0.78	0.57	5.76	4.20	9.36	6.84
- Northern		0.25	0.27	0.41	0.44	3.00	3.24	4.92	5.28
- Eastern		0.30	0.30	0.49	0.49	3.60	3.60	5.88	5.88
Coastal region									
Yakhine state	2,812	0.13	0.14	0.21	0.23	1.56	1.68	2.52	2.76
Tanninthary division	1,388	0.06	0.06	0.10	0.10	0.72	0.72	1.20	1.20
Union	**50,125**	**0.25**	**0.21**	**0.41**	**0.34**	**3.00**	**2.52**	**4.92**	**4.08**

Source: CSO, 2002, Statistical Yearbook.
Note: 1 viss = 3.6 lb = 1.63 kg.

4.2.2.3 Marketing

The domestic marketing system is finely tuned cooperation between farmers, agents, small- and large-scale wholesalers, market wholesalers, retailers and exporters in local markets and urban markets. According to market reconnaissance, traders practiced not only commission-based buying and selling but also normal trading. With regard to exports, Yangon exporters are involved in overseas trade while Mandalay exporters initiate border trade with China. In domestic markets, prices of black gram, green gram and pigeonpea are highly related to export market demand. At times, steep price increases can be found in domestic markets due to rising demand from buyer countries. Generally speaking, prices of pulses go down when a newly harvested crop begins to enter the market.

Product variety. In the domestic marketing system, product variety is important for traders and exporters and is highlighted as follows:

- The colour of black gram is commonly known as black and a big grain size of black gram can fetch a good price.
- Green gram is called mungbean or golden gram and some buyer countries prefer small size. By contrast, big size of green gram is in more demand from the Japanese market.
- The colour of pigeonpea is white, yellow, brownish and reddish-brown depending on the variety.
- Soybean with a pale yellow colour is demanded in local markets for export.
- The different colours of chickpea such as white, brown and yellow can be found in local markets. Besides, big size with white colour of chickpea, small size with white colour, whole chickpea with yellow colour and split chickpea with yellow colour are marketed.
- The colour of kidney beans is reddish-brown, white and tangerine.
- The different colours of marketed cowpea are white, pale brown and white colour with a black eye.
- The colour of lablab bean is white, black and whitish-yellow and can be found in domestic markets.

Product quality. The exporters use machines for cleaning and grading to progress to the Ready Cargo (RC) stage. For this, a slight reduction in weight occurs at this stage. It was learnt that cleaning and grading of 49 kg (30 viss bags) reduces by 2 to 2.5 per cent in weight. At the time of survey, fees for cleaning and grading 1 metric ton were between 3,000-5,000 kyats. Normally, price of RC is higher than that of the raw quality in domestic markets. With regard to export quality, Special Quality (SQ), First Quality (FQ) and Fair Average Quality (FAQ) are classified for export marketing.

Table 4.18 Specification of Myanmar pulses (percentage) (Maximum)

Specification	Black gram			Green gram	Pigeonpea	Soybean
	S.Q	F.Q	O.Q	FAQ	FAQ	FAQ
Foreign matter	1.00	1.00	1.00	1.00	1.00	1.00
Weevil seed	0.50	1.00	1.50	2.00	3.00	3.00
Damage otherwise	2.00	2.50	4.00	4.00	3.00	3.00
Foreign beans	-	-	-	1.00	0.50	0.50
Sister beans	-	3.00	2.00	2.00	2.00	1.00
Small seed	6.00	6.00	12.00	-	-	-
Big seed/ higher grade	-	15.00	10.00	-	-	-
Broken	-	-	-	-	-	0.50
Moisture	14.00	14.00	14.00	14.00	14.00	14.00
Brown seed	2.50	3.00	3.00	-	-	-

Source: Exportable Agricultural Commodities, MOAI.
Note: SQ = Special Quality, FQ = First Quality, OQ = Ordinary Quality, FAQ = Fair Average Quality.

Marketing unit. As noted earlier, different marketing units are applied in local markets. For export marketing, local exporters use the metric system and convert the value of local marketing units to 1 metric ton. As regards pulses, the marketing unit adopted by local traders in transactions can be summarized as follows:

Table 4.19 Different market units applied in local markets (Weight in viss)

Pulses	Market					
	Yangon	Mandalay	Myingyan	Pakokku	Pyay	Monywa
Black gram	60	60	-	-	20	20
Green gram	60	56.25	1	19	20	19
Pigeonpea	-	60	1	20	20	20
Soybean	60	53.25	-	-	20	18
Chickpea						
Cowpea	60	57.25	-	19	20	-
Lablabbean	60	55.25	-	19	-	19
Garden pea	60	59.25	-	20	-	20
Kidney bean	-	54.00	-	-	-	18
Bocake	60	-	-	-	20	-
Rice bean	-	60.00	-	20	-	20
Butter bean	-	56.25	1	19	20	19

Source: Trader's Association.
Note: 1 viss =3.6 lb = 1.63 kg.
1 mt = 612.5 viss.
1) Myingyan market located in Mandalay division.
2) Pakokku market located in the nothern part of Magway division.
3) Pyay market in the western part of Bago division and Monya market in Sagaing division.

Packaging material. Based on survey results, pulses are normally packed in polypropylene bags while pigeonpea is packed in gunny bags for the export market.

Intermediaries. In the marketing of pulses, farmers, agents, small- and large-scale wholesalers and exporters conduct business cooperatively. Particularly, large-scale wholesalers in the main surplus-producing areas purchase pulses for Yangon exporters and receive 1 per cent commission of buying value. Some large-scale wholesalers are involved in both commission basis buying and selling and normal trading. When export demand rises, agents for the Yangon exporters collect the crop from the main surplus-producing areas.

Processing. Regarding split chickpea marketing, millers purchase the crop for processing and supply it to market wholesalers in the same town and to large-scale wholesalers in other markets. In addition, chickpea is used as a raw material in the production of vermicelli, which can be found in Monywa market in Sagaing division. Chickpea flour marketing can be found in Mandalay market. The chickpea miller interviewed responded that chickpea flour, and chickpea flour mixed with butter bean and green gram are produced for local markets. Based on market survey results, the use of chickpea, black gram and green gram as raw materials and the turnout of processed products are set out in Table 4.20.

Table 4.20 Outturn of finished products of pulses

Pulses	Use of raw materials (viss)	Finished product (viss)	Percentage of outturn
Chickpea	56.25	Split chickpea = 42	75
Black gram	60.00	Split black gram = 40	67
Green gram	56.25	Split green gram = 41	73

Source: Millers interviewed in Mandalay market, October 2003.

Marketing channel. Based on the survey results, the marketing channel for pulses is described in Annex B.

Inter state/division trade. As noted earlier, the country has varied agro-ecological zones and the same crop, therefore, can be produced in different seasons. Depending upon the crop season, the biggest flows are presented in Table 4.21

Table 4.21 Flows of pulses in Myanmar

Pulses	From	To
Green gram	Ayeyarwady, Magway, Bago division and Pyay market	Yangon market
Black gram	Ayeyarwady and Bago division	Yangon market
Pigeonpea	Magway, Mandalay division and Pyay market	Yangon market
Soybean	Ayeyarwady, Mandalay, Southern Shan state and Bago division	Yangon market
Cowpea	Ayeyarwady, Mandalay, Magway and Bago division	Yangon market
Rice bean	Ayeyarwady and Bago division	Yangon market
Lablab bean	Ayeyarwady and Bago division	Yangon market
Garden pea	Mandalay, Magway and Sagaing division	Yangon market
Chickpea (split)	Mandalay, Magway and Sagaing division	Yangon market
Pigeonpea	Sagaing and Mandalay division	Mandalay market
Green gram	Sagaing, Magway and Mandalay division	Mandalay market
Black gram	Kachin state, Sagaing and Mandalay division	Mandalay market
Soybean	Mandalay and Sagaing division	Mandalay market
Cowpea	Mandalay and Sagaing division	Mandalay market
Kidney bean	Kachin state, Sagaing and Mandalay division	Mandalay market
Garden pea	Kachin state, Sagaing and Mandalay division	Mandalay market
Chickpea	Sagaing division, Mandalay and Magway division	Mandalay market

Source: Survey conducted in October 2003.

Exports of pulses. The total volume of pulses' exports was 0.188 million mt in 1991-1992 and reached 1.034 million mt in 2001-2002. The domestic production of pulses and export volume increased during the market-oriented economy period as can be seen in Table 4.22.

Table 4.22 Production and exports of pulses (1988-1989 to 2001-2002)

Year	Sown area ('000 ha)	Production ('000 mt)	Export volume ('000 mt)
1988-1989	730	409	17
1989-1990	856	500	56
1990-1991	999	602	195
1991-1992	1,265	770	188
1992-1993	1,497	940	449
1993-1994	1,519	923	514
1994-1995	1,746	1,161	425
1995-1996	2,046	1,403	610
1996-1997	1,963	1,398	595
1997-1998	2,092	1,631	769
1998-1999	2,459	1,720	622
1999-2000	2,680	1,920	561
2000-2001	2,934	2,263	832
2001-2002	3,196	2,656	1,034

Source: Settlement and Land Record Department, MOAI.
CSO, Statistical Yearbook.

4.2.3 Green gram

In the domestic market, local people call green gram Pe-di-sein and it is also known as mungbean as well as golden gram. It is consumed as bean sprouts and green gram flour mixed with chickpea flour, which is called pea flour, and is marketed to local consumers. It is also a prominent export commodity due to the rising demand from external trade.

4.2.3.1 Production

The area planted to green gram in 2001-2002 was 0.747 million hectares, 23 per cent of the country's sown area of pulses. It is mainly grown as a rainy season crop in the central dry zone region. The reason is that this region has less precipitation compared to the delta and coastal regions.

Table 4.23 Time of sowing and harvesting of green gram

Season	Region	Importance (High/middle/low)	Time of sowing	Time of harvesting
Rainy	Central dry zone region	H	May-Jun	Aug-Sep
Cool	Central dry zone region	M	Sep-Oct	Dec-Jan
Cool	Lower Myanmar	H	Nov-Dec	Feb-Mar

Source: Myanmar Agriculture Service (MAS), MOAI.

From Table 4.23, it can be seen that green gram is grown three times a year. As such, the first harvest comes to market in August and September, the second in December and January, and the last in February and March. In the central dry zone region, green gram is sown in May with the first shower of the monsoon and is harvested in July. If the harvesting time coincides with the dry spell period of July, it is favourable to obtain better quality.

In Lower Myanmar, it is grown as a second crop after the harvest of monsoon rice. Planting of green gram starts in November and harvesting is completed in March. Yangon division in Lower Myanmar is prominent for big-size green gram production while Pakokku market in the northern part of Magway division is well known for small-size green gram.

Table 4.24 Green gram production and exports

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg /ha)	Production ('000 mt)	Export ('000 mt)
1992-1993	254	246	612	150	86
1993-1994	292	283	602	171	109
1994-1995	383	377	721	272	128
1995-1996	460	456	739	337	186
1996-1997	450	444	751	333	127
1997-1998	546	543	827	449	121
1998-1999	706	672	690	464	174
1999-2000	744	710	674	478	145
2000-2001	742	706	736	519	186
2001-2002	747	742	779	578	207

Source: Settlement and Land Record Department, MOAI.
1 hectare = 2.471 acres.

As shown in Table 4.24, the production level increased four-fold during the one decade from 1992-1993 to 2001-2002. In Myanmar, the Central Agricultural Research Institute (CARI) released different varieties such as ML-1, KPS-2, VC-6173 B, VC-354, V3726 and VR-76-2 depending on the different agro-ecological zones and export market demand. The maturity period of different varieties ranges from 65 to 120 days.

Considering green gram sown area by region, the central dry zone has the largest sown area, followed by the delta region, the hilly region and then the coastal region. The central dry zone has 63 per cent of the country's total sown area.

Table 4.25 Regional production of green gram (2001-2002) (in thousands for sown area and production)

Particular	Delta region	Central dry zone region	Hilly region	Coastal region	Total
Rainy season					
- Sown area (ha)	1	407	*	-	408
- Yield (kg/ha)	660	688	685	-	688
- Production (mt)	1	277	*	-	278
Cool season					
- Sown area (ha)	271	66	1	1	339
- Yield (kg/ha)	905	821	659	574	887
- Production (mt)	245	54	1	*	300
Total					
- Sown area (ha)	272	473	1	1	747
- Yield (kg/ha)	905	706	669	574	779
- Production (mt)	246	331	1	*	578

Source: Settlement and Land Record Department, MOAI.
Note: * in trace.

4.2.3.2 Production and marketing costs

As regards green gram, sample farmers in Mandalay division located in the central dry zone region were selected in order to investigate production and marketing costs, selling price, yield and profit margin. Survey results showed that the profit margins of the farmers are in the range of US$ 69 to 80 per hectare.

Table 4.26 Production and marketing costs of sample farmers

Particular	Unit	Mandalay division			
		Sample 1	Sample 2	Sample 3	Sample 4
Labour cost	Kyat/ha	84,014	75,613	66,714	52,845
Buying value of agro-input	Kyat/ha	16,309	6,795	12,489	4,870
Transport and handling cost of agro-input	Kyat/ha	200	300	250	350
Land tax	Kyat/ha	9	9	9	9
Interest of loan	Kyat/ha	-	-	-	
Production cost	Kyat/ha	**100,532**	**82,717**	**79,462**	**58,074**
Marketing cost	Kyat/ha	12,503	2,973	7,166	At the farm
Production and marketing cost	Kyat/ha	**113,035**	**85,690**	**86,628**	**5,8074**
Yield	Kg /ha	1,135	567	719	583
Selling price	Kyat/kg	163	261	219	212
Returns	Kyat/ha	**185,005**	**147,987**	**157,461**	**123,596**
Profit margin	Kyat/ha	71,970	62,297	70,833	65,522
	US$	80	69	79	73

Source: Market survey team.

Note: 1) Survey data refers to rainy season production.

2) At the time of survey in October 2003, 900 kyats = US$ 1.

3) Labour cost includes family labour and hired labour. Family labour is calculated as an opportunity cost**.**

4) Production cost is referred to as variable cost.

5) Sample farmers using their own working capital to buy agro-inputs or hired labour is not calculated as an opportunity cost.

6) In terms of selling the crop, sample farmers incur marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There are no marketing costs if sample farmers sell their crop at their own farm.

4.2.4 Black gram

Local people know black gram as matpe which is consumed as bean sprouts. In addition, its flour is used as a snack food which is called fried matpe. For export marketing, it is called Myanmar Black Matpe in the domestic market.

4.2.4.1 Production

It is mainly grown during the cool season. The area planted to black gram in 2001-2002 was 0.72 million hectares, of which 99 per cent was during the cool season. Planting of black gram starts in November and is completed mid-December. In Lower Myanmar, it is grown as a second crop after the harvest of monsoon rice. Thus, early-maturing rice varieties are selected to grow as the first crop. The reason is that the second crop of black gram has to be sown timely before the reduction of residual soil moisture. There are three methods of cultivation, all of which can be found in the main surplus-producing area of Lower Myanmar:

- **Ye-lite:** Broadcasting the black gram seed before the paddy in the field is harvested.
- **Khot-phone:** This cultivation method is used when there is still a little bit of water in the field. Black gram seeds are broadcast after the rice harvest and they are mulched with straw. The main reason is not to lose the residual soil moisture.
- **Hton-pe:** Ploughing and seeding is done after the harvesting of rice. It is the normal practice for cultivation.

The first two cultivation practices: Ye-lite and Khot-phone, two zero-tillage methods, are used where the moisture of the land is not so certain and another reason is the low cost of production. However, Hton-pe has a better yield compared to the zero-tillage methods. For Ye-lite and Khot-phone cultivation methods, farmers use more seeds to assure the required plant population. The country's black gram sown area increased from 0.325 million hectares in 1992-1993 to 0.722 million hectares in 2001-2002, as can be seen Table 4.27.

Table 4.27 Change of black gram production and exports (1992-1993 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)	Export ('000 mt)
1992-1993	325	309	730	226	148
1993-1994	280	267	718	192	133
1994-1995	362	361	789	285	117
1995-1996	474	473	784	371	185
1996-1997	410	409	803	328	209
1997-1998	492	482	870	420	308
1998-1999	529	522	850	444	278
1999-2000	555	537	796	427	235
2000-2001	620	611	870	532	275
2001-2002	722	718	884	635	320

Source: Settlement and Land Record Department, MOAI.
CSO, Statistical Yearbook.

In Myanmar, the main productive area of black gram is the delta region which accounts for 91 per cent of national production, followed by the central dry zone region. Production in the coastal region is significant. Farmers in the delta region, the main surplus-producing area of rice, widely adopted the monsoon rice-black gram cropping pattern. The varieties of black gram sown in the main producing area are P-11-30, LGB-17, T-9, P33-39 and PLS-364. The maturity period of varieties is in the range of 70 to 120 days.

Table 4.28 Regional production of black gram (2001-2002) (in thousands for sown area and production)

Particular	Delta region	Central dry zone region	Hilly region	Coastal region	Total
Rainy season					
- Sown area (ha)		1	-	-	1
- Yield (kg/ha)	-	650	-	-	650
- Production (mt)	-	1	-	-	1
Cool season					
- Sown area (ha)	656	57	*	8	721
- Yield (kg/ha)	898	741	*	812	885
- Production (mt)	586	41	*	7	634
Total					
- Sown area (ha)	656	58	*	8	722
- Yield (kg/ha)	898	738	*	812	884
- Production (mt)	586	42	*	7	635

Source: Settlement and Land Record Department, MOAI.
Note: * in trace.

4.2.4.2 Production and marketing costs

As previously, farmers have adopted three methods: Ye-lite, Khot-phone and Hton-pe. The first two cultivation practices are zero-tillage methods and are low-cost production. Based on the survey results, sample farmers who use the Hton-pe cultivation method earn more profit compared to zero-tillage cultivation methods.

Table 4.29 Production and marketing costs of black gram

Particular	Unit	Mandalay division (Hton-pe)	Ayeyarwady division		
			Hton-pe	Ye-lite	Khot-phone
Labour cost	Kyat/ha	70,424	41,839	19,027	26,254
Buying value of agro-input	Kyat/ha	16,556	14,465	18,172	18,172
Transport and handling cost of agro-input	Kyat/ha	-	-	-	-
Land tax	Kyat/ha	7	7	7	7
Interest of loan	Kyat/ha	-	7,180	-	-
Production cost	Kyat/ha	86,987	63,491	37,206	44,433
Marketing cost	Kyat/ha	11,416	At the farm	At the farm	At the farm
Production and marketing cost	Kyat/ha	98,403	63,491	37,206	44,433
Yield	Kg /ha	1,049	939	403	484
Selling price	Kyat/kg	150	156	156	158
Returns	**Kyat/ha**	157,350	146,484	62,868	76,472
Profit margin	Kyat/ha	58,947	82,993	25,662	32,039
	US$/ha	66	93	29	36

Source: Market survey team.

Note: 1) Survey data refers to cool season production.
2) At the time of survey in December 2003, 890 kyats = US$ 1.
3) 1 hectare = 2.471 acres.
4) Labour costs include family labour and hired labour. Family labour is calculated as an opportunity cost.
5) Production costs are referred to as variable costs.
6) Sample farmers borrowed working capital from moneylenders at an interest rate of 5 per cent per month.
7) Sample farmers using their own working capital for buying agro-inputs or hired labour was not calculated as an opportunity cost.
8) For selling their crop, sample farmers incur marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There is no marketing cost if the sample farmer sells his crop directly from his farm.

4.2.5 Pigeonpea

Local people call pigeonpea Pesingon and it is known as Angola pea, Congo pea, non-eye pea, red gram or yellow dhal. India is a major market for Myanmar pigeonpea. It is consumed as dhal in the main surplus-producing area.

4.2.5.1 Production

It is mainly grown as a rainy season crop in the central dry zone region. Farmers in this region rely on pigeonpea cultivation. The reason is that it is rather drought resistant compared to sesame and groundnut. For daily cooking, rural people in this region encounter a scarcity of wood fuel due to deforestation. Forestry replantation, therefore, was established to protect the environment and supply wood fuel for rural areas of this region. Thus, dry stems of pigeonpea are valuable wood fuel for farmers.

It is grown once a year in the central dry zone region. Sowing starts in May and harvesting is completed in November to January depending on the variety. The maturity period of some varieties is in the range of 185 to 270 days while early maturing varieties range from 142 to 200 days. It is intercropped with sesame and green gram. The country's pigeonpea sown area in 2001-2002 was 0.484 million hectares. The main surplus-producing area is the central dry zone region, accounting for 93 per cent of total cultivated area. The second largest producing area is in the hilly region while delta and coastal regions are minor producers.

Table 4.30 Regional production of pigeonpea (2001-2002) (in thousands for sown area and production)

Particular	Delta region	Central dry zone region	Hilly region	Coastal region	Total
Sown area (ha)	4	452	27	1	484
Yield (kg/ha)	824	970	900	491	964
Production (mt)	3	438	25	*	466

Source: Settlement and Land Record Department (SLRD), MOAI.
Note: Pigeonpea is planted in rainy season.
* in trace.

As can be seen from Table 4.31, the area planted to pigeonpea increased by 0.269 million hectares to 0.484 million hectares in 2001-2002. Due to the rising demand from exports, pigeonpea production increased in the central dry zone region. Thus, pigeonpea from this region flows to Yangon market where the Indian market picks it up.

Table 4.31 Changes in domestic pigeonpea production (1992-1993 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)	Export ('000 mt)
1992-1993	215	206	674	139	109
1993-1994	231	224	637	143	133
1994-1995	258	234	621	145	110
1995-1996	250	240	603	145	142
1996-1997	285	278	671	187	169
1997-1998	252	243	726	176	256
1998-1999	270	257	621	160	68
1999-2000	308	300	617	185	
2000-2001	362	358	895	320	
2001-2002	484	483	964	466	

Source: Settlement and Land Record Department (SLRD), MOAI.
CSO, Statistical Yearbook.

4.2.5.2 Production and marketing costs

As noted earlier, the central dry zone region stands as the main surplus-producing area for pigeonpea. Pigeonpea is intercropped with sesame, which is widely adopted in the central dry zone region in which a bi-modal rainfall pattern occurs during the rainy season. If a dry spell is prolonged in July, success of the sesame harvest is uncertain. However, pigeonpea can survive during dry spells. If the dry spell is not too long and the weather is favourable, farmers can still receive good income from both sesame and pigeonpea.

The maturity period of sesame is in the range of 70-95 days, especially for early maturing varieties. Hence, farmers use early maturing sesame varieties for intercropping with pigeonpea. After harvesting the rainy season sesame, farmers grow green gram. At this time, pigeonpea plants are still at the growing period in the field. After harvesting the green gram, farmers can harvest pigeonpea.

Table 4.32 Production and marketing costs of sample farmers

Particular	Unit	Main surplus-producing area of Mandalay division				
		Sample 1		Sample 2		Sample 3
		Pigeonpea	Sesame	Pigeonpea	Sesame	Pigeonpea
Labour cost	Kyat/ha	81,790	65,482	46,702	35,582	83,273
- crop cultivation cost	Kyat/ha	32,864	32,864	24,463	24,463	-
- harvesting cost	Kyat/ha	48,926	32,618	22,239	11,119	-
Buying value of agro-input	Kyat/ha	8,649	4,942	18,656	21,127	11,861
Transport and handling cost of agro-input	Kyat/ha	618	618	494	494	300
Land tax	Kyat/ha	4	4	1	1	9
Interest of loan	Kyat/ha	-	-	-	-	2,471
Production cost	Kyat/ha	91,061	71,046	65,853	57,204	97,914
Marketing cost	Kyat/ha	4,201	3,212	At the farm	At the farm	10,020
Production and marketing costs	Kyat/ha	95,262	74,258	65,853	57,204	107,934
Yield	Kg/ha	847	454	887	472	1,130
By-product						
- dry stem of pigeonpea	Bullock cart/ha	7	-	7	-	12
Selling price						
- pigeonpea	Kyat/kg	153	368	144	347	183
- dry stem	Kyat/bullock cart	2,000	-	2,000	-	3,500
Returns	**Kyat/ha**	143,591	167,072	141,728	163,784	248,790
- pigeonpea	Kyat/ha	129,591	167,072	127,728	163,784	206,790
- dry stem	Kyat/bullock cart	14,000	-	14,000	-	42,000
Profit margin	Kyat/ha	48,329	92,814	75,875	106,580	140,856
	US$/ha	54	104	85	120	158

Source: Market survey team.

Note: 1) Survey data refers to rainy season production.
2) At the time of survey in December 2003, 890 kyats = US$ 1.
3) 1 hectare = 2.471 acres.
4) Labour costs include family labour and hired labour. Family labour is calculated as an opportunity cost.
5) Production cost is referred to as variable cost.
6) Sample farmers borrowed working capital from moneylenders at an interest rate of 5 per cent per month.
7) Sample farmers used their own working capital to buy agro-inputs or hired labour which is not calculated as an opportunity cost.
8) For selling their crop, sample farmers incur marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There are no marketing costs if sample farmers sell their crop directly from their farm.

It can be seen that profit margin returns to sample farmers are in the range of US$ 54/ha to US$ 158/ha. The survey results show that the sesame price is higher than that of pigeonpea.

4.2.6 Soybean

Soybean is an important crop. It is categorized as one of the pulses in Myanmar while it is categorized under oilseeds in other countries. It is known that soybean has the highest protein content compared to other pulses. Demand for soybean in the country has been on the increase. The reason is that it is marketed as bean curds, soybean milk, fermented soybean, soybean sauce and roasted soybean in local markets.

Since 2000, it has become a prominent crop for poultry farm and aquaculture feed in the domestic market. It was discovered that, if groundnut and sesame cake are used for feeding fish, there are high levels of lipids in the fishes' body, which is not attractive to trading partners from buyer countries[6]. As a substitute, the private sector introduced soybean cake from which oil is extracted by using a solvent extraction method. At the same time, Mya Oil Mill Ltd. in

[6] The market survey was conducted in October 2003. Yuzana Company interviewed in Yangon responded that soybean cake is important for aquaculture feed.

Industrial Zone 2, Hlaingthaya Township in Yangon supplies soybean oil to super markets in Yangon City and other large towns. However, the quantity supplied to the market is very low.

According to the market surveys, the branding product of soybean oil is called MYA.R.B.D soybean oil (R = refining, B = Bleaching and D = Deodorization). Its advertising focus is that it should be consumed by those people who wish to prevent hypertension and heart-disease. At the time of survey, its price was the most expensive compared to groundnut and sesame oil in urban markets. Soybean oil can be extracted more efficiently by using solvent technology, compared to the expeller (crush) method. Use of soybean as raw a material and turnout of product are presented in Table 4.33.

Table 4.33 Outturn of finished products of soybean oil

Oil plant	Oil extraction method	Use of raw material (soybean)	Finished product of soybean oil	
			kg	%
Yuzana plant	Solvent	20 viss (32.65 kg)	3.92-4.9	12-15
Mya oil mill	Expeller	20 viss (32.65 kg)	2.93-3.26	9-10

Source: Based on survey results.

4.2.6.1 Production

As mentioned previously, soybean demand is not only from the domestic market but also for external trade. As such, the area planted to soybean increased by 80 thousand hectares from 38 thousand in 1992-1993 to 118 thousand hectares in 2001-2002. Despite this increase in soybean sown area and production, the quantity supplied to market is still relatively low.

Table 4.34 Changes in domestic soybean production (1992-1993 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)
1992-1993	38	37	815	30
1993-1994	46	44	783	34
1994-1995	61	60	833	50
1995-1996	72	72	919	66
1996-1997	69	69	912	63
1997-1998	79	78	960	75
1998-1999	104	102	837	85
1999-2000	108	108	917	99
2000-2001	114	114	967	110
2001-2002	118	118	1,023	121

Source: Settlement and Land Record Department (SLRD), MOAI.

It is grown in the both rainy and cool season. Based on seasonal production statistics, the area planted to soybean in the cool season accounts for 57 per cent of the total. In the rainy season, the hilly region has the largest sown area in the country.

Table 4.35 Soybean production by region (2001-2002) (in thousands for sown area and production)

Particular	Delta region	Central dry zone region	Hilly region	Coastal region	Total
Rainy season					
Sown area (ha)	1	3	47	-	51
Yield (kg/ha)	825	733	1,024	-	1,003
Production (mt)	1	2	49	-	52
Cool season					
Sown area (ha)	17	24	26	-	67
Yield (kg/ha)	1,322	823	1,063	-	1,039
Production (mt)	21	20	28	-	69
Total					
Sown area (ha)	18	27	73	-	118
Yield (kg/ha)	1,296	813	1,038	-	1,023
Production (mt)	22	22	77	-	121

Source: Settlement and Land Record Department (SLRD), MOAI.

Soybean is cultivated twice a year. A large volume is supplied to markets in southern and northern Shan state. The time of sowing and of harvesting is explained in Table 4.36.

Table 4.36 Time of sowing and harvesting of soybean

Season	Main producing area	Importance (High/middle/low)	Time of sowing	Time of harvesting
Rainy season	Hilly region	H	May-June	Aug-Sep
Cool season	Central dry zone region	H	Sep-Nov	Dec-Feb
	Delta region	H	Oct-Nov	Jan-Feb

Source: Market survey team.

With regard to soybean varieties, the maturity period varies from 64 to 100 days and the prominent varieties adopted by farmers are SB-45, SB-60, Crawford, Clark and GM-8. In the delta region, soybean is mainly cultivated on Kaing land.

4.2.6.2 Production and marketing costs

To establish the production and marketing costs, sample farmers were selected in southern Shan state, Mandalay division in the central dry zone region and Ayeyarwady division in the delta region. Soybean is cultivated as a cool season crop in Ayeyarwady division and is sown on Kaing land, which is the land near a river and is flooded during the rainy season. In southern Shan state and Mandalay division, it is grown as a rainy season crop. At the time of survey, the profit margins of the sample farmers were in the range of US$ 51/ha to US$ 103/ha.

Table 4.37 Production and marketing costs of the sample farmers (kyat/hectare)

Particular	Unit	Southern Shan state*		Mandalay division*	Ayeyarwady division
		Sample-1	Sample-2	Sample-3	Sample-4
Labour cost	Kyat/ha	39,380	112,430	117,558	51,891
Buying value of agro-input	Kyat/ha	3,706	26,254	43,428	32,123
Transport and handling cost of agro-input	Kyat/ha	-	-	123	988
Land tax	Kyat/ha	3	3	8	8
Interest of loan	Kyat/ha	-	-	-	29,652
Production cost	Kyat/ha	43,089	138,687	**161,117**	114,662
Marketing cost	Kyat/ha	At the farm	16,813	10,879	11,404
Production and marketing costs	Kyat/ha	43,089	155,500	**171,996**	126,066
Yield	Kg/ha	787	1,614	1,452	1,210
Selling price	Kyat/kg	150	153	150	176
Returns	Kyat/ha	118,050	246,942	217,800	212,960
Profit margin	Kyat/ha	74,961	91,442	**45,804**	86,894
	US$/ha	84	103	51	98

Source: Market survey team.

Note: 1) Survey data is refers to rainy season production for Southern Shan state and Mandalay division.
2) At the time of survey in December 2003, 890 kyats = US$ 1.
3) 1 hectare = 2.471 acres.
4) Labour costs include family labour and hired labour. Family labour is calculated as an opportunity cost.
5) Production cost is referred to as variable cost.
6) Sample farmers using their own working capital to buy agro-inputs or hired labour is not calculated as an opportunity cost.
7) For selling their crop, sample farmers incur marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There is no marketing costs if the sample farmer sells his crop directly from his farm.
8) Sample farmers borrowed working capital from moneylenders at an interest rate of 5 per cent per month.
* For rainy season crop in 2003.

Box 4.1 Break-even yield and profit margins for soybean

In most cases, break-even yield is important for farmers to estimate profit margins. After harvesting, if the sample farmer knows his production costs, marketing costs and the market prices in the nearest town, the break-even yield and profit margin can be calculated.

1.	Production cost	=	161,117	kyats/ha
2.	Marketing cost	=	10,879	kyats/ha
3.	Production and marketing costs	=	171,996	kyats/ha
4.	Selling price	=	150	kg/kg
5.	Break-even yield (3 / 4)	=	1,146.64	kg/ha
6.	Actual yield (kg/ha)	=	1,452	kg/ha
7.	Profit yield (6 - 5)	=	305.36	kg/ha
8.	Profit margin (7 x 4)	=	45,804	kyats/ha

Thus, up-to-date market information is essential for farmers. If they know the market price, they can negotiate with traders and decide when and where to sell, for example, at the farm or at the nearest town.

4.2.7 Potato

In Myanmar, potato is known as a culinary crop. By contrast, it is categorized as a root vegetable in other countries[7]. It is grown for domestic utilization and consumed both as fresh potato and processed potato in urban areas. This is due to an increased acceptance of western-style food such as French fries and potato chips. In addition, chicken and potato curry and, beef and potato curry, are popular dishes among local people.

4.2.7.1 Production

In the domestic market, potato is classified by traders and consumers based on origin of produce, namely Shan produce (highland produce) and Myanmar produce (lowland produce). Southern Shan in the hilly region is by far the largest potato producing area and is where potato can be cultivated three times a year. In lowland areas, it is mainly grown as a cool season crop, the production of which is fairly large-scale.

Table 4.38 Potato cultivation by season

Season	Main producing area	Importance (High/middle/low)	Time of sowing	Time of planting
Rainy season	Southern Shan	H	May-Jun	Aug-Sep
	Southern Shan	H	July-Aug	Oct-Nov
Cool season	Magway division	H	Nov-Dec	Feb-Mar
	Mandalay division	H	Nov-Dec	Feb-Mar
Summer season	Southern Shan	M	Jan-Feb	Apr-May

Source: Survey results.

Note: 1) Southern Shan state is located in the hilly region (or) highland area.
2) Magway and Mandalay divisions are located in the central dry zone region (or) lowland area.
3) Summer season production requires irrigation.

Table 4.39 Potato production by region (2001-2002)

Region	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg /ha)	Production	
				('000 mt)	%
Hilly region	22	22	10,939	242	74
Central dry zone region[1]	4	4	15,661	62	19
Coastal region[2]	3	3	6,860	24	7
Delta	*	*	6,559	1	*
Total	30	30	11,060	329	100

Source: Settlement and Land Record Department (SLRD), MOAI

Note: [1.] Pyin Oo Lwin township in Mandalay division has a mountain climate as does southern Shan. Its production is minor.
[2.] Produced mainly for own consumption without much long distance transportation.
* in trace.

[7] Some major horticultural products, Horticultural Marketing, FAO, 1989, P-8.

As can be seen from Table 4.39, 74 per cent of production comes from the hilly region and the remaining 19 per cent is produced in the central dry zone region. According to market reconnaissance, potato produced in the lowland area is not fit for long-term storage when compared to southern Shan state produce due to the higher moisture content and the thinner skin. As noted earlier, potato is cultivated three times a year in southern Shan and it is the rainy season crop that has the largest sown area. The second cultivation starts mid-rainy season (July and August). Local people call this second cultivation *saga* (in between) potato cultivation. Summer season production is mainly in southern Shan. The summer crop is cultivated in the paddy fields on Le land while the rainy season crop and the mid-rainy season crop are cultivated on Ya land. As for the cool season, the harvest starts to supply local markets in February to March. At this time, the produce from southern Shan state is dwindling at the markets. Thus, lowland potato supplements the supply to market between February and March. Due to the supply of highland and lowland areas, potato is available the whole year round at local markets.

Table 4.40 Potato production in Myanmar (1992-1993 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)
1992-1993	16	15	9,300	143
1993-1994	16	16	10,640	173
1994-1995	16	16	9,400	146
1995-1996	19	19	9,640	187
1996-1997	21	21	10,660	219
1997-1998	22	22	10,720	237
1998-1999	23	23	10,440	245
1999-2000	26	26	9,900	255
2000-2001	29	29	10,860	319
2001-2002	30	30	11,060	329

Source: Settlement and Land Record Department (SLRD), MOAI.

The area planted with potato increased from 16,000 hectares in 1992-1993 to 30 thousand hectares in 2001-2002. Potato production in 2001-2002 increased more than two-fold compared to 1992-1993.

4.2.7.2 Production and marketing costs

A survey was conducted in the main producing area of southern Shan state to find out the production and marketing costs for farmers. At the time of survey, rainy season production and mid-rainy season production had already been harvested. However, the summer cultivation hadn't started yet. Based on survey results, production and marketing costs for sample farmers are summarized in Table 4.41.

Table 4.41 Production and marketing costs of sample farmers (kyat/hectare)

	Particular	Southern Shan		
		Rainy season* (Sample-1)	Mid-rainy season* (Sample-2)	Summer season** (Sample-3)
1.	Labour cost	139,147 (25%)	130,666 (31%)	81,888 (10%)
2.	Buying value of agro-input	370,586 (70%)	276,084 (65%)	566,353 (68%)
	Urea	37,065	29,652	-
	TSP	24,710	19,768	-
	Potash (MOP)	15,444	12,355	-
	Potato (seed purpose)	96,522	74,130	222,390
	Farm yard manual	77,219	61,775	118,608
	Bio composer	16,679	13,343	-
	Pesticide	102,947	65,061	17,791
	Compound fertilizer	-	-	118,608
	Irrigation	-	-	88,956
3.	Transport and handling cost of agro-input	46,237	19,768	35,681
4.	Land tax	3	3	3
5.	Interest of loan	-	-	148,260
6.	**Production cost**	**555,973**	**426,521**	**832,185**
7.	Marketing cost	17,359	At the farm	At the farm
8.	**Production and marketing costs**	**573,332**	**426,521**	**832,185**
9.	Yield (kg/ha)	10,086	6,051	14,523
10.	Selling price (kyat/kg)	80	92	67
11.	**Returns**	**806,880**	**556,692**	**973,041**
12.	Profit margin (kyat/ha) (11 - 8)	233,548	130,171	140,856
13.	Profit margin (US$/hectare)	262	146	158

Source: Marketing survey team.

Note: * Profit margins based on year 2003-2004.

** Profit margins based on 2002-2003. At the time of survey, potato cultivation for summer season hadn't started yet.

1) At the time of survey in December 2003, 890 kyats = US$ 1.

2) Labour costs include family labour and hired labour. Family labour is calculated as an opportunity cost.

3) Production cost is referred to as variable cost.

4) Sample farmers use their own working capital buy agro-inputs or hired labour which is not calculated as an opportunity cost.

5) For selling their crop, sample farmers incur marketing costs associated with packaging material costs, handling costs, transport costs and commission fees. There is no marketing cost if the sample farmer sells his crop directly from his farm.

From Table 4.41, it can be seen that production cost varies among sample farmers depending on cost of agro-inputs. Of the total production cost, agro-inputs constitute a larger portion which is in the range of 65 to 70 per cent. Put another way, farmers require sufficient working capital to grow potato. Summer crop production farmers borrow money from moneylenders to purchase agro-inputs at an interest rate of 10 per cent per month. Thus, the cost of interest for three months is 148,260 kyats (494,200 x 10 per cent x three months). Potato seeds (tubers) are used for cultivation, which are assumed as an input, and potato is harvested for market, which is considered as an output. Output-input ratio of potato based on the sample farmers is in the range of 6-8 (Table 4.42).

Table 4.42 Output-input ratio of potato cultivation based on sample farmers

Particular	Rainy season	Mid-rainy season	Summer season	Average
Input				
Potato used for seed purpose	1,259 kg	1,007 kg	2,417 kg	1,561 kg
Output				
Potato production	10,086 kg	6,051 kg	14,523 kg	10,220 kg
Output-input ratio	8	6	6	6.55
Profit margin (kyat/ha)	233,548	130,171	140,856	168,192

Of the three farmers interviewed, two farmers sell their crop from their farm and one farmer, who grows potato in the rainy season, stores it waiting for higher prices. With regard to

production and marketing, break-even cost of production and marketing is an important issue and is presented in Box 4.2.

Box 4.2 Break-even cost of production and marketing of potato

Mostly, causal readers consider farmers' profit based on the cost of production and returns derived from crop yield and its by-products. If farmers sell their produce at the farm, there is no marketing cost. However, if a farmer delivers his or her crop to the nearest town, marketing costs will be incurred. The break-even cost of production and marketing is important for farmers.

1.	Production cost of potato	=	555,973	kyats/ha
2.	Marketing cost	=	17,359	kyats/ha
3.	Production and marketing costs	=	573,332	kyats/ha
4.	Yield	=	10,086	kg/ha
5.	Break-even cost of production and marketing per kg (3 / 4)	=	56.84	kyats/kg
6.	Selling price	=	80	kyats/kg
7.	Profit margin per kg (6 - 5)	=	23.16	kyats/kg
8.	Profit margin per hectare (7 x 4)	=	233,592	kyat/ha

If a farmer knows the break-even cost of production and marketing per kg, price negotiations can take place. If the market price does not cover the break-even cost of production and marketing, farmers can decide whether to store their or not produce.

4.2.7.3 Consumption

Based on the Statistical Yearbook 2002, monthly per capita consumption of potato in 2001 was 0.55 kg (0.34 viss) in urban households and 0.46 kg (0.28 viss) in rural households. Annual, per capita consumption of potato was 6.60 kg (4.08 viss) in urban and 5.52 kg (3.36 viss) in rural households respectively. Consequently, urban households consume more potato than in rural areas.

Table 4.43 Per capita consumption of potato in urban and rural households (2001)

Region	Population	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	('000)	(viss/month)		(kg/month)		(viss/year)		(kg/year)	
Central dry zone region									
Magway division	4,675	0.32	0.14	0.52	0.23	3.84	1.68	6.24	2.76
Mandalay division	6,935	0.27	0.29	0.44	0.47	3.24	3.48	5.28	5.64
Sagaing division	5,418	0.46	0.36	0.75	0.59	5.52	4.32	9.00	7.08
Delta region									
Ayeyarwady division	6,921	0.27	0.17	0.44	0.28	3.24	2.04	5.28	3.36
Yangon division	5,801	0.28	0.19	0.46	0.31	3.36	2.28	5.52	3.72
Bago division	5,146								
- Eastern part		0.26	0.21	0.42	0.34	3.12	2.52	5.04	4.08
- Western part		0.35	0.04	0.57	0.07	4.20	0.48	6.84	0.84
Mon state	2,548	0.15	0.22	0.24	0.36	1.80	2.64	2.88	4.32
Hilly region									
Kachin state	1,308	0.51	0.38	0.83	0.62	6.12	4.56	9.96	7.44
Kayah state	277	0.38	0.34	0.62	0.55	4.56	4.08	7.44	6.60
Kayin state	1,512	0.26	0.10	0.42	0.16	3.12	1.20	5.04	1.92
Chin state	480	2.05	1.40	3.34	2.28	24.60	16.80	40.08	27.36
Shan state	4,904								
- Southern		0.67	0.44	1.09	0.72	8.04	5.28	13.08	8.64
- Northern		0.46	0.52	0.75	0.85	5.52	6.24	9.00	10.20
- Eastern		0.33	0.11	0.54	0.18	3.96	1.32	6.60	2.16
Coastal region									
Yakhine state	2,812	0.21	0.10	0.34	0.16	2.52	1.20	4.08	1.92
Tanninthary division	1,388	0.14	0.12	0.23	0.20	1.68	1.44	2.76	2.40
Union	**50,125**	**0.34**	**0.28**	**0.55**	**0.46**	**4.08**	**3.36**	**6.60**	**5.52**

Source: CSO, 2002, Statistical Yearbook.
Note: 1 viss = 3.6 lb = 1.63 kg.

4.2.7.4 Marketing

In the domestic marketing system, farmers, collectors, small- and large-scale wholesalers, market wholesalers and retailers are involved in the marketing chain.

Product variety. As noted earlier, the rainy season and mid-rainy season crops are grown on Ya land while the summer crop is cultivated on paddy fields on Le land. Potato from Shan state is known as red skin potato because of the red soil of Ya land. After the harvest of monsoon paddy, potato is grown in the Heho Valley which is known as brown skin potato. In the local market, the prominent producing area is Sinphyu Kyun Township in Magway division and Tatkone Township in Mandalay division. In the local market, Shan potato (highland produce) and lowland produce are classified by traders and consumers depending on their origin of produce.

Product quality. Potato is graded by size such as special big, O.K, A-1, Swathe and Gawli. The small size of potato is called Gawli in local markets. Un-graded potato is called Jon. Thus, prices of potato are wide ranging, depending on the size.

Packaging material. Potato is normally packed in polyethylene net bags. The reason is that polypropylene bags cannot provide air ventilation during long-distance transportation.

Marketing. The wholesale price quotation of potato is based on one viss (1 viss = 1.63 kg).

Intermediaries. With regard to potato marketing, farmers, collectors, small- and large-scale wholesalers and retailers are involved in the domestic marketing system. Large-scale wholesalers in Yangon and Mandalay markets sell potato on behalf of traders in the main surplus-producing area and receive 5 per cent commission from sale value.

Marketing channel Based on the survey results, the marketing channel of potato from farmer to consumer is mentioned in Annex C.

4.2.8 Economic impact on CGPRT crop farmers

Based on cost and return analysis, CGPRT crop farmers and other crop producing farmers are compared in this section. According to survey results, production costs of CGPRT crops varies among sample farmers. The main reasons are:

- The level of agro-inputs applied by farmers such as chemical fertilizers, hybrid seeds, high yielding varieties and farmyard manual labour varies depending on the farmers' working capital.
- Even though the sample farmers know crop production technology, as advised by extension workers, cultural practices are different which amounts to variations in production costs among sample farmers.
- Some sample farmers borrow working capital from moneylenders and the interest on the loan increases the production cost. By contrast, large-scale farmers use their own finance for crop cultivation. In the calculation of production costs, opportunity costs of farmers' own working capital for buying agro-inputs or hired labour is not considered. Strictly speaking, if the farmer did not borrow money but used his or her own money, the interest paid on that money is a cost. The reason is that if farmers borrow cash from moneylenders or deposit their money in a bank, the interest paid or received on that money is a cost.

With regard to returns of CGPRT crop farmers, the following key points are determined:

- Yield per hectare is highly related to the level of agro-inputs used by farmers and the level of adoption of systematic production technology advised by extension workers. From the standpoint of agricultural marketing, when to sell and where to sell is important. Regarding where to sell, some farmers sell their crop at the farm or to nearest town. If they sell at the farm, there are no marketing costs. Generally speaking,

prices paid by traders in 'nearest towns' is higher than the prices paid at the farm by primary collectors (village brokers) or agents for wholesaler.

- In this case, the price difference between the farm and the nearest town should be covered by marketing costs and opportunity costs of farmers' labour. For example, a farmer receives 400 kyats more profit but wastes the whole day when he sells his crop at the nearest town instead of selling at the farm. If the farmer himself works in the field, the opportunity cost of his labour is equal to 500 kyats/day of hired labour.
- Selling price of farmers' produce is highly related to quality and time of selling the crop. Seasonal price variation is one of the factors which influences farmers' returns. Generally speaking, the price goes down when a newly harvested crop begins to supply the local market.
- Some farmers sell their crop at the time of harvesting. The reason is that they urgently need cash to pay for the next crop's cultivation or to pay debts. By contrast, some large farmers store part of their crop, commanding a higher price later in the season. Seasonal price variations influence farmers' selling price. In addition, product quality affects price for farmers.

As mentioned, profit margin returns for the sample farmers who are involved in CGPRT crop farming are influenced by production costs, yield per hectare, marketing costs and selling price. To be clear the facts of cost and return, a comparison based on survey results is shown in Table 4.44.

Table 4.44 Comparison of CGPRT crop and other crop farmers based on cost and return ratios

Particular	Sample number	Production and marketing costs (kyat/ha)	Returns (kyat/ha)	Cost and return ratio	Farmers' selling price (kyat/kg)
Delta region					
Ayeyarwady division					
Monsoon rice	1	152,423	231,280	1.52	56
Summer rice	1	251,494	289,212	1.15	66
Black gram	3	48,377	95,275	1.97	157
Soybean	1	126,066	212,960	1.69	176
Central dry zone region					
Mandalay division					
Monsoon rice					
- irrigation water	1	159,202	277,816	1.75	77
- rain water	2	130,204	232,725	1.79	83
Summer rice	1	151,760	269,062	1.77	65
Maize					
- hybrid seed production	1	198,677	277,609	1.40	160
- hybrid production	1	168,951	229,476	1.36	65
Green gram	4	85,857	153,512	1.79	213
Black gram	1	98,403	157,350	1.60	150
Soybean	1	171,996	217,800	1.27	150
Pigeonpea	3	89,683	177,886	1.99	160
Sesame	1	83,554	200,236	2.40	443
Magway division					
Sesame	1	123,567	295,845	2.39	489
Groundnut*	1	253,653	276,752	1.09	112
Sunflower	1	82,689	133,221	1.61	367
Hilly region					
Southern Shan state					
Monsoon rice	1	173,379	257,250	1.48	75
Maize	3	178,416	215,033	1.21	56
Soybean	2	99,295	182,496	1.84	152
Potato	3	610,679	778,871	1.28	80

Source: Market survey team.

Note: * Groundnut with shell.

1) Figures are derived from a small number of samples and must be regarded as indicative only.

2) Average production and marketing costs (kyat/ha) based on sample numbers.

3) Average returns (kyat/ha) based on sample numbers.

As shown in Table 4.44, prices of oilseeds are the highest compared to rice, maize, groundnut, pulses and potato. The reason is that domestic edible oil production cannot fully supply domestic consumption. Thus, palm oil is imported from neighbouring countries, mainly from Malaysia, to bridge the gap between supply and demand. In addition, a small volume of sesame is exported. Thus, a sharp price increase of sesame can be found in the domestic market when export market demand increases.

As can be seen, prices of black gram and soybean are higher than that of rice in the delta region. Thus, sample farmers of pulses make more profit compared to rice farmers. Rice prices in the delta region are cheaper than Mandalay division in the central dry zone region and southern Shan state in the hilly region. The reason is that although rice is in surplus for the country as a whole, some regions are not self-sufficient. The main rice-deficit areas in the country are the central dry zone region, the hilly region and Tanintharyi division in the coastal region in which rice consumption relies not only on regional production but also rice supplied from the delta region, the main surplus-producing area in Lower Myanmar. Because of this, rice farmers in deficit areas receive a better cost and return ratio.

In the delta region, the return on sample summer rice producing farmers was 37,718 kyats/ha (289,212 - 251,494) and black gram producing farmers received 46,898 kyats/ha (95,275 - 48,377). Thus, black gram producing farmers received more profit. At the time of survey, the price of summer rice was 66 kyats/kg and the black gram price was 157 kyats/kg. Thus, 2.4 kg of rice was equal to one kilogram of black gram. After harvesting the monsoon rice, black gram or summer rice is grown as a second crop in the delta region. In particular, Ayeyarwady division in the delta region has the largest sown area of summer rice and black gram. In this case, the cropping patterns that give a better return are mentioned in Table 4.45.

Table 4.45 Comparison of rice-based cropping patterns

Cropping pattern	Profit margin (kyat/ha)			
	Monsoon rice	Summer rice	Black gram	Total
Monsoon rice - summer rice	78,857 (231,280-152,423)	37,718 (289,212-251,494)	-	116,575
Monsoon rice - black gram	78,857	-	46,898 (95,275-48,377)	125,755

Source: Market survey team.

Note: Calculation based on Table 4.44.

1) Production and marketing costs of monsoon rice-summer rice cropping pattern = 152,423 + 251,494 = 403,917 kyat/ha. Production and marketing costs of monsoon rice-black gram cropping pattern = 152,423 + 48,377 = 200,800 kyat/ha. And monsoon rice-black gram cropping pattern gains more than 9,180 kyat (125,755-116,575).

The cropping pattern of monsoon rice – black gram makes more profit than monsoon rice – summer rice. In this case, the price of black gram is highly related to export market demand. Put another way, steep price increases of black gram can be found in local markets due to rising demand for export. However, its price goes down when the quantity demanded by the export market declines. Generally speaking, the price of black gram is above the rice price in the local market. To obtain the profit margin of black gram (46,898 kyats/ha), the break-even yield of summer rice should be 4,521 kg/ha, which is calculated as per Table 4.46.

Table 4.46 Break-even yield and profit margin for summer rice and black gram

Particular	Summer rice	Black gram
1. Production and marketing costs (kyat/ha)	251,494	48,377
2. Returns (kyat/ha)	289,212	95,275
3. Selling price (kyat/kg)	66	157
4. Yield (kg/ha)	4,382	606.85
5. Profit margin (kyat/ha) [(2 - 1)]	37,718	46,898

$$(Y_R \times P_R) - V_R = (Y_B \times P_B) - V_B$$
$$(Y_R \times 66) - 251,494 = (606.85 \times 157) - 48,377$$
$$(Y_R \times 66) - 251,494 = 95,275\text{-}48,377$$
$$(Y_R \times 66) - 251,494 = 46,898$$
$$Y_R = (46,898 + 251,494)/66$$
$$Y_R = 4,521 \text{ kg/ha}$$

Source: Market survey team.

Note: 1) Y_R = rice yield, P_R = rice price, V_R = production and marketing costs.
2) Y_B = black gram yield, P_B = price of black gram, V_B = production and marketing costs.
3) Figures refer to Table 4.45.
4) Average yield of black gram and selling price refer to Table 4.29.

For the cropping pattern of monsoon rice-summer rice, farmers incur more costs for production and therefore receive less benefits compared to a monsoon rice - black gram pattern practiced by farmers. Based on the survey results, the maize price in the central dry zone region and the hilly region is low compared to rice, oilseed crops and pulses. In southern Shan, the potato price is higher than that of maize. On the whole, the production of pulses is attractive to farmers due to less cost, low risk and better returns due to good market prices.

4.3 Other major crops

Apart from CGPRT crops, rice, wheat, oilseed crops, industrial crops, culinary crops, vegetables and fruits are important for domestic utilization and external trade, which are highlighted in this section.

4.3.1 Rice

In Myanmar, rice is the most important crop for millions of farmers and some landless farmhands who derive their income from working as seasonal labourers. In addition, people in Myanmar consume rice not only as a staple food but also as rice-based processing foods such as rice noodles, vermicelli, rice cake etc.

4.3.1.1 Production

Before 1992-1993, the country's domestic utilization and external trade relied only on monsoon rice production. To supply the greater demand for rice and have surplus, a summer rice (second rice crop) production programme was implemented in 1992-1993, with the provision of irrigation facilities and extension services throughout the country. The area expansion was mainly targeted at the delta region, which has an abundance of irrigation water sources. Due to the wide adoption of summer rice cultivation, the area planted to summer rice increased from 0.33 million hectares in 1992-1993 to 1.16 million hectares in 2001-2002. Because of this the country's rice sown area changed dramatically and reached 6.45 million hectares in 2001-2002. Monsoon rice accounts for 80 per cent of aggregate production and the remaining 20 per cent comes from summer rice production.

Table 4.47 Rice production situation in Myanmar (1992-1993 to 2001-2002)

Year	Rice sown area ('000 ha)			Yield (kg/ha)			Production ('000 mt)	Population (million)	Rice export ('000 mt)
	Monsoon rice	Summer rice	Total	Monsoon rice	Summer rice	Total			
1992-1993	4,801	332	5,133	2,913	3,236	2,934	14,835	42.33	195
1993-1994	4,804	870	5,674	2,966	3,556	3,054	16,757	43.92	261
1994-1995	4,849	1,077	5,926	3,066	3,622	3,167	18,192	44.74	1,041
1995-1996	4,917	1,221	6,138	2,870	3,398	2,975	17,950	45.57	354
1996-1997	5,024	852	5,876	2,965	3,638	3,064	17,673	46.40	93
1997-1998	4,899	886	5,785	3,006	3,466	3,079	16,651	47.26	28
1998-1999	4,827	932	5,759	3,035	3,585	3,128	17,075	48.12	120
1999-2000	5,153	1,131	6,284	3,147	3,660	3,240	20,122	49.13	55
2000-2001	5,258	1,101	6,359	3,266	3,938	3,383	21,320	50.13	251
2001-2002	5,288	1,163	6,451	3,307	3,913	3,417	21,912	51.14	939

Source: Settlement and Land Record Department, MOAI.
CSO, 2001, Statistical Yearbook.

With regard to rice varieties, 59 per cent of monsoon rice's sown area is cultivated with High Yielding Variety (HYV), with High Quality Variety (HQV) planted on over 15 per cent. The rest are traditional varieties which are grown based on local consumer preference. In the summer rice area, the varieties adopted by rice farmers are short-maturing high yielding varieties, which are widely sown in the delta region. The main reason is to avoid the monsoon showers during harvest time.

Planting of monsoon rice starts in May and the harvest is in October. As for summer rice, planting begins in November with the harvest in April. Rice planting and harvesting times vary depending on the agro-ecological zones. In particular, the planting of monsoon rice is delayed in the central dry zone area while it starts early in the delta and the coastal region. In Lower Myanmar, after harvesting the monsoon rice, summer rice is grown as a second crop. However, some farmers practice a monsoon rice-pulses-summer rice cropping pattern depending on water availability. The most common cropping pattern is monsoon rice-summer rice (or) monsoon rice-black gram or green gram in Lower Myanmar.

According to historical information, Myanmar is traditionally a rice exporting country. During the pre-war era, rice export volume was in the range of 2.7 to 3.04 million metric tons from 1930-1931 to 1939-1940. After the Second World War, rice continued to be exported, however its traded volume did not regain pre-war levels. The government monopolized rice exports in 1963, during the centrally planned economic era. Based on time-series data from 1964-1965 to 2001-2002, the last large volume of rice exports was in 1964-1965 and amounted to 1.18 million metric tons. From then on, rice exports have declined. Rice exports in 1994-1995 were 1.04 million metric tons, close to the level of 1964-1965. After this, the country's rice exports showed fluctuations but did reach around 1 million metric tons in 2001-2002.

4.3.1.2 Consumption

As discussed earlier, people in Myanmar consume rice as a basic staple food. The monthly per capita consumption of rice in urban and rural households[8] in 2001 was 10.69 kg and 13.22 kg respectively. People in the country also consume large quantities of processed food made from rice such as vermicelli, rice noodles, rice cakes, traditional snacks etc. It was discovered that rural people consume more rice than urban dwellers.

With regards to rice consumption, even soaring rice prices could not reduce the quantity consumed in Myanmar. The demand for rice is relatively price inelastic meaning it does not change very much in response to price changes. It was also calculated that a 10 per cent increase in the price of rice results in only a 2 to 4 per cent decrease in rice consumption in Viet Nam[9].

[8] Statistical Yearbook 2001, CSO, Yangon.
[9] Nicholas Minot and Francesco Goletti, Rice market liberalization and poverty in Viet Nam, International Food Policy Research Institute.

Factors influencing rice demand are household income, rice price and preference. If the price of rice goes down, consumers in the country have a good opportunity to shift from low quality rice to a better one based on their income and preference. Generally speaking, if low-income consumers do not spend much money on rice, surplus cash can be used to buy more meats, vegetables and fruit. When the rice price starts to rise, consumer demand increases. The reason is that some consumers in urban areas expect further price hikes so they try to purchase more rice than normal to secure the family requirement. Thus, a stable rice price at a reasonable level is important for consumers in Myanmar.

4.3.1.3 Marketing

For the country as a whole, rice is surplus. However, the central dry zone region, the hilly region and Tanintharyi division in the coastal region are still rice deficient. Rice from the surplus areas of lower Myanmar, is therefore marketed to deficit areas. Put another way, inter-state/division trade can be found in the domestic marketing system.

Functionality of the rice marketing system is highly related to the National Rice Policy (NRP). As noted in the beginning of the introduction, the government adopted market-oriented economic policy in 1988. For the staple food rice, domestic marketing has been partially liberalized while rice exports were, until recently, monopolized by the state. With regard to NRP, the government focuses two types of policy on rice:

- a price policy that applies to rice farmers, and
- a subsidy policy that applies to low income consumers.

On the production side, the government attempts to subsidize the price at the highest possible level in order to secure at least remunerative prices and to provide irrigation facilities, cheaper tax for land and irrigation and free of charge extension services for rice production.

On the consumption side, the government endeavored to stabilize the price at the lowest possible level maintaining buffer stocks in order to assure that all consumers can at least afford the minimum nutritional requirement. For this, paddy is purchased from farmers using a quota system with a fixed price which is below the market price. It was learnt that rice farmers sold 42-229 kg per acre (1 hectare = 2.471 acres) to the state depending on the rice surplus and the deficit areas. From the purchased quantity, rice is distributed to the target groups including government employees at a subsidized price and the surplus is exported.

The government evaluated both its rice trade policy and its pricing policy and abolished its monopoly on rice exports in 2003 and allowed the private sector to control rice exports. At the same time, paddy purchased from farmers at a fixed price was brought to an end in the 2003-2004 crop season**.** Under the present NRP it is expected that the country's rice production and external trade will increase due to market-oriented production. In addition, traders will endeavor to supply in a competitive manner based on the demand of internal and external trade.

Some rice-consuming countries prefer higher quality rice; the level of per capita consumption reduces due to increases in income. Thus, Myanmar exporting rice in line with market demand, is an important issue. For this, quality-rice production programmes have been implemented in main surplus-producing areas. The area planted to quality rice in 2001-2002 was 0.809 million hectares. If per capita consumption of rice in Myanmar continues to grow or stays at the current rate, feeding the increasing population will became an important issue. Thus, rice will stand as the most important commodity to supply the growing population in Myanmar.

4.3.2 Wheat

Wheat is one of the most important cereal crops in Myanmar, after rice and maize. Due to increases in the urban population and an increased acceptance of western-style foods, sandwiches, cookies, biscuits, cakes and noodles are consumed more. In addition, nan-pya

(Indian flat bread) and ei-kyar-kwe (deep fried dough sticks) are well-known snacks for consumers.

4.3.2.1 Production

Wheat cannot be widely grown in Myanmar due to limitations of the agro-ecological zones. It is sown as a cool season crop and is planted in October and November. The newly harvested crop begins to enter the market in January.

Wheat cultivation relies on residual soil moisture and irrigation. The main producing areas are Shan state in the hilly region and the northern part of Sagaing division where wheat is grown with the provision of irrigation. The area planted to wheat declined by 72 thousand hectares from 151 thousand hectares in 1992-1993 to 79 thousand hectares in 2001-2002. The main reason is that farmers prefer to grow pulses due to rising market demand. The declining trend in wheat production is dearly visible in Table 4.48.

Table 4.48 Domestic wheat area, yield and production (1992-1993 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production ('000 mt)	Imports of wheat flour ('000 mt)
1992-1993	151	145	953	139	2
1993-1994	125	115	948	109	2
1994-1995	109	107	833	89	58
1995-1996	93	91	856	78	54
1996-1997	91	90	961	87	26
1997-1998	88	88	1,047	92	25
1998-1999	99	96	972	93	41
1999-2000	105	105	1,113	117	72
2000-2001	80	80	1,167	94	67
2001-2002	79	79	1,209	96	n.a

Source: Settlement and Land Record Department, MOAI.

4.3.2.2 Consumption

Despite wheat production showing a declining trend, wheat-based processed foods are in greater demand in urban areas. Thus, wheat grain and wheat flour are imported. Based on the statistics of external trade, wheat flour imports increased from 58 thousand metric tons in 1994-1995 to 67 thousand metric tons in 2000-2001. At the same time, domestic wheat production was 96 thousand metric tons in 2001-2002.

Per capita consumption of wheat flour was estimated to be four kilogram in 2000-2001, based on domestic production and imported volume, of which a stored quantity of seed for the next planting season and losses were deducted.

4.3.2.3 Marketing

Myanmar is a wheat-importing country. The private sector imports wheat to provide the local wheat mills. Large-scale mills are established in Yangon located in Lower Myanmar and most small-scale local mills can be found in the main producing areas. The imported wheat grain and flour mainly comes into Yangon market. Wheat mills in Yangon market mainly distribute to local markets under various brand names. Sometimes, locally produced wheat flour is mixed with the imported flour, which can be found in domestic markets.

Wheat from the main producing areas is supplied to Mandalay market, which is known as a transit market to Central Myanmar. There are four different types of wheat, such as Monywa, Myinmu, Myaung and Shan in Mandalay market which is referred to as the origin of produce. The first three are supplied from Sagaing division and the last one from Shan state, all of which command different prices.

According to market reconnaissance, the price of Monywa wheat is expensive while the price of wheat supplied from Shan state is cheaper. Monywa is the most productive area in

Sagaing division and wheat cultivation with irrigation can be found in this area. Because of the better quality, the price of Monywa wheat is expensive compared to other product varieties.

4.3.3 Oilseed crops

Consumers in Myanmar consider edible oil as the second most essential commodity after the staple food rice. In addition, elderly people say that rice, edible oil and salt are the most important commodities in the daily diet.

4.3.3.1 Production

To supply edible oil for domestic consumption, there are five major oilseed crops namely, groundnut, sesame, sunflower, niger and mustard which are grown in the country depending on the different agro-ecological zones. The best known example is that sesame and sunflower are cultivated in the monsoon season in the central dry zone region and in the cool season in Lower Myanmar. Additionally, an oil palm plantation programme is carried out in Tanintharyi division located in the coastal region in the southern part of the country which has an equatorial climate.

The area sown to oilseeds in 2001-2002 was 2.596 million hectares of which sesame is the most significant at 53 per cent of the total. Groundnut is the second largest area sown, followed by sunflower, niger and mustard in that order. For the country as a whole, edible oil is not sufficient. However, the central dry zone region stands as an edible oil surplus area. The reason is that this region is the main producing area of sesame and groundnut.

Regarding sesame, the country's sown area is 1.38 million hectares. Based on seasonal planting, 81 per cent is cultivated in the rainy season and the balance of 13 and 6 per cent is cultivated in the cool and summer season respectively. However, summer season production requires irrigation. Regionally, the central dry zone region is the main producing area. As mentioned in earlier chapters, the rainfall pattern in the central dry zone region normally occurs bi-modally. Planting of sesame starts in May and the harvest is in August.

Table 4.49 Oilseeds' sown area by different regions, 2001-2002 ('000 hectares)

Oilseed crop	Central dry zone region	Delta region	Coastal region	Hilly region	Total
Sesame	**1,277**	**82**	**2**	**21**	**1,382**
Rainy season	1,060	37	2	17	1,116
Cool season	146	33	*	4	183
Summer season	71	12	-	-	83
Groundnut	**380**	**98**	**23**	**68**	**569**
Rainy season	184	20	1	41	246
Cool season	196	78	22	27	323
Sunflower	**355**	**131**	*	**12**	**498**
Rainy season	54	*	-	6	60
Cool season	301	131	*	6	438
Niger	**36**	*****	*	**55**	**91**
Cool season	36	*	*	55	91
Mustard	**12**	*	**18**	**26**	**56**
Cool season	12	*	18	26	56
Grand total	2,060	311	43	182	2,596
Per cent of sown area	79	12	2	7	100

Source: Settlement and Land Record Department, MOAI.
Note: * in trace.

During the rainy season, a dry spell normally occurs in July which influences the level of sesame harvested area and yield. In this case, if sesame plants encounter a long dry spell in July, low yields as well as a reduction in harvested area can be expected. Fluctuations in sesame harvested area can especially be found in the monsoon season, ranging from 56 to 91 per cent from 1992-1993 to 2001-2002. Thus, the level of domestic sesame production is highly related to the success of the area sown in the monsoon season.

Table 4.50 Harvested area of sesame during the rainy season (1989-1990 to 2001-2002)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Percentage of harvested area
1989-1990	990	690	70
1990-1991	1,025	732	71
1991-1992	1,004	565	56
1992-1993	1,121	779	70
1993-1994	1,155	829	72
1994-1995	1,091	902	83
1995-1996	995	636	64
1996-1997	1,002	877	88
1997-1998	872	616	71
1998-1999*	976	485	50
1999-2000	1,104	785	71
2000-2001	1,118	1,023	91
2001-2002	1,116	977	88
Average	1,044	761	73

Source: Settlement and Land Record Department, MOAI.
* El Nino occurred in 1998-1999.
1 hectare = 2.471 acres.

With regard to sunflower, the area sown to sunflower in 2001-2002 was 0.49 million hectares. It is intercropped with pulses as a cool season crop in Lower Myanmar. At present, high yielding varieties and hybrid sunflower varieties are sown in the main producing areas. The country's niger sown area in 2001-2002 was 91 thousand hectares and it is mainly grown in Shan state in the hilly region followed by the central dry zone region. Mustard is mainly grown in Yakhine state in the coastal region and accounts for 56 thousand hectares. Mustard oil is locally consumed.

Table 4.51 The sown-area trend of oilseed crops in Myanmar (1992-1993 to 2001-2002) ('000 ha)

Year	Groundnut	Sesame	Sunflower	Niger	Mustard	Total
1992-1993	494	1,368	156	37	13	2,068
1993-1994	487	1,300	120	44	14	1,965
1994-1995	507	1,331	199	45	16	2,098
1995-1996	527	1,276	221	46	18	2,088
1996-1997	479	1,145	125	47	18	1,814
1997-1998	450	1,035	120	49	20	1,674
1998-1999	503	1,199	343	57	30	2,132
1999-2000	567	1,357	487	82	41	2,534
2000-2001	590	1,424	518	92	52	2,676
2001-2002	569	1,382	498	91	56	2,596

Source: Settlement and Land Record Department, MOAI.

As can be seen from Table 4.51, the area planted to oilseeds in 1992-1993 was 2.07 million hectares, but this rose 26 per cent to 2.59 million hectares in 2001-2002. Oilseed production for 2001-2002 is presented in Table 4.52.

Table 4.52 Oilseed crop production in 2001-2002

Oilseed crop	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (kg/ha)	Production	
				('000 mt)	(%)
Groundnut	569	567	1,274	723	49
Sesame	1,382	1,239	322	399	27
Sunflower	498	486	574	279	19
Niger	91	91	412	38	3
Mustard	56	56	609	34	2
Total	**2,596**	**2,439**	**604**	**1,473**	**100**

Source: Settlement and Land Record Department, MOAI.

Due to increases in area and yield per unit area, domestic edible oil production increased substantially. However, production is not yet fully sufficient for domestic consumption. To bridge the gap between demand and supply, palm oil is imported from neighboring countries, mainly Malaysia. The area planted to palm oil in 2001-2002 was 29 thousand hectares, 28 per cent of the sown area was at the harvesting stage.

Total production of Fresh Fruit Bunch (FFB) was 74 thousand metric tons. Crude Palm Oil (CPO) production in 2000-2001 was 8,102 tons; at present, there are eight CPO mills and two refineries. Some are used for producing soap.

4.3.3.2 Consumption

In the domestic market, there are three kinds of edible oil, namely groundnut, sesame and palm oil, which are widely marketed. Sunflower oil mixed with groundnut oil, and palm oil mixed with groundnut oil can also be found in the market. In addition, there are high quality products such as groundnut, sesame and sunflower oil on the market, which carry the brand names High-tech, Golden Horse and Yangon Se-thant and command premium prices compared to the others. Groundnut oil is the most expensive while palm oil is the cheapest in the local market.

Consumer choice of edible oil relates to preference, household income and health concerns. In the local market, groundnut oil is the most preferred and in Central Myanmar (central dry zone region) sesame is in high demand. From a health standpoint, some consumers prefer edible oil which has a lower cholesterol content. Generally speaking, low-income consumers rely on imported palm oil.

Groundnut without its shell and sesame are utilized not only for oil extraction but also for the traditional snack business such as groundnut brittle, roasted groundnut, roasted sesame powder, sesame brittle and sesame with pickled tea leaves. Generally, niger and mustard are consumed as edible oils in the main producing area.

Table 4.53 Per capita consumption of edible oil in 2001

Particular	Groundnut oil	Sesame oil	Palm oil	Other*	Total
Urban household					
- Viss/month	0.20	0.14	0.15	0.02	0.51
- Viss/year	2.40	1.68	1.80	0.24	**6.12**
- Kg/month	0.33	0.23	0.24	0.03	0.83
- Kg/year	3.96	2.76	2.88	0.36	9.96
Rural household					
- Viss/month	0.18	0.16	0.07	0.03	0.44
- Viss/year	2.16	1.92	0.84	0.36	**5.28**
- Kg/month	0.29	0.26	0.11	0.05	0.71
- Kg/year	3.48	3.12	1.32	0.60	8.52

Source: CSO, 2002, Statistical Yearbook.
Note: 1 viss = 1.63 kg.
* Mustard oil, niger oil, rice bran oil and cottonseed oil.

4.3.3.3 Marketing

As mentioned above, the central dry zone region is the edible oil surplus area from which edible oil is marketed to deficit areas. With regard to imported palm oil, Yangon market is the main point of entry. At times, palm oil in 16 kg capacity containers from Thailand comes to the local market. According to market reconnaissance, groundnut without its shell is marketed for the purpose of oil extraction and snacks. The price of groundnut without its shell for snacks is expensive in local markets compared to groundnut with shell.

The first groundnut harvest of the monsoon season starts to supply the markets from October to November. Afterwards, the second harvest of the cool season crop begins to enter the market from February to March. Normally, the price of groundnut goes down when a newly harvested crop starts to supply the local market.

In the domestic market, there are different sesame colours such as white, black, yellow, red and reddish-brown, all of which command different prices. White and black sesame can fetch a good price compared to others. For export marketing, traders prefer sesame having less content of free fatty Acid (FFA). It was discovered that high-quality and low FFA are in greater demand from the Japanese market. Thus, Htaung-hnan[10] is preferred to Talin-hnan[11] by the local exporters.

As noted earlier, the country's largest sown area of monsoon sesame begins to supply markets in August. As a result, prices decline in the main producing area. At this time, marketing activities of temporal and spatial arbitrage can be found in the domestic market. Local exporters start to purchase sesame from main producing area and pay a 1 per cent commission of the buying value to a large-scale wholesaler from the main producing area. Local exporters demand niger, which is to be used as bird feed in buyer countries.

Based on market surveys, the supply volume of imported palm oil influences the price of locally produced edible oil. If palm oil is in oversupply in the local market when the newly harvested sesame and groundnut begin to enter the market, prices of oilseed crops decline sharply. By contrast, if the supply volume of palm oil is low compared to the quantity demanded during the planting time of the monsoon season oilseed crops, prices of oilseeds and edible oil rise. Thus, the quantity of palm oil supplied to the local market is an important issue to stabilize the edible oil price in the domestic market. Local oil mills supply groundnut and sesame cake to market for feed which is mainly demanded from feed mills and poultry farms.

Of the oilseeds, a small volume of sesame is exported. At times, niger is in demand from buyer countries. The country's oilseed crop production, exports of sesame seed and the volume of imported palm oil are mentioned in Table 4.54.

Table 4.54 The country's sesame exports and imports of palm oil (1992-1993 to 2001-2002) ('000 mt)

Year	Sesame			Import of palm oil
	Export	Production	% of export	
1992-1993	48.0	237	20	125
1993-1994	62.0	223	27	155
1994-1995	80.0	304	26	205
1995-1996	50.3	303	17	218
1996-1997	52.5	344	15	72
1997-1998	51.7	296	17	154
1998-1999	42.2	210*	20	138
1999-2000	19.5	295	7	158
2000-2001	34.4	426	8	205
2001-2002 (provisional)	13.2	399	3	192

Source: Sesame export figures based on Selected Monthly Indicators, CSO.
Sesame production based on SLRD, MOAI.
Palm oil imports refer to Statistical Yearbook, CSO.
* Due to El Nino, sesame production declined in 1998-1999.

4.3.4 Industrial crops

In Myanmar, cotton, sugarcane and jute are known as industrial crops. According to historical information, agro-industries were owned by the state sector under the centrally planned economic era. As such, farmers sold their fixed quota of industrial crops to state-owned mills at a fixed price and the rest of the marketable surplus was sold to privately owned small-scale factories. Even after adopting market-oriented economic policy, this system is still in practice. The reason is that the private sector cannot operate solely from their own finance.

[10] The harvested sesame plants are erected for drying. After drying, threshing is done on tarpaulin sheets. This type of threshing is called Htaung-hnan, which has less content of FFA and foreign matter.
[11] The second way is that the harvested sesame plants are stacked for drying. After that, threshing is done on the bare ground, which is known as floor threshing. This type of threshing has more content of foreign matter as well as FFA.

Because of this, the government is still running the factories. Domestic industrial crop production is shown in Table 4.55.

Table 4.55 Sown area trend of industrial crops (1992-1993 to 2001-2002) ('000 ha)

Year	Cotton (seed cotton)	Sugarcane	Jute
1992-1993	168	76	55
1993-1994	144	62	33
1994-1995	205	52	39
1995-1996	379	67	50
1996-1997	333	82	47
1997-1998	267	108	38
1998-1999	325	126	40
1999-2000	341	134	38
2000-2001	324	139	45
2001-2002	295	163	51

Source: Settlement and Land Record Department, MOAI.

4.3.5 Perennial crops

Rubber and oil palm are the major perennial crops in Myanmar even though there are some other perennials such as coconut, tea, coffee and fruit trees.

Rubber has been planted since 1909 but it has never become a major perennial crop in Myanmar. A rubber expansion programme initiated in 1956 increased the area under rubber from 46,000 to 74,000 ha in 1962. However, during 1962-1987, fewer plantations were established because the government nationalized the private rubber plantations. Only when the market-oriented system was introduced in 1988, the area under rubber gradually increased from 77,000 ha in 1990/1991 to 180,000 ha in 2000/2001. Rubber yield increased from 370 to 577 kg/ha as the old unproductive varieties were replaced with new HYVs. Of the 35,000 mt produced in 2000/2001, about 25,000 mt were exported and 10,000 mt consumed domestically.

Oil palm sown area in Myanmar was 36,000 ha in 2002-2003 and the yield was 8.6 fresh fruit bunch (FFB) or 1.7 crude palm oil (CPO) per ha. Production areas are Taninthari, Mon state, and Rakhine state. Current planted area is expected to be in full production by 2008 with the average economic life being about 30 years. Current production is about 8,500 mt of CPO. Myanmar is an edible oil deficient country and 150,000 to 200,000 mt of palm oil is imported annually. The government is trying hard to reduce this level and it is necessary to increase both sown area and yield in Myanmar. Therefore, the role of the private sector has become very important. The government has allocated thousands of acres to national private investors in southern parts of Myanmar to increase the sown area of oil palm.

4.4 Summary

In Myanmar, more than 60 different crops are grown based on the prevalence of different agro-ecological zones. The total crop area including both seasonal and perennial crops amounted to 15.85 million hectares in 2001-2002. The country's cropping intensity was 149 per cent. These crops can generally be categorized into 8 groups namely: cereal crops, oilseeds crops, pulses, industrial crops, culinary crops, vegetables, fruits and other crops.

Among these, cereal crops constitute the largest share of cropped area with 46 per cent of the multiple crop sown area followed by pulses and then oilseeds. Of the 7.23 million hectares of cereal crops, the area planted to paddy was 6.45 million hectares.

Based on seasonal planting, the area cultivated in the monsoon (or) rainy season was over 10.68 million hectares, 67 per cent of the total multiple crop area sown. After that, crop cultivation during the cool season is second, followed by the area cultivated during the pre-monsoon or summer season. The success of domestic crop production, therefore, relies on the cultivated area of the monsoon season.

Pulses, one of the CGPRT crops, are important from the viewpoint of national economics, ecology and social impact. Pulses are a major foreign exchange earner for Myanmar and can slow forest depletion and enrich soil fertility where low levels of fertilizers are used due to the unavailability and un-affordability of poor farmers. At the same time, pulses serve as stable income generators for poor farmers especially in the dry zone.

Maize is also important for exports, income generation and as a staple food for some hill tribes especially in Chin Hill. If production of maize is increased, raising animals in Chin Hill has great potential.

The cost and return ratio could vary depending upon the production area. For instance, the cost and return ratio of summer rice and black gram in the delta area (rice surplus area) is 1.15 and 1.97 respectively but in the dry zone (rice deficit area), 1.77 and 1.79. This occurs because of the difference in prices in respective areas.

5. Review and Analysis of Agricultural Development Policies

5.1 Land use policy

The land use policy is stipulated in the Land Nationalization Act 1953, Tenancy Act and Rules 1963, and Procedures Conferring the Rights to Cultivate Land 1963. Under this policy, all land belongs to the state but farmers are given land use or tillage rights on their holdings, which cannot be transferred, mortgaged, or taken in lieu of loan repayments. However, land right is legally inheritable by family members who remain as farmers and till the land by themselves but absentee ownership is illegal.

The land allocation committee has the right to change the ownership of misused land holdings according to the act and to transfer the right to entitled landless farmers. The land use policy does not allow farmers to use their land as collateral to borrow money from banks. As most farmers' main asset is their land, the policy makes it difficult to access institutional credit for large-scale agricultural investment. The Myanmar Agricultural Development Bank (MADB) thus uses joint liability as the basis of loan guarantees. Using this approach however, farmers can only obtain small loans from MADB. Although land cannot be legally transferred or sold, some farmers unable to cultivate their land have unofficially transferred or sold it to other farmers.

In 1988, The State Law and Order Restoration Council (SLORC) announced the end of the socialist economic system and introduced a market-oriented economy. However, land laws have basically remained unchanged. The government encourages private sector participation in the production, supply, and distribution of agricultural machinery, farm inputs and in the commercial production of annual and perennial crops. After 1988, the government relaxed its rules on the production of food and industrial crops by allowing farmers to grow crops of their choice. However, since 1993, it is still an obligation for farmers in irrigated areas to grow summer paddy.

The government allows private investors and farmers to develop fallow land and cultivable wasteland for agriculture. To implement this policy, the government in 1991 established the Central Committee for the Management of Cultivated Land, Fallow Land, and Waste Land, chaired by the Minister for Agriculture and Irrigation. The committee approves local and foreign investment in agriculture. The committee can approve the provision of up to 20,000 ha of land to investors for agricultural purposes. This was a major departure from the earlier policy, which limited the size of land holdings to less than 20 ha per family for rice land, 10 ha for *kaing* (alluvial land) and 4 ha for *Ya* (uplands) land for reasons of equity.

5.2 Production policy

Food security, export promotion, increasing income and better welfare for the rural populace are the major components of the goal of agricultural policies of most developing countries in Southeast Asia and they are also interrelated. Under present circumstances, Myanmar is paying much more attention to a production drive than a rural welfare oriented approach, which includes growth, stability and sustainability of the rural poor. In August 1992, the State Law and Order Restoration Council (SLORC), predecessor of the present State Peace and Development Council (SPDC) issued guidelines that paddy is designated as a national crop and to promote its production, that other agro-related-sectors support rice production, and the

concerned authorities must collaborate to increase rice production and regard it as a national cause.

These guidelines suggest that the government accords top priority to increase rice production to achieve self-sufficiency not only at the national level but also at divisional and state levels. Accordingly, within the entire irrigation scheme, the farmers are obliged to grow rice during the summer rather than more profitable or agro-ecologically sound crops. In sandy soil, farmers are asked to grow rice even though maize, pulses or, oil crops such as groundnut and sesame, would be more suitable in terms of their agronomy and water use efficiency.

Rice is the staple food crop for Myanmar and it is important culturally, economically and strategically. It is understandable in the interest of Myanmar, especially under the current political atmosphere, that it is targeted for national level self-sufficiency. By doing so, there could be enough flexibility for diversification at the regional level, which would mean agro-ecologically suitable crops could be produced in respective regions. If the rice self-sufficiency programme is launched at regional and local levels, problems could arise, such as the inefficient use of irrigation water and land, sub-optimal agricultural production and a high cost on farmers' welfare. Diversification is on the agenda of Myanmar agriculture but not yet in practice as required. The main question to answer is whether production is the end or the means? In fact, enhancing production is a tool to achieve the end of raising income. In other words, production is for raising income, it is not income raising productivity. Stability and sustainability of income growth are much more desirable and important for sustainable national economic growth. At the same time, for the sake of sustainability, whatever decision is made, it should be made based upon economic and ecological considerations.

5.3 Procurement and marketing policy

In Myanmar both the public and private sectors play active roles in the procurement and marketing of agricultural products. In the public sector, state economic enterprises (SEE) under MOAI are responsible for procurement, processing and marketing of sugarcane, cotton, rubber, Jute, cashew and oil palm from the cultivators. The quota sold to SEE ranges from 15 per cent to 45 per cent of production.

The government continued to force rice farmers to sell 10 to 15 baskets per acre (1 basket of unmilled rice = 46 lb or 20.9 kg) to MAPT at prices well below the market price until April 24, 2003. The amount of paddy to be sold to MAPT depends on yields with a ceiling of 619 kg/ha or about 15 per cent of total production. Summer rice grown under irrigation is exempt from this requirement as an incentive for farmers to grow a second crop of rice. The purchase price of rice is low. In 2002, for example, paddy was officially procured at K 320/basket, while the prevailing market price ranged from K 1,000 to 1,500 per basket. It was a kind of implicit tax on the farmers which constrained the expansion of rice production, the government justifies the low price by providing high subsidies to farmers for the purchase of fertilizers, pesticides and other agro-inputs. This justification no longer holds since subsidies on imported fertilizers and pesticides have been removed since 1993-1994. Domestic urea fertilizers, which continue to be sold at a subsidized price to farmers, constitute only a part of the fertilizers sold in the market.

A new rice trade policy was announced in April 2003 and the government no longer buys paddy direct from farmers. Many people welcome it as a positive step and production is predicted to rise but a number of conditions must be fulfilled for this expectation to be realized.

Compared to rice and other industrial crops such as sugarcane, CGPRT crops could enjoy exemption from government procurement at low prices and could be one of the major factors to promote the expansion of pulses' sown area within a short period of time.

5.4 Investment policy

To achieve its policy objectives, the government adopted five specific strategies for agricultural development.

- Development of new agriculture land
- Provision of sufficient irrigation water
- Provision and support for agriculture mechanization
- Application of modern agricultural technologies
- Development and utilization of modern varieties

Development of new agricultural land. As mentioned before, Myanmar is endowed with vast cultivable land. Thus, the country still has large areas to expand its cultivated area by converting fallow land and wasteland. But to reclaim these areas will require heavy investment in flood control, drainage improvement, weed control, and infrastructure. Due to the high capital investment cost, the government granted concession rights to large private companies (domestic and foreign) to cultivate paddy and tree crops for 30 years on fallow land and wasteland.

Provision of sufficient irrigation water. To increase crop yields and cropping intensity, the government gives high priority to irrigation development. From 1988-1989 to 2000/2001, the government increased public investment in irrigation development and expanded the irrigated area from 1 million to 2 million ha, which is currently about 20 per cent of the total cultivated area.

Provision and support for agricultural mechanization. To increase cropping intensity, the government also accords high priority to expanding the use of machinery for land preparation, planting, harvesting, threshing and drying. About 23 model mechanized villages have been established to demonstrate the benefits of farm mechanization. A large number of four-wheel tractors, power tillers, threshers, and reapers have been sold to farmers in these villages. Timely land preparation is very important for the production of pulses in the cool season using residual soil moisture after harvesting monsoon rice around October and November. It is impossible to use cattle to finish land preparation for large areas within a few weeks. A review mission of the AGRIDIV project witnessed the importance of mechanized land preparation for the production of pulses in Thongwa Township, Yangon division during their review in Myanmar.

Application of modern agricultural technologies. Through agricultural extension, the government emphasizes the importance of technology transfer to farmers, including improved cultivation practices, appropriate cropping patterns, application of fertilizers, and systematic plant protection practices. Various extension approaches like the use of mass media (newspapers, radio, television, and journals); production of pamphlets; training and visits by extension workers to farmers; farmer training and; on-farm demonstrations are applied for the transformation of modern technologies.

Development and utilization of improved varieties. To improve the yield and quality of crops grown, the government promotes the breeding of HYVs, the production of hybrid varieties, and the introduction of new improved varieties of fruits and vegetables from abroad. Under the third Five-year Development Plan (2001/2002-2005/2006), the government plans to increase the value of net output of crops from MK 445 billion to MK 541 billion.

5.5 Summary

Myanmar agriculture is still production oriented, not yet rural welfare oriented. Rice is a national priority crop and the government accords top priority to increase rice production to achieve self-sufficiency not only at the national level but also at regional levels. If the rice self-sufficiency programme is launched at regional and local levels, it could result in problems, such

as the inefficient use of irrigation water and land, sub-optimal agricultural production and a high cost on farmers' welfare. It is therefore suggested that decisions concerning production should be based upon economic and ecological considerations.

The Government of Myanmar has adopted five specific strategies for agricultural development in Myanmar and private investors are being encouraged to invest in agriculture. However, most of the farmers are small-scale and poor. The present land use policy does not allow farmers to use their land as collateral to borrow money from banks. As most farmers' main asset is only their land, this policy makes it difficult to access institutional credit for relatively large-scale agricultural investment.

6. Impact of Global Trade Orientation on CGPRT Crop Agriculture

6.1 Background information on foreign trade

Foreign trade in Myanmar can be classified in two categories: (i) normal overseas trade carried out through conventional systems mainly from Yangon Port and (ii) border area trade. During the FY 1988/1989, for the first time, private exportation of pulses, maize and some crops other than rice, was permitted. Border trade was legalized and allowed to be conducted at the market exchange rate. Exporters were permitted to retain their earnings in foreign currency bank accounts, although they were required to use the bulk of it for imports.

The Trade Council headed by the vice-chairman of the State Peace and Development Council (SPDC) is responsible for making decisions on trade policy. All exports require a permit from the Ministry of Commerce. Exports of agricultural products are controlled and carried out by a number of central government marketing agencies. These include Myanmar Agricultural Produce Trading (MAPT) under the Ministry of Commerce, Myanmar Agriculture Service (MAS), and the State-owned Economic Enterprises (SEEs) such as Myanmar Farms Enterprise (MFE), Myanmar Perennial Crops Enterprise (MPCE), Myanmar Cotton and Sericulture Enterprise (MCSE), Myanmar Jute Industries (MJI) and Myanmar Sugarcane Enterprise (MSE) under the Ministry of Agriculture and Irrigation.

MAPT exports all agricultural products but MAS exports specific varieties of rice such as 'Basmati' cultivated under an organic farming system and 'Lone-Thwe-Mhwe' variety as well as pulses, yellow maize, oilseed crops, and fruits and vegetables produced on their farms. MFE can export its produce including coffee, and the other SEEs export their respective products such as natural rubber, cotton, jute and sugar.

The Ministry of National Planning and Economic Development prepares as a part of the foreign exchange budget an annual plan for exports and imports by the public sector enterprises. For this it fixes annual targets for foreign exchange earnings for each ministry. Each ministry requires earning foreign exchange to meet its requirements. All public sector international trade is transacted at the official exchange rage. All export proceeds are surrendered to the Ministry of Finance.

For meeting its foreign exchange requirements, the MOAI is allocated an export quota of various commodities produced on farms under its control and/or through purchases from farmers and traders. In turn the MOAI has set up a Central Economic Committee (CEC) headed by the Deputy Minister for Agriculture. The CEC meets at least once a week to evaluate the export price offered by various traders for different commodities. If the price offered is acceptable the CEC recommends it to the Agriculture and Irrigation Minister for approval. The CEC also reviews the export performance of various enterprises under MOAI.

In March 1998, the private entrepreneurs who reclaimed wetland, virgin and fallow land in Myanmar were allowed to export 50 per cent of their rice production. The Trade Council has made frequent amendments to the list of prohibited exports, issuing temporary bans with little or no advance notice. Following the balance of payment crisis in 1997/1998, the Trade Council reintroduced a somewhat state monopoly on exports of a large number of agricultural products. In 2003 it was announced that the private sector is allowed to export rice. In April 2004, the private sector was allowed to deal in sugar, cotton and rubber except for export.

The country makes frequent and abrupt changes announced by the Trade Council in its agricultural export policy. For instance following the increase in domestic prices of rice in late 1994 and early 1995, the GOM stopped exports of rice. Again in late 2003 temporary

suspension on the export of five commodities including rice was imposed even under the announcement of rice trade liberalization. This could make Myanmar suffer set backs in its credibility as a supplier in the international rice market.

Before April 2004, the various SEEs engaged in the export of agricultural products followed different policies regarding the procurement of produce from farmers, setting procurement and export prices and allowing private traders to export. For instance for natural rubber, the Myanma Perennial Crops Enterprise (MPCE) sets the procurement price for five grades of raw rubber based on the export prices prevailing in neighbouring countries such as Singapore and Thailand. However, the Myanmar Cotton and Sericulture Enterprise (MCSE), procured seed cotton according to three grades based on the prices fixed by the Trade Council, which had remained unchanged for three seasons.

There are some problems with the official foreign trade data. These arise mainly from the use of both the official and the market exchange rates in recording external transactions and a reported widespread informal border trade. Based on the data available at the moment, Myanmar's merchandise exports, mainly f.o.b. during 1992/1993 to 1998/1999, averaged equivalent to US$ 882 million. Of these total exports, overseas trade accounted for 85 per cent, while recorded exports through border areas accounted for the remaining 15 per cent. The country's total merchandise imports, mainly f.o.b. during the same period averaged US$ 1,740 million.

The recorded border trade figures seem to be significantly under-valued, as a considerable amount of unrecorded border exports continue due to the long porous borders with the four neighbouring countries.

Border trade takes place with China, Thailand, India and Bangladesh. Among these countries China is the leading partner accounting for almost 55 per cent of both the recorded total border exports and imports. Thailand follows with roughly one-third of border exports and 41 per cent for border imports. India accounts for over 3 per cent for exports and supplies 5 per cent of Myanmar's border imports. Bangladesh absorbs over 10 per cent of Myanmar's border exports while contributing only 1 per cent towards borders imports. Detailed information on the commodities involved in border exports and imports is not available. Generally, border merchandise exports consist mainly of agricultural products and imports are mainly construction material and electronic consumer goods.

6.2 International commitments on trade liberalization

Myanmar is an ASEAN member country and an active participant in the ASEAN Free Trade Area (AFTA). AFTA has been considered the most important sub-regional economic endeavour of ASEAN in recent years. AFTA was also created to provide an integrated market that would be attractive to foreign investors and encourage them to build plants to efficiently scale and promote the growth of intra-industry trade within ASEAN. The ultimate objective of AFTA is to increase ASEAN's competitive edge as a production base geared for the world market. A critical step is the liberalization of trade in the region through the elimination of intra-regional tariffs and the elimination of non-tariff barriers. As the cost competitiveness of manufacturing industries in ASEAN is enhanced and with the larger size of the market, investors can enjoy economies of scale in production.

The agreement to realize AFTA is implemented through the scheme of Common Effective Preferential Tariff (CEPT), which was introduced in 1993. The CEPT scheme is a cooperative arrangement among ASEAN member countries that would reduce intra-regional tariffs and remove non-tariffs barriers over a 15-year period commencing 1st January 1993. The goal of the scheme is to reduce tariffs on all manufactured goods to 0-5 per cent by 2008.

All manufactured products including capital goods and processed agricultural products, and those falling outside the definition of agricultural products are covered by the CEPT scheme. Agricultural products are defined as agricultural raw materials and unprocessed

products covered under Chapter 1-24 of the Harmonized System Code (HS), and similar agricultural raw materials and unprocessed products in other related HS headings, and products which have undergone simple processing with minimal change from the original products.

CEPT concessions granted on a reciprocal basis are the lower tariff rates or customs duties that exporters from ASEAN member countries have to face when exporting a product to other ASEAN member countries.

Three conditions for a product to be eligible for concessions under CEPT are:

- The product has to be included in the Inclusion List of the exporting and the importing countries and must have a tariff of 20 per cent or below.
- It has to have a programme of tariff reduction approved by the AFTA council.
- It has to be an ASEAN product, i.e. it has to satisfy the local content requirement of 40 per cent.

6.3 Myanmar's participation in AFTA

Myanmar joined ASEAN on 23rd July 1997. Myanmar acceded to the CEPT Agreement and submitted her CEPT Product Lists and tariff reduction plan. Myanmar submitted the lists of products to be phased in from the Temporary Exclusion List (TEL) into the Inclusion List (IL) with their tariff reduction schedules at the 29th ASEAN Economic and Ministers meeting on 16-18 October 1997 in Kuala Lumpur.

Under the terms and conditions of the CEPT Package and Commitment, Myanmar is to:

- Extend on a reciprocal basis, Most-favoured Nation (MFN) and National Treatment (NT) to ASEAN member countries.
- Provide relevant information on her country's economic profile, particularly trade statistic requirements when requested.
- Prepare a list of tariff reductions and begin reducing tariffs effective from 1st January 1998 and ending at 0-5 per cent tariff rates by 1st January 2008, and prepare a list of these products for their annual installment; phase-in agricultural products which are temporarily excluded beginning 1st January 2002 in equal installments and ending 1st January 2008 at 0-5 per cent, and prepare a list of these products for their annual installment.
- Phase-in agricultural products which are considered sensitive beginning 1st January 2006 and ending 1st January 2015 at 0-5 per cent and prepare a list of these products for their annual installment; and
- Submit a list of products for General Exception (GE) which are consistent with Article 9 of the CEPT scheme.

Myanmar's tariff reduction schedule plan was submitted to the ASEAN secretariat in July 1997. Myanmar has 2,356 tariff lines (43 per cent of total tariff lines) on its inclusion list; 21 tariff lines of unprocessed agricultural products on the sensitive list; and 108 tariff lines on the general exception list. Due to difficulties in removing non-tariff barriers (NTBs) and quantitative restrictions (QRs), 2,987 tariff lines were placed on the temporary exclusion list.

Table 6.1 Distribution of Myanmar's CEPT products list

Product list	No. of tariff lines	Percentage
Inclusion list (IL)	2,356	43.0
Temporary exclusion (TEL)	2,987	54.6
Sensitive list (SL)	21	0.4
General exception (GEL)	108	2.0
Total	**5,472**	**100.0**

Source: ASEAN Secretariat.

On 1st January 1998, Myanmar implemented her first package of the CEPT Scheme, which was legally enacted by the Ministry of Finance and Revenue on 10th December 1997. In this first package, Myanmar included 2,356 tariff lines on the inclusion list.

Table 6.2 Composition of Myanmar's inclusion list based on the tariff lines

Sector	Percentage
Base metal	19.91
Machinery	14.09
Optical	9.80
Chemicals	9.25
Live animal	9.04
Others	37.91
Total	**100.0**

Source: ASEAN Secretariat

Table 6.3 Number of tariffs in Myanmar's temporary exclusion list

Temporary exclusion list	No. of tariff lines	Percentage
Unprocessed agricultural products	265	8.9
Processed agricultural products	507	17.0
Manufactured products	2,215	74.1
Total	2,987	100.0

Source: ASEAN Secretariat.

6.4 Analysis of impacts of trade liberalization

Myanmar became a WTO and an ASEAN member country in 1995 and 1997 respectively. The findings of Myanmar confirmed the theoretical concepts of gainers and losers in trade liberalization. At the national level in the case of import commodities, there is a consumer's gain due to the increase of imports and lower import prices. For the case of export commodities there is a producer's gain due to the increase in export quantity and price. In addition, farm level analysis also confirmed that farmer's gross returns decreased due to decreases in farm gate prices of imported commodities, while the reverse is true for the case of export commodities.

Consequently commodity production decreased for import commodities and increased for export commodities. Based on these concepts, a hypothesis was put forward and tested for the impacts of trade liberalization after introduction to the WTO in 1995 as follows:

- National level:
  - Import commodities: the quantity increased, import prices and domestic production decreased.
  - Export commodities: the quantity increased, export prices and domestic production increased.
- Farm level:
  - Import commodities: the quantity increased, production and farm gate prices decreased.
  - Export commodities: the quantity increased, production and farm gate prices increased.

6.4.1 Time trend analysis

In order to understand the impact of trade liberalization, a time trend analysis was conducted using the following equation:

$$\mathbf{Y = a + bT + cD}$$

Where Y = annual quantity or price
T = year
D = 0 starting from 1984 to 1994
D = 1 starting from 1995 to 2001

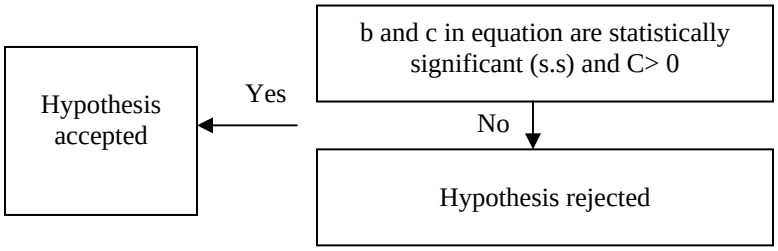
The time trend equation is calculated covering the period from 1984 to 2001 and using a dummy variable to test the impact of the WTO.

If the estimated coefficient T or "b" and D or "c" are statistically significant and "c" is positive then the hypothesis is accepted.

The above formula uses the example of import quantity. A similar explanation is possible for export quantity, import price, export price, production quantity and farm gate price.

Two main CGPRT crops, maize and pulses, were selected for calculation. The term statistically significant means that all the coefficients of an equation have a t-value significant at the 90 per cent level. An equation is deemed successfully if it is statistically significant; its multiple correlation coefficients are more than 0.1 per cent. The value mentioned in parenthesis is standard error.

A flow chart to test the hypothesis on the effect of trade liberalization in trade quantity, production and farm gate price for export is as follows:



Due to the effect of trade liberalization;
Hypothesis **A** is trade quantity significantly increased for export commodities.
Hypothesis **B** is production quantity significantly increased for export commodities.
Hypothesis **C** is farm gate price increased for export commodities.

According to the statistical analysis conducted during the study based on available data from the central statistical organization, the following are the outputs for key CGPRT crops.

Maize

Myanmar is assumed as an exporter in this case. For the export quantity, hypothesis **A**, is rejected as follows:

Y	=	-2.632 – 4.348T – 36.844D	
		(2.388)	(25.422)
t-value		1.820	1.449
R^2	=	0.698	

For the production quantity, hypothesis **B** was accepted as follows:

Y = 277.545 – 7.54T + 139.95D
(3.456) (36.786)
t-value -2.170 3.805
R^2 = 0.550

For the farm gate price for maize, hypothesis **C** was accepted for Myanmar as follows:

Y = -5421.132 + 1620T + 6477.9D
(306.69) (302.63)
t-value 5.282 1.985
R^2 = 0.921

Pulses

Myanmar is assumed as an exporter. For the trade quantity, hypothesis **A** was successful as follows:

Y = -73.209 + 39.23T + 115.16D
(9.089) (96.724)
t-value 4.317 1.191
R^2 = 0.6871

Black gram

For the production quantity of black gram in Myanmar, hypothesis **B** was successful as follows:

Y = -15188.34 + 3793T + 19635D
(991.22) (1054.9)
t-value 3.827 1.861
R^2 = 0.876

The farm gate price, hypothesis **C** was successful as follows:

Y = 15.798 + 16.76T + 127.50D
(3.932) (41.85)
t-value 4.262 3.047
R^2 = 0.92

Green gram

For the production of quantity significantly increased for export, hypothesis **B** was successful as follows:

Y = -20029.49 + 4824.2T + 21585D
(131.25) (139.68)
t-value 3.076 1.545
R^2 = 0.857

For farm gate price, hypothesis **C** was successful as follows:

Y = -52.316 + 19.007T + 168.49D
(3.651) (38.857)
t-value 5.206 4.336
R^2 = 0.952

Pigeonpea

B hypothesis, production quantity increased for export commodities was unsuccessful.

$$Y = -3.478 + 10.746T + 27.568D$$
$$(3.167) \quad (33.708)$$
$$\text{t-value} \quad 3.393 \quad 0.818$$
$$R^2 = 0.798$$

For farm gate price, hypothesis **C** was unsuccessful as follows:

$$Y = -22434.39 + 5339T + 16309D$$
$$(167.84) \quad (178.63)$$
$$\text{t-value} \quad 3.181 \quad 0.913$$
$$R^2 = 0.881$$

Soybean

For the production quantity, hypothesis **B** was successful as follows:

$$Y = -12350.01 + 3421.5T + 9568.2D$$
$$(833.71) \quad (887.27)$$
$$\text{t-value} \quad 4.104 \quad 1.078$$
$$R^2 = 0.856$$

For the farm gate price, hypothesis **C** was also successful in following equation:

$$Y = 7.549 + 3.514T + 16.733D$$
$$(98.442) \quad (10.477)$$
$$\text{t value} \quad 3.57 \quad 1.597$$
$$R^2 = 0.854$$

6.4.2 Simple welfare analysis

Attempts are made to know the effect of trade liberalization for the CGPRT crops like pulses and maize in Myanmar at the national level by using simple welfare analysis. Essentially this analysis consists of estimating the own price elasticity of demand and supply, and the elasticity of price transmission between the two market levels in Myanmar.

The difficulties encountered by using this method of analysis in this research are due to a lack of availability and reliability of data. The first problem is a lack of time series data sufficient for estimating the equations. For example, time series data for the wholesale and retail prices of specific pulses is not sufficient to estimate the domestic demand and supply. The next problem is that when data is available it is often unreliable. For example, in calculating the elasticity of price transmission, the wholesale and export price data for pulses, from the statistical year book published by Central Statistical Organization (CSO) was tried to be used, but it was found that the wholesale price for the product was higher than the export price for each year as the export prices of commodities are converted into local currency using the official exchange rate. As a result, it was impossible to conduct a simple welfare analysis in this report

6.5 Resource reallocation and employment

Resource reallocation as a result of trade liberalization following the WTO and AFTA tariff reduction schemes are presented in Table 6.4. In general, ASEAN countries have experienced a shift of resources from primary sectors such as agriculture and mining to manufacturing sectors. The outputs of manufacturing sectors, ranging from labour intensive to more capital intensive are predicted to increase by significant percentages.

Table 6.4 The impact of trade liberalization on changes in output growth (GDP) (%)

Sector	1994-1995	2000-2001
Agriculture	6.7	9.5
Forestry	-14.3	3.3
Livestock and fisheries	6.0	17.8
Mining	21.3	25.5
Processing and manufacturing	8.5	23.4
Construction	15.7	11.9
Service sector	10.0	13.2

Source: CSO, 2001, Statistical Yearbook.

The shift of resources from primary sectors to processing and manufacturing sectors can clearly be seen. Sectors, which are predicted to have output increases, are agriculture (6.7 to 9.5 per cent), forestry (-14.3 to 3.3 per cent), livestock and fisheries (6.0 to 17.8 per cent) and mining (21.3 to 25.3 per cent). Output increases in the forestry, livestock and fisheries, and mining sectors are associated with the growing resource-based processing and manufacturing. Therefore, Table 6.4 shows that Myanmar will have to depend on its processing and manufacturing industries, mainly labour-intensive and resource-based manufacturing. The smaller output of the agriculture sector will lead to smaller labour demand in rural or agricultural areas and create unskilled labour migration to other sectors, especially labour-intensive manufacturing.

Therefore, Myanmar's comparative advantage in the near future will remain in its relatively cheap labour. The changing pattern of employment is consistent with the changing sectoral output as a result of resource reallocation. In general, sectors, which expand as a result of trade liberalization demand more labour, and given the flexibility in the domestic labour market, labour moves from the shrinking to expanding sectors. The manufacturing sector in Myanmar is expected to benefit from trade liberalization and resources will move from the primary sectors such as agriculture, forestry, livestock, fisheries and mining to the manufacturing sector. The expansion of the manufacturing sector will increase labour demand and therefore labour will migrate from the primary sectors to the manufacturing sector. Myanmar, as a labour abundant country, will receive benefits from the development of labour-intensive industries.

6.6 Summary

There are two types of foreign trade in Myanmar; normal trade from Yangon Port and border area trade, which account for 85 per cent and 15 per cent of total trade respectively. The Trade Council is responsible for making decisions on trade policy and State Economic Enterprises are actively playing important roles in exporting agricultural products together with the private sector. In 2003 it was announced that the private sector would be allowed to export rice, but in reality this is frequently on and off due to the Trade Council through its agricultural export policy. This could make Myanmar suffer a set back in its credibility as a regular rice supplier in the international market. Recently, in April 2004, the sugarcane, rubber and cotton markets were liberated but only rubber is allowed for export by the private sector.

Myanmar is an active participant in the ASEAN Free Trade Area (AFTA) and a member of the WTO. As a result of trade liberalization, production of key CGPRT crops has significantly increased for export. In future, Myanmar will have to depend on its processing and manufacturing industries, mainly labour-intensive and resource-based manufacturing.

7. Benefits of Agricultural Diversification on Poverty Alleviation

In previous agricultural development programmes in Asian countries, the main effort was on increasing the production of food crops, livestock, fisheries, and perennial crops. Now, however, the major objective has shifted to the improvement of the income and welfare of farmers and the rural population. Unfortunately, Myanmar is still at the stage of a production-oriented agricultural system while other countries are marching towards developing commercialized farming and poverty alleviation. Improvement or stability of the income of the farmers or rural people could be achieved through diversification of farming activities and the freedom of choice to choose the line of activities for their betterment of life. Increasing production should only be pursued if it is consistent with improving income under the given condition that food shortages are not a critical problem.

Due to negative impacts of production and price risks generated by globalized trade as well as unstable climatic conditions such as drought, setting up a safety net or assurance system in the rural economy is essential. CGPRT crop farming in this sense could play an important role.

CGPRT crops, generally secondary crops after rice, are an important farming resource, particularly for the poor in upland marginal areas like the central dry zone of Myanmar where other agricultural resources and employment opportunities are limited. Even though CGPRT crops in the dry zone could not directly substantially increase rural income, these crops can significantly secure or stabilize income levels of the poor in particular.

Rural poverty and agriculture are closely linked in Myanmar. About 70 per cent of the poor live in rural areas and are engaged in agriculture. Agricultural income must be stabilized and raised for the benefit of farmers. At the same time, the rural poverty rate varies regionally in Myanmar. The World Bank conducted a survey on rural poverty and prepared a ranking of rural poverty (head count index) by state and division as presented in Table 7.1.

Table 7.1 Ranking of rural poverty in Myanmar

State/division	Urban	Rural	Overall	Rank
Chin (hilly)	19.8	47.1	42.1	1
Kayah (hilly)	30.8	37.4	35.4	2
Magway (dry zone)	44.9	36.3	37.9	3
Bago (delta)	26.6	25.4	24.7	4
Sagaing (dry zone)	27.6	24.3	24.9	5
Mandalay (dry zone)	18.8	23.9	22.3	6
Rakhine (coastal)	34.5	19.2	22	7
Ayeyarwaddy (delta)	47	17.3	22.7	8
Yangon (delta)	16.6	16.7	16.7	9
Mon	27.1	16.1	19.9	10
Shan (hilly)	7.1	13.4	12	11
Kayin	11.8	12.8	12.7	12
Kachin (hilly)	4.6	11.9	10.1	13
Tanintharyi (coastal)	9.8	7.4	8.1	14
National	**23.9**	**22.4**	**22.9**	

Source: World Bank, 1999.

According to Table 7.1, it can be observed that divisions in the central dry zone, a major production area of two main crops, pulses and oil crops, are ranked high in terms of the poverty rate. Moreover, the poorest region Chin (sown area of maize in Chin state was 30,000 ha), where maize is the staple food, is a major production area of maize and if production was

increased, it could contribute not only to food security but also breeding of domesticated Indian bison which could become a major income generating activity for hill tribes people. Oppositely, in the delta area such as Myaungmya 73.8 per cent of income comes from paddy. The people of Magwe rely on 81 per cent of their income coming from a diversified farming system of mainly pulses and oil crops as shown Table 7.2.

Table 7.2 Income share from different sources

Area	HH[1] size	Income share from different sources				Poverty % nominal
		Paddy	Other crops	Farm labour	Non-agri	
Myaungmya	3.3	73.8	2.8	4.9	18.6	44.8
Kalaw	4.4	1.4	84.8	8.3	5.5	32.4
Kyaykse	3.4	33.8	42.2	4.0	20.1	22.1
Magwe	4.4	0.0	81.9	2.8	15.3	37.5
Taungdwingyi	5.3	19.6	68.6	7.9	3.9	66.7
Bago	5.0	60.5	28.4	3.6	7.5	21.7
Overall	4.0	31.2	42.9	4.9	21.1	33.3

Source: Department of Agricultural Planning, 2003.
Note: [1] HH stands for household.

Growers of pulses, especially in the central dry zone area, benefited from exploiting residual soil moisture without irrigation water. Moreover, pulses are soil-building crops, which fix nitrogen from the air. This is a good advantage for growing pulses for resource poor farmers under the condition of scarcity of credit and fertilizers from the viewpoint of financial and environmental sustainability. As discussed in previous chapters, pulses are profitable crops for farmers and one acre of pigeon pea, which is extremely suitable for the dry zone, could provide enough wood fuel for one person for a year. It contributes greatly to the protection of both buffer and reserved forests in the dry zone while there are practically no other energy sources available for the rural poor. Therefore, growing pulses, one of the main CGPRT crops, is ecologically sound, economically viable, socially just and politically acceptable in Myanmar.

In fact, pulses are not only good for the farmers but also advantageous for the country. Aye Aye Mon from the Department of Agricultural Planning conducted a comparative advantage study on black gram and green gram using Direct Resource Cost (DRC) method in 2001.

According to the analysis of DRC and benefit/cost for black gram and green gram in four different locations, DRC ratios were less than one and greater than zero for black gram and green gram in all regions. This can be interpreted that there was comparative advantage for producing these crops. The overall average DRC result for the two commodities was 0.54, indicating clear comparative advantage of production with respect to world markets given current technology and input prices.

Table 7.3 Comparison of DRC and benefit/cost for two groups of crops in four locations

Activity	Region	DRC	Private benefits/costs	Social benefits/costs
Black gram	Hinthata (delta)	0.55	1.50	1.74
Black gram	Pyinmana (dry zone)	0.19	4.03	4.62
Green gram	Thonegwa (delta)	0.74	1.14	1.29
Green gram	Magway (dry zone)	0.65	1.28	1.47

Source: Aye Aye Mon, DAP, MOAI

San Thein and Matthias von Oppen wrote a paper: Measuring Comparative Advantages of Myanmar Sugarcane Production in the State Sector: a Policy Analysis Matrix Approach. According to their findings, comparative DRC and social cost benefit ratio can be presented as follows:

Table 7.3a DRC and social cost benefit ratio (SCB) in major sugarcane growing regions of Myanmar, 2001

Crop	DRC	SCB
Sugarcane	0.91	0.94
Maize	0.43	0.47
Green gram	0.24	0.31
Rice	0.33	0.47

Source: San Thein, MSE, MOAI.

Table 7.3a clearly indicates that sugarcane offers the least comparative advantage and green gram the highest and rice. Pulses are shown to be an efficient earner of foreign exchange per unit of DRC used. Since maize is the major staple food in Chin state, the poorest area in Myanmar, one can imagine the importance of maize in Myanmar.

7.1 Summary

Myanmar is still at the stage of production-oriented agriculture while other Asian countries are moving towards developing commercialized farming and poverty alleviation. Improving or stabilizing the income of farmers or rural people could be achieved through diversification of farming activities and the freedom of choice to choose the line of activities for their betterment of life. Increasing production should only be pursued if it is consistent with improvements in income under the given condition that food shortages are not a critical problem.

CGPRT crops, generally secondary crops after rice, are important farming resources, particularly for the poor in upland marginal areas like the central dry zone where other agricultural resources and employment opportunities are limited. Generally, CGPRT crops cannot contribute directly to substantial increases in rural income but they can significantly secure or stabilize income levels of the poor in particular. In some cases, such as Chin Hill, increased maize production could not only help food security but also promote income generation for the poor through raising Indian bison.

8. Industrial Importance of CGPRT Crops-Current Use, Future Prospects, Policy and Others

If we look back into the past five decades, compared with Myanmar's neighbours, Myanmar seems to be the only country in Southeast Asia with the share of industry in total GDP at around 12 per cent indicating no significant structural change. As mentioned in previous chapters, the first of the four national objectives states the development of agriculture as the base for all-round development of other sectors of the economy. However, at the beginning of 1995, Myanmar Industrial Development Committee (MIDC) was formed and the development of industries with agriculture as the base became the first of five objectives of the committee regarding industrial development in Myanmar.

The development of agro-industries in Myanmar can be justified in many ways.

- The economic, social and environmental features of Myanmar are very favourable for agro-based industrial development.
- The prolonged dependence on the export of agricultural products cannot ensure the sustainable development of Myanmar's economy and raise the standard of living of the people under the present globalization environment.
- Myanmar's agricultural sector is totally in the hands of the private sector, which could promote sustainable industrial development with proper encouragement and fair competition.
- Over 80 per cent of the value of manufacturing output falls into the food and beverages sub-sector alone. As a matter of fact, the internal structure of the manufacturing sector is dominated by the agro-processing industries such as rice, oil and sugar mills in the food and beverages category.
- The agro-based industrial activities are more labour intensive in nature and suit Myanmar's endowment factors. Most of the skill and expertise needed for agro-based industries is locally available or could be acquired at relatively low cost and time.

8.1 Food processing sector

The food processing industry is an important industry within the agro-industrial sector of Myanmar, making up 62 per cent of the industrial establishments and 53.5 per cent of the industrial workforce in 1998. Private enterprises constitute the bulk of the food industry and the private food processing enterprises make up the bulk of the registered private enterprises in Myanmar. In 1998 the total number of registered private enterprises under the Private Industrial Enterprise Law of 1990 was 36,156 of which 61 per cent were involved in food and beverage production. This percentage remained almost unchanged the following year (1999). The size of the food and beverage labour force, and the value of production relative to other industrial sectors increased significantly over the previous 40 years and into the late 1990s. At the same time, the role of the state and cooperative sectors became less significant and the proportion of private enterprises has increased from 95.9 per cent in 1989-1990 to 98 per cent in 1996-1997.

Table 8.1 Change in ownership patterns in food processing industries

	1989-1990		1996-1997	
Industry	Number	%	Number	%
State	242	1.76	209	1.00
Cooperative	322	2.34	219	1.05
Private	13,194	95.90	20,408	97.95
Total	13,758	100.00	20,836	100.00

Source: Agro-industry in Myanmar by Dr. Kudo.

In 2000, the food processing industry consisted of about 40 different categories of industry, of which rice mills, oil mills, powder processing, sugar mills, and pulses' and beans' processing constituted over 85.5 per cent with rice milling and oil milling being the largest industries (55 and 15 per cent respectively).

Most of the private food processing industries consist of small-scale processing enterprises similar to other private enterprises. The categories of enterprise could be described as follows:

1. Import substituting enterprises.
2. Domestic market enterprises.
3. Processing and value adding enterprises.

The importance of this distinction is that while the majority of small private enterprises fall into categories (2) or (3), government policies have induced several larger private enterprises to establish themselves as import substituting enterprises (1). The majority of the smaller enterprises lack the capital or equipment to produce the quality needed to compete with imported goods, while the larger private and state companies under category (1) have enough capital investment and modern machinery to compete with imported goods. The constraint of these latter enterprises is that they rely on the importation of machinery and raw material inputs in order to produce import-substituting products for the domestic market.

Table 8.2 Relative importance of the food processing industry in terms of manufacturing output (%)

Commodity group	Value of production (current price)				
Manufacturing sector	1960/1961	1971/1972	1981/1982	1991/1992	1998/1999
Food and beverages	*60.06*	*61.1*	*65.41*	*79.39*	*84.97*
Clothing and apparel	14.76	10.29	8.22	3.13	1.47
Personal goods	3.60	2.90	3.03	1.57	0.92
Household goods	0.20	0.37	0.61	0.49	0.16
Printing and publishing	0.70	0.87	0.88	0.59	0.11
Industrial raw materials	3.40	4.73	6.31	4.38	4.34
Mineral products	5.86	7.48	5.00	4.04	5.42
Agricultural equipment	0.00	0.26	0.62	0.11	0.28
Industrial equipment	0.08	0.15	0.03	0.02	0.04
Transportation vehicle	0.53	1.97	2.02	0.49	0.52
Electrical goods	0.25	0.60	0.89	0.69	0.10
Miscellaneous	2.87	2.27	2.85	1.26	0.61
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Agro-industry in Myanmar by Dr. Kudo.

8.2 Role of CGPRT crops in agro-industry

From the viewpoint of current industrial importance, maize and pulses are the two most important CGPRT crops for Myanmar with the remainder not being that significant. It is to be noted however, that crops such as soybean could become industrially important even though it is not important yet.

Maize

Maize is grown industrially for its resource rich kernel. There are major parts of the corn kernel, namely seed coat (pericarp), germ (embryo), the tip cap and the endosperm, which make up about 80 per cent of the kernel and are composed primarily of starch. About 25 per cent of the weight of the germ is oil. The industrial separation or compartmentalization of important chemicals such as fiber, starch, gluten and oil in corn kernels is a main process in developed countries. Table 8.3 presents the finished products from the major parts of the kernel.

Table 8.3 Items produced from maize

Main Source	Primary products	Secondary products
Germ	Oil	Refined corn oil
	Germ/fiber	
Fiber	Feed products	
Starch	Cornstarch	
	Alcohol/beer	
	Corn syrup	Dextrose
		Fructose
Gluten	Feed products	

Source: MAS, MOAI.

At the moment, there are no processing plants for value-added products for maize in Myanmar and Myanmar is still exporting the whole grain to foreign countries. There are many products which could be produced from maize. Cornstarch can be processed and used as food and industrial products. It is routinely used as an adhesive, in the manufacture of papers and as filler for pharmaceuticals. It can be converted into an enormous assortment of industrial chemicals currently being produced from petroleum sources.

In addition, cornstarch derived from wet milling can be fermented to produce alcohol. The distilling and brewing industries both use cornstarch as the raw materials in their fermentation processes. It is a raw material for the production of energy. Ethanol is a high performance fuel made from cornstarch. It's safe for the environment, reducing air pollutants by more than 50 per cent because it burns much cleaner than gasoline.

Other products obtained from this process are corn oil, bran and protein. The oil is further processed to produce various salad oils and similar products. The protein and bran are used primarily as feed ingredients. Additional processing produces modified starches, maltodextrans (slightly degraded starch), sweeteners, and other chemicals/pharmaceuticals derived from fermentation. If maize production is increased to a sufficient volume for supply, and marketing opportunities are improved in future, maize represents an opportunity for edible oil production in Myanmar. At present, demand for maize is mainly for local feedstock, and processing facilities are needed to extract maize germ for oil extraction.

Pulses

When the pulses industry is considered, two things in Myanmar come to mind. The first one is processing for grain sizing and the second is the production of value-added products. Equal grain size quality is also an important factor for the value-added products of pulses. When splitting is done by machine, unequal size peas result in lower outturn, greater loss and an unequal size of split peas. Equal maturity is the important factor when considering the quality of green gram, the pods of which are picked 3-4 times per harvesting season. Mixture of the first and second picking results in poor grain quality. Processing for sizing produces value-added products for the quality market. It is better to export the special quality and first quality instead of fair average quality (FAQ) for better income.

The second is the production of value-added products. There is still a large opportunity to produce value-added products such as sweet paste for local and foreign markets, split grain with or without husk, vermicelli, sauce and a variety of snacks. The clear example is the

processing of the split grain, the price of which is almost two times higher than the whole grain. Table 8.4 shows the price (August 2002) difference between split and whole grains.

Table 8.4 Price difference between whole grain and split without husk (Price in US dollars/mt, FAQ, f.o.b. Yangon)

Type of pulses	Whole grain	Split without husk	Split with husk
Black gram	250	465	415
Green gram	330	480	430
Pigeonpea	260	390	-

Source: Pulses Traders Association.

There are already a few millers for processing black gram, green gram and pigeonpea but there are many people who have been involved in chickpea processing. Most of the chickpea mills are located in Sagaing and Mandalay division. According to the report of the Ministry of Industry (1), the role of pulses' processing in the food industry is presented in Table 8.5.

Table 8.5 Number and share of different products in the food industry

Sr. No.	Types of industries/product	Number	Share (%)
1	Rice mills	12,397	54.86
2	Oil mills	3,434	15.15
3	Powder processing (including pulses powder)	1,723	7.62
4	Sugar mills	819	3.62
5	Confectionery	496	2.19
6	Pulses and beans processing	492	2.17
7	Ice factory	474	2.09
8	Popsicle factory	441	1.95
9	'Mothingar' (traditional rice noodle) factory	437	1.93
10	Wheat flour mills	328	1.45
11	Processed food (others)	287	1.27
12	Noodle factory	259	1.19
13	Tapioca	187	0.82
14	Alcoholic products	125	0.55
15	Tea (dried)	114	0.50
16	Vermicelli	114	0.50
17	Salt	109	0.48
18	Soft drinks	107	0.47
19	Others	292	1.29
	Total		100.00

Source: Ministry of Industry (1) and Dr. Kudo.

Soybean

Myanmar is still not sufficient in edible oil even though she is producing an average of 400,000 tons annually and as a result, palm oil has been imported annually from Malaysia. Soybean is grown in mainly the north and south of Shan state bordering China and Thailand. And there is some production in Mandalay and Ayeyarwaddy division. The crop is popular as a food grain at present but edible oil could be extracted from soybean. Moreover, protein-rich cake could be obtained as a by-product. It is grown in the early monsoon in Shan state and as a cool season crop in Central and Lower Myanmar. There are roughly eight maturity groups of soybean classified based upon the sensitivity of day length that makes it possible to grow soybean in various parts of Myanmar. Since it is a legume, it can fix nitrogen from the air and supply it the host plant and also can benefit subsequent crops. Under irrigation, it can produce 2.5 ton/ha and the oil and protein content of the local variety are 17-18 per cent and 30-40 per cent respectively.

As mentioned above, soybean has a great potential in Myanmar which is still trying to be self-sufficient in edible oil. However, for commercial operation, solvent extraction or a combination of both propeller and solvent extraction methods is necessary. At present, solvent extraction plants are being used for rice bran oil extraction under the management of MAPT and MPCE. Some advanced private companies such as Yuzana and Diamond Star have been trying to introduce solvent extraction plants with a capacity of around 100 tons per day mainly for soybean but efficiency and safety issues still need to be studied because high utility consumption and high solvent emissions are important for economic and environmental sustainability.

8.3 Agro-industry policy

After the Second World War, some national leaders of Myanmar tried to stimulate economic growth through industrialization but industrial policies and strategies at that time were mostly based on import substitution and unfortunately failed to achieve their objectives. In 1962, Myanmar introduced socialism, and a centralized, in-ward looking, self-reliance policy was adopted. Myanmar missed the chance to develop into a modern industrialized country in that era while her neighbours successfully changed their economic structure by scaling down the agricultural component and simultaneously increasing the contribution of the industrial sector in GDP. After the formation of MIDC under the current military government, there was a push for further industrialization with the following objectives:

- Development of the industrial sector with agriculture as the base.
- Enhancement of the quality and quantity of industrial products.
- Development of new machinery and equipment.
- Production of machinery and equipment for industrial uses.
- Creation of conditions for transforming into an industrialized state.

Since its formation, MIDC has taken steps to achieve its objectives and the following are some of its achievements to date:

- Formation of 13 industrial zones in areas where private industrial enterprises are concentrated.
- Stimulation of public awareness by holding national and zonal seminars, exhibitions and conferences, which contribute to the creation of markets and the exchange of ideas.
- Establishment of a private industrial bank called Myanmar Industrial Development Bank (MIDB) for providing loans for industrial ventures.

In conformity with a market-oriented economy, Myanmar enacted the Union of Myanmar Foreign Investment Law in November 1988, which allows and encourages FDI with the prime objectives of export promotion and expansion of technology. In the agricultural sector, opportunity exists for the establishment of new agro-industries in the area of crop production, upgrading and renovation of existing facilities, expansion of downstream industries equipped with appropriate technology and having a sound market component.

8.4 Constraints for agro-industry

Even though MIDC was formed, a number of constraints that need to be resolved for agro-industry in Myanmar including CGPRT crops are as follows:

- Myanmar cannot raise the entire investment fund from its own resources under present economic conditions. Foreign Direct Investment (FDI) must be attracted on a large-scale and facilitate foreign investment flow for diversifying the industrial sector. Under

the present circumstances, there are few foreign investors, especially from western countries in Myanmar.

- Foreign direct investment is important but the development of local entrepreneurship is also important. There must be better coordination of foreign investment policy with domestic investment promotion and entrepreneurship development.
- There should be a more active policy to assist the local private sector to improve their technical efficiency and management skills so that they can compete in the open market and succeed at a time of globalization and market competition.
- Government-induced policy must be assured to be market friendly. The role of the government is important in creating a business friendly environment where the government facilitates mechanisms to promote information exchange, coordination of investment, and competition among private groups. The private sector and government are not rivals or substitutes in this globalization era but are complementary to each other.
- A successful industry is one that can establish competitive and comparative advantage based on technical efficiency and progress. The government has established Myanmar Chamber of Commerce and Industry. In fact, the MCCI has been established since 1919 but was reorganized in 1993. Similarly the Myanmar Industrial Association was founded under the chamber. These institutions should actively take part in leading agro-industrial development.

8.5 Summary

The food processing industry is an important industry within the agro-industrial sector of Myanmar comprising 62 per cent of industrial establishments and 53.5 per cent of the industrial workforce in 1998. Private enterprises make up the bulk of the food industry.

It is rather difficult to know the exact figure of the contribution of the two main CGPRT crops; pulses and maize. But, in terms of numbers, pulses alone constitute about 10 per cent of the total in the food industry.

The government has already formed the Myanmar Industrial Development Committee (MIDC) but there is long way to go for further development of agro-industry including CGPRT crops due to the many constraints such as the attraction of FDI into the country, the development of local entrepreneurs, market friendly policies etc.

9. Constraints and Accelerators to CGPRT Crop Production and Diversification

There are many constraints and accelerators to crop diversification through CGPRT crops, which are linked to policy, socio-economic and technical factors.

9.1 Constraints

9.1.1 Land policy

As mentioned, Myanmar still favours rice-biased policies and the establishment of a land policy for farmers, guaranteeing land rights that allow liberal land use by the farmers is a fundamental requirement for the change in agricultural development in Myanmar, even when the state is the ultimate owner of all natural resources including land. More freedom in land use and clear land use rights protected by the legal system are prerequisites for further farmer investment in their land and improved production.

Since land is owned by the state, in some areas farmers are forced to grow summer rice which needs fossil fuel for pumping water for irrigation, high levels of inputs such as chemical fertilizers and relatively high costs of cultivation, even though they would prefer to grow pulses which are environmentally more friendly because they use residual soil moisture without any irrigation water, low external inputs, less risk and more profitability. When farmers fail to conform, their land can be repossessed by the government and allocated to others who will abide by the rules laid down by the government. Even though this is not very common, repossessing land from the farmers is similar to a stiff punishment and therefore, farmers generally follow the rules.

9.1.2 Credit

Legally protected land use rights could allow farmers to use their land as collateral for loans which could reduce credit constraints faced by the farmers throughout the country. Myanmar Agricultural Development Bank (MADB) under MOAI is a state-owned bank and major source of agricultural credit even though there are other sources for credit such as licensed pawnshops, savings and credit cooperatives. When farmers cannot pay in cash e.g. for tractor services for land preparation, an extra charge or margin is added to the normal rate of interest. There are three types of loan provided by MADB namely, seasonal crop loan, long- and short-term loan for activities such as the procurement of farm implements, establishing orchard farming and small-scale livestock raising, and area development loans.

The seasonal crop loans are the major source of funds for farmers. These loans can be repaid within one year and cover major crops such as paddy, pulses, oil crops, cotton and jute even though the coverage of crops and the amount of loans are different from region to region and year to year. MADB has been providing billions of kyats to farmers as seasonal crop loans (12.124 billion kyats in 2000-2001), long and short-term loans (6.126 billion kyats in 2000-2001) and area development loans (38.7 billion in 2000-2001). Present seasonal crop loans cover about 5 per cent of the cost of cultivation as presented in Table 9.1.

Table 9.1 MADB loans for targeted crops

Crop	1993 (kyats/ha)	1995 (kyats/ha)	2002-2003 (kyats/ha)	Percentage of total production costs
Paddy	1,000	2500	10,000	6
Maize	200	750	5,000	5
Groundnut	750	2,500	5,000	7
Sesame	175	2,000	3,700	8
Mustard	200	500	1,500	6
Black gram	250	750	2,500	3
Green gram	250	750	2,500	3
Pigeonpea	250	750	2,500	2
Soybean	250	750	2,500	-
Jute	500	1,750	3,000	-
Cotton	500	2,500	6,200	6

Source: DAP/ASR report.

The shortage of funds is the most critical problem for MADB but negative interest rates and heavy dependence on government funding could worsen the problem. It would be better for the farmers if the participation of private banks could be attracted into the crop loan distribution. But, after the near-collapse situation of private banks in early 2003 due to their financial crisis, the situation is far from over.

9.1.3 Agro-ecological suitability

Crop diversification could be approached in two ways. The main form and the most common concept is the addition of more crops to the existing cropping system, which could be referred to as horizontal diversification. The other is vertical diversification in which various other downstream activities such as canning for fruits are undertaken. Vertical crop diversification reflects the stage and extent of the industrialization of crops. It is to be noted that crop diversification takes into account the economic returns from different crops. Diversification at the farm level involves growing several crops but regional and national level diversification involves the selection of specific crops to achieve high profits or to attain national objectives.

Horizontal diversification at the farm level is difficult for Myanmar to adopt because some regions are especially assigned for specific crops due to their agro-ecological suitability. For instance the delta area in Ayeyarwaddy division is a rice zone and the central dry zone is the corn and pulses production zone for Myanmar

9.1.4 Rice favoured policy

Rice is the staple food in Myanmar, a rice-exporting country adopting rice-favoured policies. It is understandable that attention is paid for national rice self-sufficiency due to political stability and national security, especially when Myanmar is under economic sanctions from some western countries. Rice sufficiency programmes launched at the local level can have negative affects not only for crop diversification but also for environmental protection. For example, rice production programmes in both irrigated and rainfed areas for self-sufficiency are being implemented in some districts in the central dry zone where soil is sandy and rainfall is as low as 100 cm per year. Agro-ecologically speaking, these areas are suitable for CGPRT crops such as pulses and maize, which are also exportable items with a good market. There may be reasons behind this rice-biased policy but it is definitely an unsustainable way of approaching agricultural development.

9.1.5 Agriculture mechanization

Timely land preparation is very important for growing CGPRT crops, especially when they are grown without irrigation water at the end of the rainy season, exploiting the residual

soil moisture, which gradually decreases day by day. Myanmar still relies on draft cattle for tillage operations but this is inefficient when the land preparation time is very short. The government began to encourage farm mechanization in the early 1990s to increase crop intensity and diversity. The Agricultural Mechanization Department (AMD) was established in 1972 under the Ministry of Agriculture and Irrigation. This department is responsible for the promotion of farm mechanization at the field level. Both government and private companies produce farm machinery locally, supplemented by imported machinery.

The public sector was once dominant in the distribution of farm machinery but this has witnessed a declining trend. The private sector, both in terms of production and imports, now plays a much larger role in distribution at present.

However, the usage of machinery is still limited. The main reason lies in the lack of economic viability of farm mechanization with the present economic status of farmers. At the moment, agricultural mechanization plays an important role mainly in primary tillage operations but farm mechanization schemes have to be specific to local conditions with different cropping patterns. For instance, reaper and thresher machinery is important for rice double cropping areas.

9.1.6 Research

There are several government research organizations working under the MOAI for agricultural research. Of these organizations, the Central Agricultural Research Institute (CARI) under Myanmar Agriculture Service (MAS) is mainly responsible for research on cereals, oilseed crops, pulses, and fiber crops. And there is another research institution under MAS called Vegetable and Fruit Research and Development Centre (VFRDC) which also conducts research on horticultural crops including potato. Unfortunately, nobody is paying proper attention to research on other roots and tubers. MAS is the main technical body for the ministry and MAS has several technical divisions, besides CARI, such as the seed division, land use division, plant protection division and extension division.

National agricultural policy calls for freedom of choice in agricultural production, expansion of agricultural lands, safeguarding the rights of farmers, commercial production of industrial and perennial crops, and participation of the private sector in the distribution of inputs and farm machinery. These policies underpin the targets of surplus paddy production, self-sufficiency in edible oils, and exports of pulses and industrial crops.

The research institutions follow very closely the main guidelines set by MOAI in defining the approaches, priorities and objectives of their programme. The objectives of MAS, the main umbrella organization for the coordination of agricultural research, include increased production of major crops through the use of modern technology, area expansion, and identification of export markets for relevant commodities.

The research work at CARI is fully oriented to increase crop productivity by way of developing quality seeds of improved varieties, proper cultural practices, efficient soil, nutrient and pest management, and efficient cropping systems. All crop divisions emphasize the development of high yielding varieties with tolerance to pest and diseases for different agro-ecological conditions. As a consequence, most technologies developed are represented by improved varieties and hybrids of the various crops. The priorities of the supportive disciplinary divisions are also oriented towards technologies that will sustain high productivity crops.

Issues of profitability, production costs, marketing, environmental limitations, and the socio-economic conditions of farmers are seldom referred to by the major crop divisions of CARI as important aspects to be considered in the planning, design and implementation of research projects.

The development of low cost technology is necessary to meet the pressing needs of resource-limited small-scale farmers, but often researchers fail to explain how they actually plan and design research projects in order to develop low cost technology. Often researchers will

refer to the development of disease and pest tolerant varieties as a strategy to meet the needs of small farmers, but for most cases genotypes are evaluated and selected under stress-free environments, with the addition of recommended high levels of inputs, which favours genotypes that will perform better under optimum growing conditions.

Research priorities at CARI are usually set by research leaders based on discussions that occur during their annual technical meetings. For the most part, participation of field level research personnel, extension staff and farmers is weak in setting these priorities.

The functions of CARI's research farms are to implement research projects planned and designed at CARI-Yezin. The planning capability of local research staff is very limited. In addition, research facilities and equipment are generally not so modern. The research priority of VFRDC and the Central Agricultural Research and Training Centre (CARTC) is to develop high yielding varieties of vegetables and fruits with good quality and tolerance to pest and diseases. Much like CARI, issues of profitability, cost of production, marketing, and socio-economic conditions of farmers are not considered in the planning process of the projects. The research conducted by the Seed Division of MAS is very limited and focused on simple rice variety trials, fertilizer rates, and cultural practices. Most research on rice is conducted under full utilization of the recommended levels of fertilizer.

CARI, the main research organization, was established at Yangon in 1954 and then transferred to Yezin, Mandalay division in 1971. Yezin is situated in the area between Lower and Upper Myanmar so that it can enjoy the climatic conditions suitable for rice and other upland crops and address the problems of these crops. CARI is the largest and oldest research institute in the country, with about 400 staff in Yezin, and 300 on 18 satellite farms scattered throughout the country. At this moment, of these staff, two have a Ph.D., 18 have M.Sc., and the rest have B.Sc degrees or lower.

Table 9.2 Strength of research staff under the MOAI in 2000-2001

Degree	No. of staff
Ph.D	5
M.Sc	54
B.Sc/Diploma	676
Others	176
Total	**911**

Source: DAP.

CARI has the mandate to (i) develop better-quality HYVs of cereals, oilseed crops, and pulses; (ii) develop hybrid varieties for some major crops such as maize and rice;(iii) promote research and development of biotechnology; and (iv) develop profitable cropping systems and cultural practices for different crops. But CARI has an annual budget which is less than 1 per cent of the total budget of MAS as a whole. Table 9.3 presents the crop research expenditure for the whole ministry.

Table 9.3 Crop-related research expenditure of the Ministry of Agriculture and Irrigation (million kyats)

Sr. No.	Particular	2000-2001	2001-2002	2002-2003
1.	Expenditure for manpower and research activities	428.01	573.95	652.16
2.	Total expenditure	83,406.22	84,188.61	102,070.45
3.	Ratio between 1 and 2 (in %)	0.51	0.68	0.64

Source: DAP.

CARI released seven open pollinated HYVs for maize, three hybrids of maize, four for groundnut, two for black gram, six for green gram, three for chickpea, four for pigeonpea and three for soybean. Moreover, CARI produced 1 million packets of rhizobium inoculants for pulses despite being under serious financial and staff constraints, and limited financial assistance from external funding agencies such as ADB, UNDP, JICA and international

agricultural research centres (e.g., International Rice Research Institute, International Maize and Wheat Research Institute and International Crops Research Institute for Semi-Arid Tropics).

However, the research institutions are not well equipped to develop a modern and competitive agricultural sector. The difficult challenge will be to increase agricultural productivity and improve product quality. This will require more sophisticated research work, well-trained research staff, and modern equipment. The major weaknesses of the research institutions are as follows:

- Low priority which was accorded by the government to agricultural research in the past, as reflected in the small budget allocation for research.
- Low capacity of research staff since relatively few have postgraduate degrees.
- Old and inefficient research equipment, which cannot be replaced with new and modern equipment, particularly for research on modern biotechnology, due to the lack of funds.
- Lack of involvement of the private sector in agricultural research.
- Lack of on-farm research conducted with extension staff and farmers.
- Lack of strong NARS which should be set up to give proper guidance and generate improved production technologies.

9.1.7 Extension

Myanmar Agriculture Service (MAS) under the Ministry of Agriculture and Irrigation is the key agency in charge of agricultural extension. MAS has about 750 officers and 13,000 other staff, and is responsible for disseminating improved seed varieties, fertilizers and technologies to farmers and exploring export markets for agricultural products. Moreover, Agricultural Extension Division (AED) launches special programmes for selected crops in selected areas and establishes large-scale demonstration plots on farmers' fields to serve as training tools for the farmers. Besides, AED launches crop substitution programmes in opium growing areas and serves as a focal point for integrated rural development programmes.

Under MAS, research, extension and provision of farm inputs can be easily integrated and coordinated for maximum results. The Agricultural Extension Division (AED) under MAS has about 9,900 staff, which is almost 75 per cent of the total staff of MAS while the country has 4.8 million farm families, a ratio of 1: 480.

AED has two main functions: transfer appropriate technologies to farmers, and collect information on farmers' field problems and find solutions for them from CARI. AED use a modified Training and Visit system which was adopted and used in special high yield (SHY) programmes for selected crops such as paddy during early 1980. SHY programmes introduced in the late 1970's resulted in a considerable increase in rice production due to yield improvements and area expansion, but it was still not enough to generate a significant surplus. Concerted efforts were made by the Ministry of Agriculture and Irrigation to provide timely supply of improved seeds, chemical inputs, farm machinery, and irrigation water.

One of the major extension thrusts of AED has been to promote higher rice production in recent years, i.e. the Summer Paddy Program that was implemented on a large-scale. Summer paddy is planted under irrigation in the dry season from October to April. The rationale of the programme is to increase crop intensity by the efficient use of irrigation water. Environmental conditions during the growth period favour the attainment of high yields, provided that recommended packages of inputs (certified seeds, fertilizers, pesticides, machinery, irrigation, improved agronomic practices) are applied. However, it should be noted that the majority of rice farmers do not have access to irrigation and do not apply the recommended level of inputs.

The most recent extension programme for rice implemented by the AED is the "Reaching Towards Optimum Productivity (RTOP)", jointly planned and coordinated by the central offices of the Land Use Division and AED, and implemented by the AED in state, division, district, township, and village tract levels. The RTOP is the most important extension

programme for rice in the country. It is an integrated extension package designed to educate farmers on fertilizer and crop management. It includes high yielding varieties, integrated pest management, on–farm water management, and site-specific nutrient management with application of recommended levels of nutrients. Extension camps, located throughout the rice growing area are demonstration tools to show the affect of nutrients on plant growth and yield. Control and treated plots for nutrients are established in the camps to demonstrate the symptoms of nutrient deficiency.

The scientific basis of the RTOP was developed by IRRI in other Asian countries, and tested initially in Hlegu near Yangon. After one season the results were so encouraging that the process was scaled up to cover all important rice growing areas of the country. The programme is presently being implemented in 180 townships throughout the rice producing areas.

For pulses and other CGPRT crops, there are no special extension programmes under implementation. The most common pulses are green gram, black gram, pigeonpea, chickpea, and cowpea. These crops are well adapted to the dry zone and have been grown there for many years. The Ministry of Agriculture and Irrigation is working actively to expand areas under these crops but there is problem of shortages of trained staff in AED for crops including CGPRT crops. Even though AED consist of 75 per cent of the total number of staff of MAS, there are relatively few technical personnel with post-graduate degrees. The Training and Visit system with insufficient subject matter specialists may not be so effective and efficient to transfer technology.

Another weakness of AED is that it pays too much attention to the increase of production of selected crops favoured by the government rather than to enhance farmers' income and the welfare of the rural population. Sometimes the government's choice of crop and farmers' choice of crop is different but AED is obliged to stand on the government's side as a government agency. This leads to a loss of trust of farmers for the AED staff.

9.1.8 Input supply

Chemical fertilizer and seeds: The current level of fertilizer use (ranging between 21.0 kg and 53.5 kg per ha during the past five years) is undoubtedly well below the optimum level of application. The fertilizers mainly used in Myanmar are urea, Triple Super Phosphate (TSP) and Muriate of Potash (MOP), of which TSP and MOP are imported 100 per cent from abroad. Urea is produced locally with a capacity of around 100,000-150,000 tons per year. All together, fertilizer consumption in Myanmar is around 200,000 to 300,000 tons a year of which more than 80 per cent is used for rice. Table 9.4 shows the comparison of fertilizer use in Myanmar with some other ASEAN members in 2000.

Table 9.4 Comparison of fertilizer use in Myanmar and ASEAN countries

Country	Fertilizer (in thousands of tons)
Thailand	1,550
Viet Nam	2,097
Myanmar	210

Source: FAO, RAPA.

Distribution of farm inputs like chemical fertilizers and pesticides that were formerly handled mainly by the Myanmar Agriculture Service (MAS) is being dramatically transferred to the private sector while subsidies on farm inputs are being removed. However, a lack of sufficient incentives, and a lack of credit and inappropriate extension services constrain the farmers' ability to use the optimum level of fertilizer. The private sector is permitted to import and distribute fertilizer but its ability to do so is constrained by a lack of a distribution and storage network, prevailing import and export regulations and scarcity of foreign exchange. The amelioration of the stagnating circumstances needs to be addressed.

The current level of quality seed provision is also well below the desired level even though the Seed Division, under the Myanmar Agriculture Service, is the main technical agency responsible for the production of seeds including CGPRT seeds. In this area also, the harmonization of the private and state sectors is necessary in enhancing the capacity of supply. Due considerations in a seed industry development policy should be paid to the international standard in plant varietal protection concerned with intellectual property rights in order to attract private investment in the seed industry.

9.2 Accelerators

9.2.1 Low rainfall

Myanmar agriculture is still a low input, low risk and low output type agriculture and technologically is not so advanced. However, cropping systems in some important areas such as the dry zone are sophisticated compared to other parts of Myanmar and diversification of the farming system, including crop diversification, could be a strategy for increasing agricultural production and improving rural welfare in the area. The Government of Myanmar has built hundreds of irrigation facilities in the dry zone area but they cover only a small portion of the total crop area and the remaining crop areas are forced to rely on rain for agriculture purposes.

A cropping pattern can serve as a basic tool for assuring food security but there are narrow farmers' choices in irrigated areas because of the government's plan for growing target crops. In the rainfed areas of the dry zone in central Myanmar, it is vital for the farmers to make decisions in accordance with the climatic conditions, which change day by day. During in growing season around June and July, even around midnight after rain, farmers with bare feet have to go to their fields in total darkness to check the moisture content of the soil for the germination of seeds. If they are convinced about the soil moisture, they make seeding early in the morning before strong radiation from the sun evaporates the little moisture in the soil. There are no other crops, which can compete with CGPRT crops under the dry zone's conditions.

CGPRT crops such as sorghum and pulses are very tolerant to abiotic stresses such as draught and the dry zone is the area where farm-level diversification of crops could be found because farmers want and need to mitigate risk.

9.2.2 Rural energy

The main focus on rural energy in this topic is wood fuel, which provides about 75 per cent of all energy used in Myanmar according to estimations by experts from Harvard University. Forests provide wood fuel mainly for the rural people. There are a variety of estimates for forest depletion in Myanmar and according to the estimates of experts, the deforestation rate in Myanmar is about 500,000 acres (200,000 ha) per annum even though there are replanting programmes. Whatever the exact depletion rate, it is safe to say that the current trend is not favourable for the forest. Wood fuel and other wood uses are growing at least in line with population growth of about 2 per cent a year. In rural areas of the dry zone, this imposes significant additional work upon women and children who must walk for hours to collect wood fuel, enough for cooking 3 kg of rice. According to interviews with farmers in the central dry zone, some need to spend a week, including travel time to the nearest forest, to collect a full bullock cartload of wood fuel. Twenty years ago, it took only one day to find same amount. In fact, Myanmar might be approaching the point where substitution of other sources of fuel will be required to reduce pressure on the forests and allow wood to be use for higher value non-fuel purposes.

One of the CGPRT crops, pigeonpea, has contributed greatly to relieve fuel shortages in the dry zone. Pigeonpea is hardy and has a physiological mechanism that can utilize fixed phosphate in the soil, which is not possible by other plants. As a result, it can be grown on any

soil type in the dry zone. According to interviews with farmers, it was discovered that one acre of pigeonpea could provide enough fuel for one person for a whole year. Farmers in the dry zone are interested to grow pigeonpea not only for income but also for wood fuel. This is one of the reasons why the sown area of pulses has to be increased within a few years in the dry zone of Myanmar.

9.2.3 Policy and market demand

The sharp increase in pulses' sown area and exports are good examples of a change in policy and market demand. After the pulses' market was liberated to the private sector, together with high demand from foreign markets such as Singapore and India, exports and sown area drastically increased.

9.2.4 Risk mitigation and stabilization of income in marginal areas

Modern agriculture is dependent on very complex and interrelated systems with the environment, producers, suppliers, consumers and other agents playing important roles. However, agricultural production is directly controlled by the limited capacity of the land to produce. The limits of production are set by the climate, land use and land/crop management practices. All these major physical, socio-economic and operation factors and their interactions controlling agricultural productivity are known as the agricultural production system.

Significant differences in climate cause floods and droughts, both the frequency and intensity of which affect agricultural production in varying degrees causing crop damage. The pattern of annual and seasonal variability over a small region may have diverse effects in different parts of the region.

In areas where agriculture is the basic source of income, the type of crop grown or the cropping pattern has great significance for poverty and indeed, poverty alleviation. Diversification of crops means diversification of risk. If cultivated in a diversified way, the incidence of poverty of the farmers could be reduced.

9.3 Summary

There are many constraints and accelerators linked to policy, socio-economic and technical factors. Land policy, credit, agro-ecological suitability, rice-biased policies, agricultural mechanization for timely sowing, research, extension for technology transfer and input supply are constraints for the promotion of crop production and diversification including CGPRT crops. But low rainfall, rural energy, agricultural policy and market demand, risk mitigation and stabilization of income in marginal areas are the accelerators to CGPRT crop production and diversification.

10. Conclusion and Policy Recommendations for Agricultural Diversification Schemes

10.1 Improvement of research capacity and Human Resource Development (HRD) programmes for CGPRT crops

Since rice is the priority crop in Myanmar, more attention has been given to HRD for rice. As a result, a sizable number of trained personnel on rice production are available whereas CGPRT crops including pulses, the most important export item for Myanmar, have few masters degrees and no Ph.D holders working in the area of CGPRT crop research and extension.

Total sown area of pulses, one of the CGPRT crops, in Myanmar has been drastically increased and new areas where pulses have never been grown have been put under pulses' cultivation for the expansion of area horizontally. But, appropriate technology such as improved seeds, agronomic practices and crop protection measures suitable for the newly extended areas are not yet identified. It is obvious that research, which can answer the above questions is urgently needed.

Successful production of pulses in the future will depend upon the identification and selection of appropriate rhizobium strains, which are variety specific for high yields. At the same time, trained technicians for the identification of proper production techniques for effective inoculums are also as important as the selection of appropriate strains. Moreover, there is a need to conduct research on cropping systems, which would be well suited to pulses. In order to fulfill the said objectives, highly trained personnel are in urgent need for the further development of CGPRT crops. More emphasis on R&D on crop diversification necessitates a shift of attention from rice to non-rice crops and in the long-term, crops to livestock and fisheries.

10.2 Investment

Due to shortages of funding, Myanmar's agriculture including the promotion of CGPRT crops is faced with insufficient and low quality supply of infrastructure access, agricultural machinery, and agricultural processing facilities. The problem is better understood by distinguishing two dimensions of agricultural investment: investment in agriculture versus investment for agriculture, and public investment versus private investment (farmers and private enterprises).

Investment in agriculture includes land and water resources development, R&D, human resource development, agricultural input industries, and agricultural mechanization. The role of the public sector must be the highest in R&D. Enhancing farm mechanization with appropriate technology is a pre-requisite for both horizontal and vertical expansion in agricultural production. The role of farmers (actual investor) and private enterprises (developer and supplier) should be larger in this area, requiring proper policies and strategies for the development of agricultural mechanization.

Investment for agriculture includes transportation, communication, and electrification. In rural areas, farm roads are in extremely poor condition, which complicates access to markets and processing facilities. Better communication is a must for all sectors. Electrification in Myanmar, both urban and rural, is also lagging behind some Asian countries. Therefore, more resources should be allocated to investment for agriculture. Since the role of public investment

should be larger in these areas, careful re-examination of the budget allocation among sectors is required.

Investment in agricultural processing facilities lies between investment in and for agriculture. Most of the processing facilities in Myanmar are inadequate in terms of both quantity and quality, which seriously affects competitiveness and prices obtained by farmers as well as export earnings. The noodle making, oil extraction, and other agricultural processing facilities are at present in poor condition due to long years of lost maintenance and modernization on account of a lack of liberalization and funding constraints. A comprehensive assessment of the agro-based industries is needed to determine the requirements of modernization and expansion programmes. This should also cover opportunities for agricultural and rural income diversification including the livestock and fisheries sector (including fish ponds). The assessment should be implemented under the state/private harmonized approach leaving the role of main investor to the private sector.

10.3 Market

As a result of assured markets in international trade and the market-oriented economic system adopted in Myanmar, pulses and major CGPRT crops' production and exports increased remarkably. In 2000-2001 total sown area of pulses had already reached about 2.9 million hectares with production of about 2 million metric tons and an export volume of nearly 800,000 tons to over 11 countries.

Among ASEAN member countries, Myanmar's average annual growth rate for pulses' harvested area is the highest (Table 10.1).

Table 10.1 Peas' and beans' harvested area in ASEAN countries (ha)

Country	1989	1996	1997	1998	1999	Average annual growth rate (%) (1989-1999)
Cambodia	26.0	26.8	27.1	25.0	25.0	0.2
Indonesia	467.0	534.0	543.0	563.0	563.0	1.36
Lao People's Democratic Republic	15.0	14.7	15.5	15.6	15.2	(-) 0.2
Myanmar	**518.4**	**1,852.4**	**1,726.0**	**1,838.3**	**2,190.1**	**14.3**
Philippines	65.9	76.0	76.0	76.0	76.0	2.0
Thailand	651.4	415.4	385.4	423.0	428.0	(-) 4.3
Viet Nam	290.0	325.0	340.0	357.5	357.5	2.2

Source: RAPA Publication 2000/15.

Myanmar may be the only country which can produce more pulses for food and animal feed in years to come. Due to the abundance of land and water resources and the introduction of short-maturing rice varieties which allow pulses to grow using residual soil moisture, the pulses' growing area can easily reach about 3 million hectares in the near future. Therefore, Myanmar has immense possibilities of extending pulses' exportation. But due to the increased globalization phenomenon in the international market, the challenge of increased competition is also becoming immense, particularly for high quality products.

To cope with this situation and remain competitive in the international market, Myanmar has to improve the quality of present exported pulses and to find new market opportunities, be it low- or high-end, other than India. It is also necessary and imperative to find a place in the export market for new species of pulses other than the existing traded species, which are commonly traded by other countries too.

Since the international market's demand for processed food is increasing, Myanmar has to learn and adapt the processing technology and find market places for processed forms of pulses.

10.4 Fertilizers and seeds

The current level of fertilizer use (ranging between 21.0 kg and 53.5 kg per ha during the past five years) is undoubtedly well below the optimum level of application. Distribution of farm inputs like chemical fertilizers, pesticides and seeds that were formerly handled solely by the Myanmar Agriculture Service (MAS) is being dramatically transferred to the private sector while subsidies on farm inputs are being removed. However, lack of sufficient incentives, lack of credit and inappropriate technical support services constrain farmer's ability to use the optimum level of fertilizer. The private sector is permitted to import and distribute fertilizer but its ability to do so is constrained by a lack of a distribution network, prevailing import and export regulations and scarcity of foreign exchange. The amelioration of the stagnating circumstances needs to be addressed. The current level of quality seed provision is also well below the desired level. In this area also, the harmonization of the private and state sector is necessary in enhancing the capacity of supply. Due to considerations in the seed industry, development policy should be to the international standard in intellectual property rights or plant variety protection.

10.5 Land policy and land resource development

The establishment of a land policy for farmers, guaranteeing clear and transparent land rights that allow liberal land use by the farmers and that enable the government to rationalize land taxation, is probably the fundamental need for agricultural development in Myanmar, even when the state continues to function as the ultimate owner of all natural resources including land. More freedom in land use and clear land use rights protected by a legal system are prerequisites for farmers to invest in their land and to improve their productivity.

In addition, legally protected land use rights permit the transfer of these rights and the use of land leases as collateral for loans. The legal transaction of users' rights contributes to a situation in which more efficient farmers are able to produce more. The use of land rights as loan collateral would reduce credit constraints faced by producers throughout the country.

10.6 Stability of the financial sector

With the promulgation of the Central Bank and the Financial Institution of Myanmar Law, the government allowed private banks to commence operations in 1992 as a policy for opening banking to the private sector. Private banks have been playing increasingly substantial roles in the development of the financial sector and the national economy. To date, twenty domestic private banks with more than twelve thousand employees operate in Myanmar. As of October 2002, there were 245 branches of domestic private banks. Under the transition economy, the financial intermediary roles of banks became more and more important due to the domestic deposit mobilization.

However, there are still many issues to be considered in order to establish a firm foundation of public trust (by ensuring a sound financial system and improving financial service quality) and contribute to economic growth (by providing capital to sectors that have higher productivity).

As the private banks have significant roles in developing Myanmar's economy, their credibility and durability are important. Unfortunately, Myanmar currency (*kyats*) shortage problems in 2003 believed to originate from over-lending of private banks to service companies made internal trade activities and the price of maize and pulses go down, discouraging farmers from growing them. It is necessary to improve the banking and financial sector's stability, which affects CGPRT crop trade and production. At the same time, huge differences between

the official exchange rate and parallel market rates also affects CGPRT crop trade and production. It would be better if the exchange rate was stabilized first and unified later but it is not an easy task for a developing country like Myanmar.

10.7 Involvement of the private sector in agricultural credit

Due to the limited availability of formal credit, producers, especially those who are without solid financial background, have to rely on informal lending sources such as relatives, friends, and traders and pay high interest rates ranging from 5 to 15 per cent per month. The repayment of the interest for these informal loans often squeezes the slight profit that farmers can earn from production. Along with the improvement of MADB operation, promoting the involvement of private banks in agricultural financing and designing small-scale credit schemes for agriculture-related financing would benefit rural people.

10.8 Diversified farming systems for the welfare of farmers

The diversification of farming aims at not only having more kinds of crops and varieties but also introducing new types of mixed farming systems of crop production, animal breeding, and aquaculture. Although such types of farming system are less developed in Myanmar at present, they should be highly emphasized in agricultural development in the near future for the following two reasons. Firstly, natural resources such as land, water, nutrition, and labour can be optimally utilized by adopting mixed farming. Secondly, farmers can have a wide range of products to sell, which protects them from the risk of market price fluctuations. In this sense, mixed farming systems are effective and practical, particularly for small-scale farmers. Moreover, a combination of crop production with animal raising including poultry in the whole country, Indian bison breeding in Chin state and with aquaculture in the coastal areas, particularly the lower part of the Ayeyarwaddy delta, where some depression areas are not suitable for agriculture purposes, should be promoted in order to expand mixed farming systems. To promote the diversification of farming systems mentioned above, closer cooperation and linkages among the related authorities, the private sector and farmers are needed.

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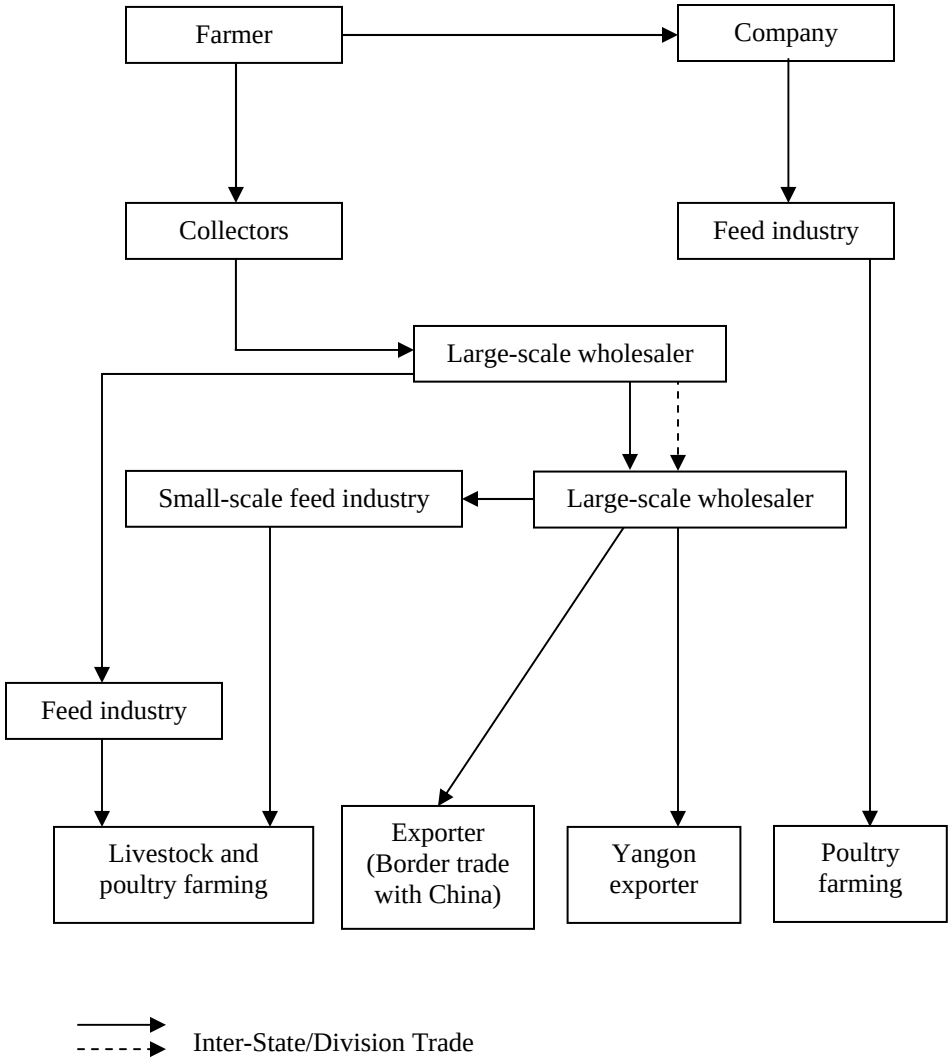
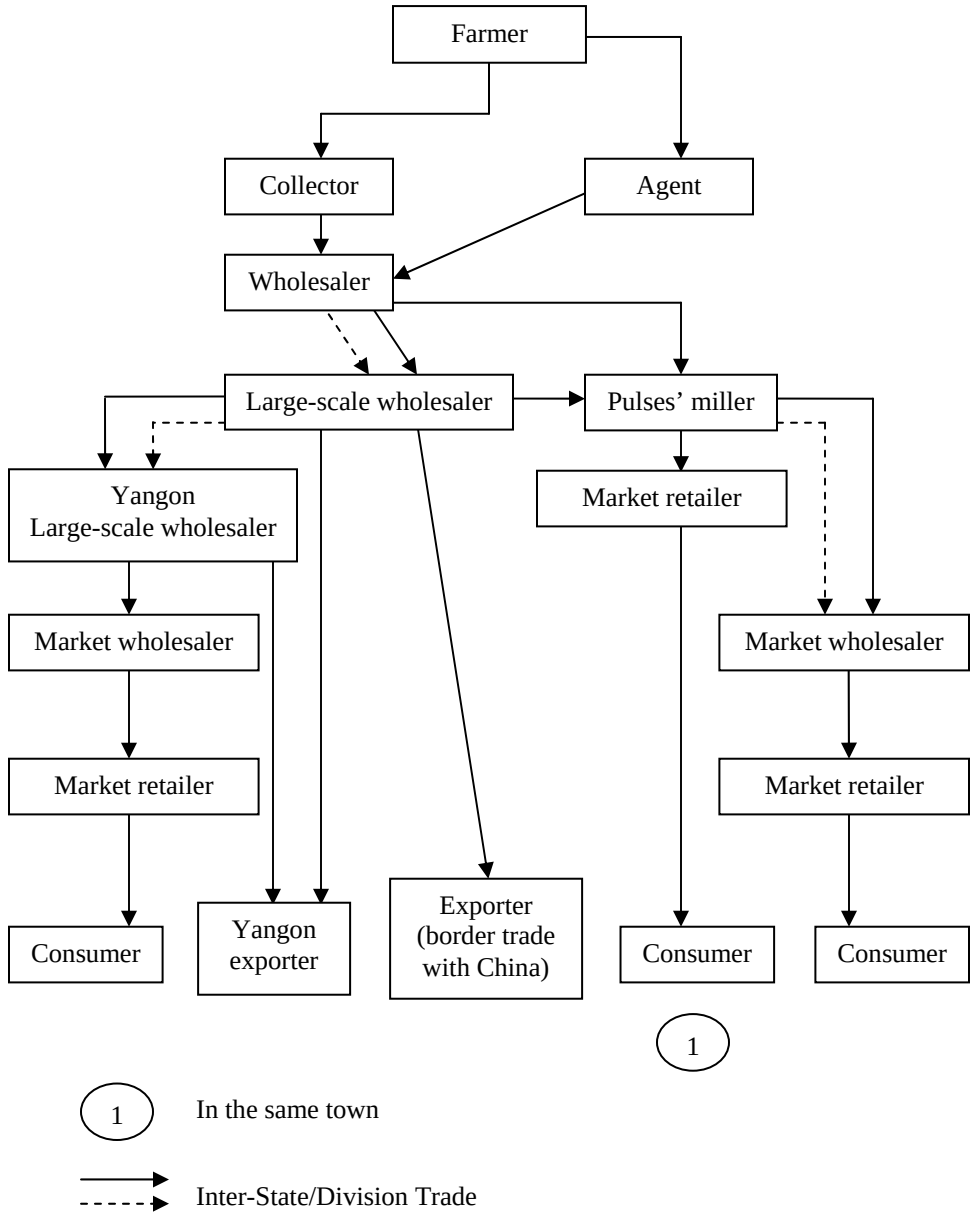
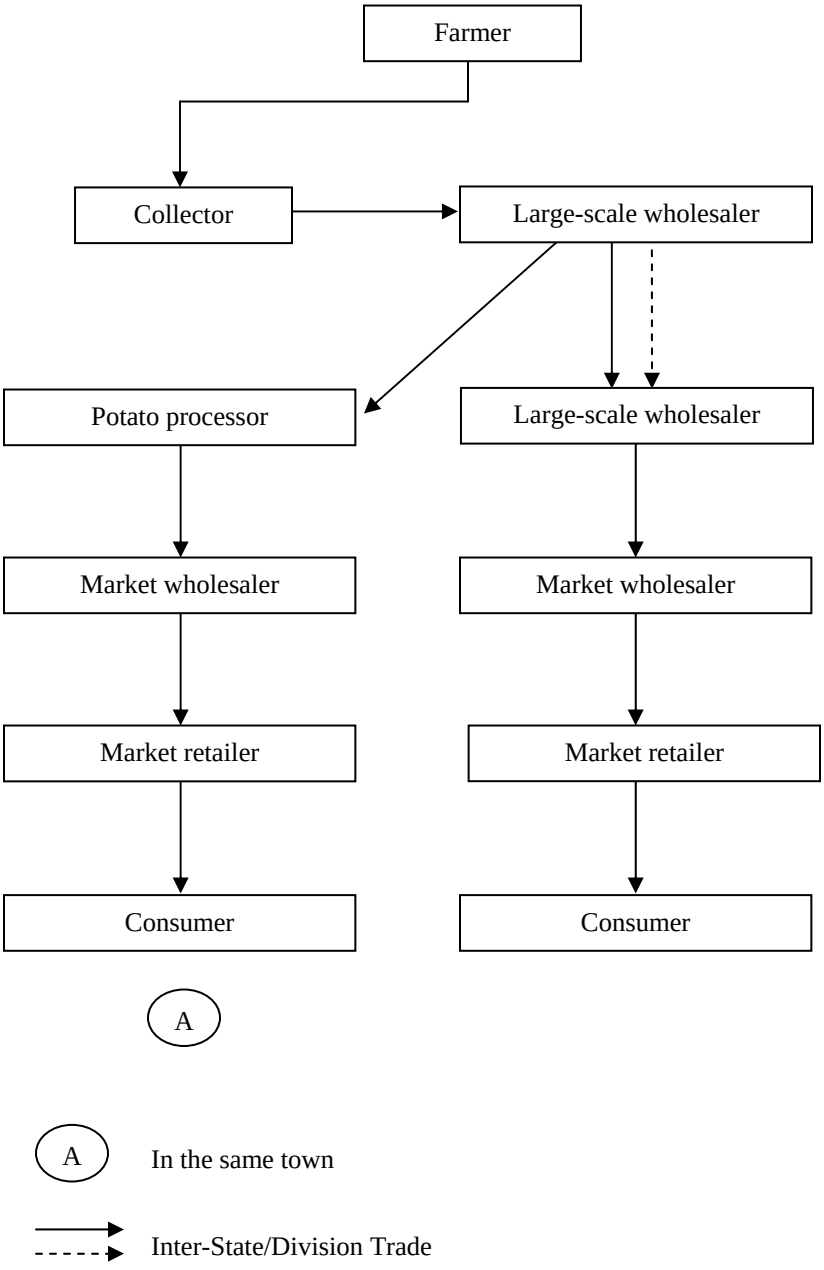
Annexes
Annex A. Marketing Channel of Maize in Myanmar



Annex B. Marketing Channel of Pulses in Myanmar



Annex C. Marketing Channel of Potato in Myanmar



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