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## **Market Prospects for Upland Crops in China**

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### **Introduction**

China is a large agricultural country, and the rural population constitutes about 80% of the total population. The issue of food for the people has always been a matter of prime importance confronting the government. Therefore, agriculture has always been regarded as the foundation of China's economic development and social stability. However, China's agriculture is facing great challenges, such as the growing population, the continuously raising income, the increasing demand of agricultural products, the continuous shrinkage of farmland and the decreasing agricultural resources. Therefore, upland crop products (UCPs) in China such as rice, maize, soybean, tubers and roots as major grain crops besides wheat will continue to play an important role in China's food security in the future. This study provides information on domestic demand, market potential and prospects of UCPs and suggests strategies for improving their marketing and trade. The study covers major UCPs (soybean, maize, sweet potato and potato), the major staple foodgrain (rice), fresh fruits (apple, citrus), fresh vegetables, edible fungi, processed fruit and vegetables and cotton. Complete results of the study have been published (Guoqiang Cheng 1997).

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### **Dietary patterns**

As shown in Table 1, great changes have been taking place in the eating habits of Chinese consumers since the start of the reforms. Grain consumption of urban consumers dropped from 145.4 kg in 1981 to 97.8 kg in 1993. However, the consumption of pork, beef and mutton grew from 18.6 kg to 20.8 kg and poultry meat from 1.9 kg to 3.7 kg. The grain consumption of rural consumers increased from 248 kg in 1978 to 266.0 kg in 1993, pork, beef and mutton consumption grew from 6.1 kg to 13.3 kg, and poultry consumption from 0.3 kg to 1.6 kg.

Rural consumption of both grain and animal products increased. In 1993, for example, the per capita grain consumption of rural consumers was 266 kg (raw grain), 18 kg higher than that in 1978; in this period, meat consumption increased 7.2 kg, eggs 2 kg and fish 17 kg.

### *Budget shares by commodity group*

Table 2 shows that differences exist in food expenditure between urban and rural areas. In

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1988, rural consumers spent 53.41% of their total expenditure on food items compared to 51.36% spent by urban consumers. Considering the expenditure structure in the four income groups, the expenditure share of food items in both urban and rural areas declined with increase in income level.

In urban areas, the share of meat (30.03%) dominated the per capita food expenditure; next

was grain (13.34%) and vegetables (12.47%); the combined share of eggs and fish was 11.84%; and the combined share of edible oil and sugar was less than 4.33%. However, except for the above mentioned items, other foods (e.g. wine, soft drink, condiment and eating-out, etc.) accounted for larger shares (22.67%) in the urban food expenditure and increased with increase of income level.

**Table 1 Annual per capita food consumption (kg) in China.**

	1978	1983	1985	1987	1989	1991	1993
<b>Rural</b>							
Foodgrain	247.8	260	257.5	259	262	255.6	266.0
Meat	6.1	10.6	11.9	12.9	12.4	13.5	13.3
Eggs	0.8	1.6	2.0	2.3	2.4	2.7	2.8
Vegetables	142.0	131.0	131.1	130.0	133.0	126.9	107.4
Sugar	0.7	1.3	1.5	1.7	1.5	1.4	1.4
Fish	0.8	1.6	1.6	2.0	2.1	2.2	2.5
<b>Urban</b>							
Foodgrain	145.4	144.5	134.8	133.9	133.9	127.9	97.8
Meat	20.5	22.5	21.9	25.3	24.0	26.6	24.5
Eggs	5.2	6.9	6.8	6.6	7.1	8.3	8.9
Vegetables	152.3	165.0	144.4	142.6	144.6	132.2	120.6
Sugar	2.9	2.8	2.5	2.5	2.4	1.8	1.8
Fish	7.3	8.1	7.1	7.9	7.6	8.0	8.0

Source: SSB, Statistical Yearbook of China, China Statistical Publishing House, various issues.

Note: The per capita food consumption data of urban areas in 1978 was replaced by the data in 1981, because of insufficient data. Grain in China includes rice, wheat, maize, barley, sorghum, millet, and other coarse cereals, pulses, as well as soybeans. Sweet potatoes and potatoes are also included but their actual weight is divided by five to turn them into grain equivalents.

Grain consumption (36.55%) dominated the per capita food expenditure of rural consumers. It was followed by meat and eggs which accounted for 16.83% and 11.59% respectively. This demonstrated that grain and vegetables were still the major expenditure of farmers. The consumption of animal products remained on the low side, in which meat and eggs held 20.5%; fish was even lower and only accounted for 2.49%. Edible oil accounted for 7.19% in the rural consumers' expenditure and its consumption level was higher than that in urban areas. Sugar consumption was rather low and only made up 1.05%. The expenditure of other foods for rural areas included wine, tea and condiment, etc. The proportion of other foods reached 18.26%, of which the major portion was for alcoholic beverages.

#### *Structural change in consumption*

As shown in Tables 1, 2 and 3, tremendous changes took place in Chinese residents' consumption structure from the early 1980s to the 1990s. The proportion of food expenditure in the

total expenditure of urban consumers (Engel coefficient) dropped from 56.7% in 1981 to 51.4% in 1988. It is evident, thus, that the non-food expenditure increased notably, showing that urban residents started to pay much more attention to housing, daily expenses and other consumption, while less emphasis was put on food consumption.

The Engel coefficient of rural consumers dropped from 61.8% in 1980 to 53.4% in 1988. Food consumption still accounted for a larger share in their expenditure compared to urban consumers. The rural population was at the stage of subsistence and had a strong demand for food. Therefore, other consumption was secondary.

Tables 1 and 3 indicate the changes in the consumption of major foods by Chinese households. As represented in Table 3, the per capita grain consumption in urban areas dropped by 32.7% (47.6 kg) from 1978 to 1993. This decrease came mainly from the increase of other food consumption, for example, meat consumption which increased by 19.5% (4.0 kg) during this period. The decrease of vegetable consumption in this period

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## ***Message from the Director***

A regional workshop "Market Prospects of Upland Crops in Asia" was held in Bogor, Indonesia, from 25 to 28 February 1997. We had 50 registered participants in total, of which three each were from India, Pakistan, the Philippines and Vietnam, four from Thailand, six each from Indonesia and Japan, one each from the Republic of Korea, Lao PDR, Malaysia, Myanmar and Sri Lanka. Around ten participants represented several embassies in Jakarta and some international as well as national institutions. To our great regret, we missed three expected participants from China because of failure to obtain visas.

Since the workshop was organized to discuss and disseminate the results of the project "Market Prospects of Upland Crop Products and Policy Analysis in Selected Countries in Asia" at its concluding stage, three participants were invited as a rule from each of the seven countries participating in the project. Each country group consisted of the national expert who worked on the project and two commentators, one from a policy planning section and one as a candidate for national expert for the next project "Effects of Trade Liberalization on Agriculture in Selected Asian Countries with Special Focus on CGPRT Crops".

Through the seven country reports and discussions, the following common observations were drawn:

- The food consumption pattern has clearly been shifting from cereals to livestock products and vegetables and fruits in most countries;
- Commercialization of agricultural products including processing has markedly developed in response to demand-driven markets and various new commodities are entering the market;
- Trade of major upland crops, i.e. maize, soybean and cassava, will be further stimulated domestically and internationally due to their increasing demand for animal feed; and
- Government intervention has become more important in influencing production, processing and marketing of agricultural commodities in this region.

It is obvious that movement and trade of agricultural products are becoming very active in these countries studied in the project. Therefore the market prospects are certainly quite positive in the region. I hope the findings harvested in the project will contribute to the further development of upland agriculture in the participating countries. Our next concern is to elucidate the real conditions of farm economies under the conditions of trade liberalization in upland farming areas of the region.

The Centre, on behalf of the participating countries and institutes in the project, would like to thank the government of Japan for its continued and generous support extended to the project by funding and providing the expert.

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was, to some extent, related to the adjustment of vegetable varieties and the increase of fruit consumption. Therefore, the changes in the consumption of urban areas are characterized by a decrease of grain and vegetable consumption and a stable increase in consumption of other food.

From 1978 to 1993, per capita grain consumption in rural areas increased most (18.2 kg) by 7.3%; although the absolute increase of animal product consumption was relatively slow (7.2 kg), the proportion change was 118%. The cases of eggs (250%) and fish (212.5%) are especially

outstanding. Only vegetable consumption dropped 34.6 kg. In sum, food consumption of rural areas featured an overall increase of all kinds of food demands except vegetables.

### **Demand analysis**

The elasticity data in Table 4, which were computed based on the cross sectional data from the National Survey of Income and Expenditure in 1991, were used in projecting with demand system approach.

**Table 2 Structural change in consumption of food in China.**

		1980	1988
Consumption expenditure (yuan/year)	Rural	157.95	476.66
	Urban	456.84	1,103.98
Food expenditure (yuan/year)	Rural	100.19	254.57
	Urban	258.84	567.01
Engel coefficient (%)	Rural	61.8	53.4
	Urban	56.7	51.4

Source: SSB, Statistical Yearbook of China, China Statistical Publishing House, various issues.

Note: The per capita food consumption data of urban areas in 1980 was replaced by the data in 1981, because of data insufficiency.

**Table 3 Annual per capita food consumption (kg) in China.**

	1978	1993	Change
<b>Rural</b>			
Foodgrain	247.8	266.0	+18.2
Meat	6.1	13.3	+7.2
Eggs	0.8	2.8	+2.0
Vegetables	142.0	107.4	-34.6
Sugar	0.7	1.4	+0.7
Fish	0.8	2.5	+1.7
<b>Urban</b>			
Foodgrain	145.4	97.8	-47.8
Meat	20.5	24.5	+4.0
Eggs	5.2	8.9	+3.7
Vegetables	152.3	120.6	-31.7
Sugar	2.9	1.8	-1.1
Fish	7.3	8.0	+0.7

Source: SSB, Statistical Yearbook of China, China Statistical Publishing House, various issues.

Note: The per capita food consumption data of urban areas in 1978 was replaced by the data in 1981, because of data insufficiency.

**Table 4 Income elasticity of food consumption, China.**

Commodity	Mean	Rural	Urban
Maize	-0.35	-0.47	-0.03
Beans	0.38	0.45	0.30
Rice	0.23	0.28	0.09
Sweet potato and potato	-0.14	-0.10	-0.20
Milk	0.18	-0.11	1.00
Edible oils	0.35	0.34	0.36
Vegetables	0.25	0.24	0.27
Pork	0.49	0.48	0.52
Beef and mutton	0.27	0.12	0.69
Poultry	0.86	0.85	0.87
Eggs	0.57	0.56	0.59

Note: The elasticity data of beans, sweet potato and potato are available from the World Bank (1991). Other elasticities were computed based on the cross sectional data from the National Survey of Income and Expenditure (SSB 1991).

### *Growth in demand for food*

Income growth and population growth will remain important determinants of food balance in the future. Population growth peaked in China in the late 1960s and early 1970s. Since then, fertility rates and the natural rate of population growth have begun to fall. Relying on the United Nation's demographic predictions, the growth rate during the projection period is assumed to be 1.283% per annum (UN 1993). The per capita income growth rate in the late 1980s and early 1990s was around 6-7%. Therefore, the consumer demand elasticity for China was used in projecting the growth in demand for food under the assumptions that per capita income grows at 6.0% per annum and population grows at 1.283%.

**Table 5 Projected growth in demand for food.**

Commodity	Expenditure Elasticity	Growth in Demand (%)
Maize	-0.35	-0.817
Soybean	0.38	3.563
Rice	0.23	2.663
Sweet potato and potato	-0.14	0.443
Milk	0.18	2.363
Edible oils	0.35	3.383
Vegetables	0.25	2.783
Pork	0.49	4.223
Beef and mutton	0.27	2.903
Poultry	0.86	6.443
Eggs	0.57	4.703

### *Demand for livestock products*

The livestock and poultry sector is the major consumer of feedgrains and oilcakes as feed. For projecting the requirement of feed, reliable demand projections for livestock products (milk, pork, beef, mutton, poultry and eggs) are required. In this section, the demand for milk, meat (pork, beef, mutton and poultry) and eggs in the year 2000 is analyzed.

Since the early 1980s, the production of meat, eggs and milk in China all increased at a high rate (as indicated in Table 6). The production of livestock grew much faster than the population, which has resulted in higher per capita availability of meat, eggs and milk.

The demand for milk, meat and eggs was projected using trend projection as well as demand system approaches. As almost no milk, meat or eggs are imported, the demand equals the production minus the export, with the average level between 1990-1992 being the projection base. The trend projection approach is based on the

assumption that the recent past trend will continue in the future. The demand projection following the consumer demand system is based on the assumption that per capita income grows at 6.0% per annum and population grows at 1.283% per annum during 1991-2000. The projected demand for milk, meat and eggs in the year 2000 is presented in Table 7.

**Table 6 Production of milk, meat and eggs in million tons, China.**

Year	Pork	Beef	Mutton	Poultry	Eggs	Milk
1980	11.34	0.27	0.45	NA	2.57	1.37
1981	11.88	0.25	0.48	NA	2.69	1.55
1982	12.72	0.27	0.52	NA	2.81	1.96
1983	13.16	0.32	0.55	NA	3.32	2.22
1984	14.45	0.37	0.59	1.49	4.32	2.60
1985	16.55	0.47	0.59	1.60	5.35	2.89
1986	17.96	0.59	0.62	1.88	5.55	3.33
1987	18.35	0.79	0.72	2.19	5.90	3.79
1988	20.18	0.96	0.80	2.74	6.96	4.19
1989	21.23	1.07	0.96	2.82	7.19	4.36
1990	22.81	1.26	1.07	3.23	7.95	4.75
1991	24.52	1.54	1.18	3.95	9.22	5.24
1992	26.35	1.80	1.25	4.54	10.20	5.64
Growth (%)	7.28	17.13	9.09	16.07	12.17	12.52

Source: SSB, Statistical Yearbook of China, China Statistical Publishing House, various issues.

**Table 7 Demand for milk, meat and eggs in million tons, China.**

Item	Average 1990 to 1992	2000	Annual Growth (%)
<i>Trend Projection Approach *</i>			
Milk	5.21	14.37	11.93
Pork	24.56	36.13	4.38
Beef	1.53	2.09	3.53
Mutton	1.17	1.70	4.24
Poultry	3.91	7.23	7.10
Eggs	9.12	24.90	11.81
<i>Consumer Demand System Approach**</i>			
Milk	5.21	6.43	2.36
Pork	24.56	35.64	4.22
Beef	1.53	1.98	2.90
Mutton	1.17	1.51	2.90
Poultry	3.91	6.86	6.44
Eggs	9.12	13.79	4.70

\* The projections are based on the data in Table 6.

\*\* The projections are based on the data in Table 5.

Since the reforms in the late 1970s, China's economy has been in transition to a market-oriented economy. All demand parameters changed frequently in this developing market. For example, the supply of meat, milk and eggs in urban areas all enjoyed government subsidies, which are certain to be canceled during the marketization process in China. Therefore, projection of the demand into the future is rather difficult.

The results of demand projection through the trend projection approach and the consumer demand system approach are similar, except for the fact that the projected demand for eggs and milk based on trend lines seems to be on the high side. The demand projections based on the consumer demand system look more realistic.

## Supply of and demand for feed

### Supply of feed

In China, feed is conventionally divided into three types: feedgrains, oilcakes and bran. Feedgrain includes maize which is the major part, rice, tubers and roots. Tubers and roots in China refer to field crops including potato and sweet potato, but taro, cassava, and other tubers and roots used as vegetables and grown in the suburbs are excluded. Generally, five kilograms of potato and sweet potato is converted into one kilogram grain (grain equivalent for tubers and roots). In the text, the grain equivalent for sweet potato and potato is used for analysis instead of data for fresh potato and sweet potato.

Because of the difficulty in accessing statistical data directly, the total level of feedgrain availability is generally judged based on its share in the output of grain. In 1990, feedgrain accounted for about 25% of the grain production compared to about 15-20% before the reforms and opening up to the outside world (Table 8). In 1994, this proportion reached more than 30%.

**Table 8 Total grain and feedgrain in China.**

Year	Total Grain	Feedgrain	Feedgrain (% of total grain)
(million tons)			
1980	320.56	59.39	18.53
1985	379.11	84.57	22.31
1990	446.24	108.94	24.41
1991	435.29	114.78	26.37
1992	442.66	120.93	27.32
1993	456.49	127.41	27.91
1994	445.10	134.24	30.16
Growth (%)	2.37	6.00	

Source: Institute of Agricultural Resource and Regional Planning, A study on feed production and livestock and poultry structure in 2000, in Chinese, Chinese Agricultural Science and Technology Publishing House; SSB, Statistical Yearbook of China, China Statistical Publishing House, various issues.

From the limited statistical data, we can not get details of the feedgrain constitution. Calculations based on related available data indicate the

following: feedgrain makes up the largest share, about 70%, oilcakes 8% and bran 20%. Maize, rice and tubers and roots account for the major proportion of feedgrain output. Some recent research demonstrated that about 58 million tons of maize output and the 13.32 million tons of rice were used for feed, but these estimates may be somewhat on the low side. Table 9 presents the availability of feed constituents.

**Table 9 Availability of feed by source in 1993.**

Feed/Component	Million tons	%
Total Feed	178.41	100.0
1. Feedgrain	127.41	71.4
Rice	20.00	11.2
Maize	80.00	44.8
Grain equivalent for sweet potato and potato	15.00	8.4
Others	12.41	6.9
2. Oilcake	15.00	8.4
Soybean Meal	4.70	2.6
Cottonseed Meal	5.23	2.9
Groundnut Meal	4.88	2.7
Others	0.19	0.1
3. Bran	36.00	20.2

Source: Institute of Feed, Development and utilization of source of feed and its industrialized production, 1995.

In addition, formulated feed is also an important product which improves feed usage as well as animal nutrition. The feed industry came into being in China in the 1980s and began to take off since that time. In 1994, the national output of formulated feed reached 42.32 million tons (Table 10). Although the output of industrial feeds rose at a rate of 10% each year, the demand still cannot be

satisfied. It is important to note that the additives used in concentrates and premix feed have to be imported (National Feed Industry Office 1995).

**Table 10 Output of formulated feed in China.**

Year	Million tons
1978	0.60
1980	1.50
1985	15.00
1990	31.22
1991	34.94
1992	36.38
1993	37.04
1994	42.32

Source: National Feed Office 1995.

#### *Demand for feed*

Based on the above demand projection for livestock products, the requirement for feed was projected for the year 2000 (Table 11). There is a big variation in the feed requirement by the year 2000 obtained by the trend projection and demand system methods. The trend line method projected the demand for feed at about 302.47 million tons in the year 2000 with annual compound growth of 7.39%. On the other hand, the consumer demand system projected the feed demand at 231.74 million tons in the year 2000 with a growth of 4.26% per annum. Looking at the actual growth rate in availability of feed during 1980 to 1992 (6.1%), the demand projections derived from demand system approach appear to be more realistic. Thus, China should plan to meet an annual domestic demand for feed of about 231.74 million tons in the year 2000.

**Table 11 Domestic demand for feed in China.**

Item	Feeding Ratio	1990-1992	2000	
			Trend Projection	Demand System
Domestic demand for livestock products				
Pork	3.50	24.56	36.13	35.64
Beef	3.20	1.53	2.09	1.98
Mutton	3.20	1.17	1.70	1.51
Poultry	2.10	3.91	7.23	6.86
Egg	3.00	9.12	24.90	13.79
Milk	1.84	5.21	14.37	6.43
Domestic demand for feed				
Feed demand for pork		85.96	126.46	124.74
Feed demand for beef		5.36	7.32	6.93
Feed demand for mutton		4.10	5.95	5.29
Feed demand for poultry		13.69	25.31	24.01
Feed demand for eggs		31.92	87.15	48.27
Feed demand for milk		18.24	50.30	22.51
Total domestic demand for feed		159.25	302.47	231.74
Annual growth rate (%)			7.39	4.26

### *Domestic demand for commodities as animal feed*

Assuming the feed composition in 1993 given in Table 9 will continue in the future, feed demand for maize, soybean meal, rice and tubers and roots can be estimated as the share of feed composition. As shown in Table 12, in the year 2000, the demand as animal feed in the year 2000 will be about 103.82 million tons of maize, 6.03 million tons for soybean meal, 25.95 million tons for rice, 19.47 million tons for grain equivalent for sweet potato and potato. Thus, these products together would meet about 67% of the projected total feed demand (231.74 million tons) for the year 2000. The other share of future feed demand has to be met from other traditional feed items like oilcakes, cotton seed, pulses, other cereals, etc.

**Table 12 Demand for commodities as animal feed, China.**

Commodity	Demand for Animal Feed in the Year 2000 million tons	%
Total feed demand	231.74	100
Maize	103.82	44.80
Soybean meal	6.03	2.60
Rice	25.95	11.20
Grain equivalent for sweet potato and potato	19.47	8.40

### *Domestic demand and market potential of major UCPs*

The main upland grain crops cultivated in China include rice, maize, soybean, tubers and roots which include potato and sweet potato, accounting for 63.75% of total grain acreage cultivated, but contributing 72.74% of total grain output. These are the four largest grain products besides wheat.

#### *Maize*

Maize is one of the major grain crops in China, accounting for about one quarter of the total grain production in China. At present, the production, marketing and export of maize are still controlled by the government to a great extent. Maize in China is used as food, animal feed, and for processing. Maize was a staple food of rural households when China was at a lower level of food consumption before the reforms. However, in 1994, only 20% of maize (about 20 million tons) was used as food but 64% was used as feed and 16% as seed, processed products and other uses (Table 13). Maize is used two ways as feed, in the production of

mixed feed and for direct feeding to animals. China has more than 4,000 feed manufacturers which consume 25 million tons annually of maize to produce over 40 million tons of mixed feed. Feeding animals directly is estimated to consume 40 million tons of maize per year (Tan 1995). Processed products of maize include starch, alcohol and other products, which annually consume 2.50, 1 and 1 million tons of maize, respectively, so the processing consumption of maize is about 5 million tons. At present, the proportion of maize exported from China in the world market is 7%, mainly exported to Hong Kong, Japan, South Korea, and Malaysia.

The domestic demand for maize in the year 2000 is projected at about 110.25 million tons (annual growth of 2.95%) by the trend projection method, with about 22.05 million tons as food, 70.56 million tons as animal feed and 17.64 million tons for seed, processed products and wastage (Table 14).

**Table 13 Demand composition for maize in 1994, China.**

Demand Composition	Million tons	%
Food	20.00	20.0
Animal feed	65.00	64.0
Seed, processing, other uses & wastage	14.28	16.0
Total	99.28	100

Source: Tan 1995.

**Table 14 Demand projection for maize in the year 2000 by the trend projection method.**

Demand Composition	Million tons
Total Domestic Demand	110.25
Food	22.05
Feed	70.56
Seed, processing, other uses & wastage	17.64

#### *Soybean*

Soybean has been produced for more than two thousand years in China. It has received increasing attention by producers and consumers with the change of consumers' views and adjustment of the food structure of households. In 1994, soybean was grown on 9.22 million hectares, accounting for 8.4% of total grain acreage and the output was 16 million tons, accounting for 3.6% of total grain production.

Soybean in China is mainly used as food (49%) and for oil extraction (43%). Most of the soybean meal is utilized domestically (89%), with a small proportion used for export (10%). As shown in Table 15, it is projected that by the year 2000, the

demand of soybean in China will be 15.32 million tons, of which 6.57 million tons will be used as food and 7.54 million tons for oil extraction. Direct consumption of soybean (such as processed into bean curd, soybean sprouts, soybean milk, etc.) will still be the major form of soybean utilization in China. Due to an ever increasing domestic demand, the export of soybean in the future will not increase.

**Table 15 Demand for soybean in the year 2000, China.**

Demand Composition	Million tons	%
Food	6.57	42.81
Soybean crushed	7.54	49.30
Soybean meal	6.03	
Domestic use	6.03	
Export	0.00	
Soybean oil	1.09	
Seed, other uses & wastage	1.21	7.91
Total demand	15.32	100

### Rice

The origin of rice is China, and China's rice cultivation has a history of about 7,000 years. Rice is grown mainly in southern China, where its acreage takes up 90% of the total. There are three categories in terms of rice production: early rice, intermediate rice and late rice, and their planting areas account for 30%, 33% and 31% of the total rice area respectively. With the development of farming techniques, especially the extension of hybrid rice production techniques, China's paddy rice production has developed further. In 1994, the area of paddy rice reached 30.17 million hectares, with a production of 175.9 million tons, both ranking first in the world. Forty-two to 45% of the grain output was rice.

Rice in China is mainly used as direct staple food, in brewing and food processing industries, animal feed and seed, etc. About 80% of the production of rice is used as food, and 20% is used for other purposes. In China, rice is consumed as a staple food by 60% of the population (about 72 million people). As shown in Table 16, the utilization pattern of rice in China can be generated using USDA's database. In 1993, rice consumption totalled 179.90 million tons; 143 million tons were used for staple, 20 million tons for feed, and the remaining 16.90 million tons for seed, processing and other uses.

It is projected that by the year 2000, China must produce 189.04 million tons of rice in order to meet the domestic demand. Of this, rice consumed as food will be 145.32 million tons, the demand of rice used as livestock feed will be 25.95 million tons,

and the demand of rice for seed and for processing will be 17.77 million tons (Table 17). The export of rice from China has had a declining trend since the 1980s although some increases took place in recent years. However, due to the influence of population growth, rice quality and other factors, export of rice from China will not increase in the future.

**Table 16 Demand composition of rice in 1993, China.**

Demand Composition	Million tons	%
Food	143.00	79.50
Animal feed	20.00	11.10
Seed, processing, other uses & wastage	16.90	9.40
Total	179.90	100

Source: USDA, Database of China-CPPA Model, 1995.

**Table 17 Demand projection of rice in the year 2000 by the demand system approach.**

Demand Composition	Million tons
Food	145.32
Animal Feed	25.95
Seed, processed products, other uses and wastage	17.77
Total domestic demand	189.04

### Tubers and roots (potato and sweet potato)

Tuber and root crops in China refer mainly to sweet potato and potato. They are the fourth major crop in China besides rice, wheat and maize, accounting for 7% of the total grain production. The major consumption forms of tuber and root crops in China include the use as human food and the use as livestock feed. Forty percent of the grain equivalent for tubers and roots is used as food for rural inhabitants, 50% is used as feed and about 10% is used for processing, with alcohol and starch as the major processed products from tubers and roots.

It is projected that by the year 2000, the domestic demand of potato and sweet potato in China will be 31.54 million tons in grain equivalent, of which 12.84 million tons in grain equivalent will be used as food (accounting for 40.71% of the total potato and sweet potato demand), and 19.47 million tons in grain equivalent will be used as livestock feed (accounting for about 50% of the total demand), (Table 18). China exports very small quantities of tubers and roots. In general, only small quantities of dried sweet potato are exported from China in addition to small quantities of potato exported as a vegetable.

**Table 18 Demand projection of potato and sweet potato in the year 2000.**

Demand composition	Million tons
Food	12.84
Animal feed	19.47
Seed, processed products, other uses and wastage	3.59
Total domestic demand	35.90

### Emerging markets of fruits and vegetables in China

Since the early 1980s, when the government gave up the agricultural policy of "grasping grain production as the key link" and implemented the production responsibility system (PRS), vegetable and fruit production has developed rapidly in China. Along with economic growth, increase of income levels and population growth, the vegetable and fruit market in China will expand further.

#### Fruits

Various fruits of tropical, subtropical and temperate areas can be grown in China, which has such a vast territory. During the period 1980 to 1994, fruit production increased rapidly (at an average annual growth rate of 11%). Almost all areas across China are exploiting fruits in accord with their respective resource advantages. The

important fruits planted in China are apples, oranges, pears, grapes and bananas (Table 19).

In 1994, the total fresh fruit export was 392,000 tons, which was only 1.1% of the total production (Table 20). This shows that most of the fruit was absorbed by the growing domestic market. It can be predicted that the growth trend will continue for a long period along with the growth of China's economy and population as well as changes of consumption patterns.

Citrus is one of the major fruits of China and China's production accounts for about 10% of the world citrus output, but the export of citrus is less than 2% of the world's citrus export. In recent years, some citrus producing regions (such as Guangdong province) have reduced the acreage of citrus plantation so as to develop other fruits. Other citrus producing regions (such as Hubei, Sichuan, Fujian, etc.) have expanded the acreage of citrus plantation. It is projected that by the year 2000, the citrus output of China will reach 12 million tons. The export of Chinese citrus will still be restricted by factors such as fruit quality and the export volume of citrus from China will not achieve a significant breakthrough. However, along with the citrus variety structure adjustment, the competitiveness of Chinese citrus in the international market will be enhanced to a certain extent.

**Table 19 Fruit output of China (in million tons).**

	Fruit	Apple	Citrus	Pear	Grapes	Banana	Other Fruits
1980	6.79	2.36	0.71	1.47	0.11	0.06	2.08
1985	11.64	3.51	1.81	1.47	0.36	0.63	3.86
1986	13.48	3.34	2.55	2.35	0.44	1.25	3.55
1987	16.68	4.26	3.22	2.49	0.64	2.03	4.03
1988	16.66	4.34	2.56	2.72	0.79	1.87	4.37
1989	18.32	4.50	4.56	2.56	0.87	1.40	4.42
1990	18.74	4.32	4.85	2.35	0.86	1.46	4.90
1991	21.76	4.54	6.33	2.50	0.92	1.98	5.49
1992	24.40	6.56	5.16	2.85	1.13	2.45	6.26
1993	30.11	9.07	6.56	3.22	1.35	2.70	7.21
1994	35.00	11.13	6.81	4.04	1.52	2.90	8.60

Source: SSB, Statistical Yearbook of China, various issues.

**Table 20 Fresh fruit exports from China.**

	Quantity (tons)	Value ('000 US \$)	Unit Value (US \$/ton)
1986	223,859	86,260	390
1987	243,792	101,360	420
1988	280,853	125,720	450
1989	252,167	108,550	430
1990	226,382	102,860	450
1991	159,756	75,510	470
1992	145,602	78,670	540
1993	319,723	135,800	420
1994	392,021	165,180	420

Source: SSB, Statistical Yearbook of China, various issues.

Although China's apple output accounts for 24% of the total world output, the share of apples exported from China accounts for less than 3% of the world market and accounts for less than 1% of the domestic output. The major reason for the lack of competitiveness of apple exported by China is its fairly poor fruit quality.

#### Vegetables

The large and inexpensive agricultural labor resources and varied climate conditions provide

favorable conditions for developing vegetable production in China. The market-oriented reforms and the Vegetable Basket Programme of the government have further promoted the development of vegetable production in China.

The major vegetable categories for export include fresh vegetables, quick-frozen vegetables, dehydrated vegetables, canned vegetables, etc. Table 21 presents Chinese exports of fresh vegetables. As shown in this table, China's largest fresh vegetable export by value continues to be mushrooms, worth US \$ 106.1 million in 1994, a 244% increase since 1992. Most of these shipments went to Japan, which imported US \$ 99.0 million of Chinese mushrooms in 1994. Other major

vegetable exports in 1994 were garlic, worth US \$ 75.6 million, up 12% in value since 1992; onions and shallots, worth US \$ 17.7 million and increasing 434% in value since 1992; leeks and other alliaceous vegetables, worth US \$ 10.4 million and increasing 24% in value since 1992; edible roots, worth US \$ 8.6 million and increasing 263% in value since 1992; and carrots and turnips, worth US \$ 7.6 million and increasing 55% in value since 1992.

Russia, Hong Kong, and Japan are China's most important markets for fresh vegetables. In 1994, Russia was the largest importer of Chinese potatoes, onions, tomatoes, and Brussels sprouts. Hong Kong and Japan were the largest importers of China's major vegetables.

**Table 21 Chinese exports of fresh vegetables, 1992-1994.**

Product	1992		1993		1994		Major Destinations
	Tons	'000 US \$	Ton	'000 US \$	Tons	'000 US \$	
Seed potatoes	486	149	768	148	1,250	267	Russia (44%), Hong Kong (21%)
Other potatoes	69,159	6,960	23,580	3,640	40,750	6,438	Russia (43%), Hong Kong (26%)
Tomatoes	9,252	2,476	8,937	2,159	12,217	3,841	Russia (47%), Hong Kong (46%)
Onions and shallots	11,288	3,324	31,956	7,639	58,757	17,749	Russia (48%), Hong Kong (22%), Korea (17%), Indonesia (15%)
Garlic	128,200	67,260	320,064	110,637	168,544	75,616	UAG (10%)
Leeks and other alliaceous vegetables	12,280	8,369	15,690	8,620	17,940	10,389	Japan (38%), Hong Kong (29%)
Cauliflower and broccoli	2,933	812	4,876	1,270	11,361	2,719	Hong Kong (49%), Russia (44%)
Brussels sprouts	1,744	251	1,795	229	4,532	892	Russia (62%)
Cabbage lettuce	6,078	1,381	10,490	2,274	15,567	3,062	Hong Kong (61%)
Other lettuce	759	196	214	134	650	212	Hong Kong (82%)
Carrots and turnips	16,173	4,889	15,316	5,051	25,215	7,572	Hong Kong (39%), Japan (28%)
Salad beetroot, salsify, Radishes, and similar edible roots	3,444	2,373	7,074	4,611	15,752	8,620	Japan (82%)
Cucumbers, gherkins	5,011	1,253	8,961	1,770	5,058	1,289	Japan (72%)
Peas	1,513	768	3,599	1,380	5,724	3,872	Japan (89%)
Beans	2,809	790	3,794	794	2,076	733	Japan (67%)
Other leguminous vegetables	9,906	4,955	11,611	5,382	8,142	4,584	Japan (52%), Hong Kong (28%)
Asparagus	1,151	2,235	1,627	2,813	2,654	5,359	Japan (44%)
Aubergines	5,042	1,257	7,596	1,687	8,008	1,841	Hong Kong (88%)
Celery and celeriac	1,461	404	1,528	357	3,006	626	Hong Kong (99%)
Mushrooms	9,169	30,819	18,321	76,709	28,234	106,066	Japan (72%)
Truffles	1,204	3,795	2,875	9,269	1,799	6,126	Japan (81%)
Peppers	4,341	1,414	7,883	2,015	5,475	1,615	Hong Kong (76%)
Spinach	7,576	1,892	14,232	2,946	5,673	1,588	Hong Kong (71%)
Bamboo shoots			4,020	5,769	4,488	5,547	Japan (72%)
Other	200,530	55,118	239,987	55,652	326,447	84,301	Hong Kong (80%)
<b>Total</b>	<b>511,510</b>	<b>203,140</b>	<b>766,795</b>	<b>312,995</b>	<b>779,590</b>	<b>360,924</b>	

Source: China Customs Statistics Yearbook.

China ranks first both in the total output and export volume of edible fungi in the world, accounting for 65% and 50%, respectively. The share of edible fungi export income in the total export income of vegetables from China is as high as 46.4%.

Along with the increase of edible fungi production, exports have also continuously increased. In 1993 the export of major edible fungus products was 193,075 tons, accounting for 47.5% of the world trade. In 1994 exports achieved a further increase, reaching 247,000 tons accounting for over

50% of the world market. The major species of edible fungi export from China include double-spore mushroom (*Agaricus bisporus* including salt solution mushroom, canned mushroom, dried mushroom

chips, etc.), *Lentinus edodes*, black fungi (*Auricularia auricula*), and *Volvariella volvacea* (Table 22).

**Table 22 Export of major edible fungi from China.**

	<i>Agaricus campestris</i> s				<i>Lentinus edodes</i>		<i>Auricularia auricula</i>		Dried <i>Volvariella</i>	
	salt solution		canned						<i>volvacea</i>	
	Tons	US \$ '000	Tons	US \$ '000	Tons	US \$ '000	Tons	US \$ '000	Tons	US \$ '000
1982	6,786	6,370	98,773	115,660	302	2,110	918	8,940	246	110
1983	5,824	6,050	91,653	102,510	952	10,370	1,272	12,730	51	130
1985	29,704	28,080	118,060	125,820	1,011	7,310	1,344	9,790	104	790
1986	33,949	27,910	129,810	124,170	1,391	10,340	1411	9,530	58	70
1987	24,874	21,640	129,602	130,560	3,545	28,480	893	8,000	228	240
1988	26,987	31,860	112,314	152,980	6,004	48,970	1,239	10,630	911	1,620
1989	35,467	43,990	133,553	185,700	5,413	39,610	1,246	9,560	849	1,050
1990	30,885	33,760	108,837	138,160	6,698	47,930	1,733	8,430	2,047	2,820
1991	28,178	31,510	118,041	144,980	7,596	42,910	1,625	9,280	1,521	2,560
1992	35,054	34,000	121,372	138,330	13,089	41,570	1,772	12,560	793	2,790
1993	37,688	38,210	138,106	133,760	16,786	81,990	3,587	15,740	1,978	3,950
1994	41,677	51,370	166,346	174,360	21,876	110,850	4,238	24,210	NA	NA

Source: Ministry of Foreign Economic and Trade, Foreign Economics and Trade Yearbook of China, 1982-1994, China Society Publishing House.

Since the early 1980s, while reforming the planned economic system, China has strengthened the construction of the vegetable and fruit market system, developed processing, storage, transportation and fresh preservation techniques and enhanced construction of the export infrastructure. In addition, China has attached great importance to the cultivation and breeding techniques of good quality and highly efficient varieties of vegetables and fruits. This is the essential reason for the rapid development of vegetable and fruit production in China in recent years.

With respect to institutional arrangements, the government has attached enough importance to the guarantee of farmland used for vegetable production, credit, techniques, and marketing through the Vegetable Basket Programme, which has promoted the development of vegetable production and improved vegetable supply capability.

However, the backward techniques of transportation, cold-storage and fresh preservation and low processing skills will remain to be major issues which restrict the export of vegetables and fruits produced by China and the domestic supply of vegetables and fruits.

## Recommendations

For the major upland crop products, such as maize, soybean, potato and sweet potato, which play an important role in China's food security, a number of specific recommendations merit consideration by policy makers, research scientists, traders, processors and farmers. They are outlined briefly below.

- Increase investment in the construction of the agricultural infrastructure to improve production conditions. The investments in irrigation development, road building, research and extension for grains need be increased.
- Research and extension services for upland crops should be improved. Speed up scientific and technological research into breeding, crop cultivation, and prevention and control of plant diseases. More attention should be paid to processing, storage and preservation of agricultural products.
- Create favorable conditions and promote the development of the feed industry with food demand as the real guide. The high income elasticities for livestock and feedgrains imply that demand for these products will increase faster than that for rice. Therefore, the growth of grain demand in the future is a result of the growth of feed grain demand. The future strategy for feedgrain development should include the

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breaking up of regional trade partitions, the cessation of regional agricultural protectionism and the implementation of preferential policies for the development of the feed industry to bring into full play the regional production superiority and a more efficient utilization of resources. Optimization of the production structure and efficient distribution of resources should bear the whole country in mind. There should be an increase of investment in irrigation development for yield augmentation of feedgrains such as maize in dryland areas.

- Because the shortage of grain in China is a shortage of feed grain, the state could consider a strategic policy of partially changing direct grain import (feed grain) into partial import of animal products.
- Further reform the agricultural marketing system and strengthen linkages between production, processing and exports. Speed up the progress of commercialization of the grain trade and speed up investment in port facilities to cope with a possible increasing demand of grain import. This will be beneficial not only in alleviating the gap of output deficit but also in reducing the time and cost of grain imports.
- For vegetables and fruits, the future strategy should be as follows:
- Increase investment in the construction of infrastructure of vegetable and fruit markets, and strengthen the construction of marketing systems.
- Strengthen the construction of market information systems, establish market information networks in vegetable and fruit producing regions and marketing areas, and release production, marketing and price information of vegetables and fruit by utilizing advanced communication media.
- Improve the technical level of vegetable and fruit processing and fresh preservation.
- Improve the storage and transportation facilities for vegetables and fruit so as to reduce post-harvest losses.
- Strengthen the administration of quality control and monitoring for vegetables and fruit.
- Improve the technical level of vegetable and fruit packing, which is an important aspect for the promotion of agricultural product export.

## Production, Consumption and Marketing of Pulses in Myanmar

*Hla Kyi*

### Background information on Myanmar

#### *Population*

Myanmar's population is increasing steadily with an annual growth rate of 1.87% and the estimated total for 1995 is approximately 45 million. Out of this total about 75% are living in rural areas where farming is the main occupation. There are 4.4 million farm families working in the whole country. The total labour force is estimated at 17 million out of which 65% are engaged in the agricultural sector.

#### *Climate*

Most of Myanmar lies in the tropical monsoonal zone with the exception of the temperate northern most parts of the country. There are three well-defined seasons: a hot summer from March to mid-May, a rainy season from mid-May to mid-October and a dry and a cool season from mid-October to February, with large variations depending on latitude, altitude and topographical characteristics of each region.

#### *Soils*

The soils of Myanmar vary greatly as a result of diverse climate and geology. But there are only three agriculturally significant soil groups namely alluvial, black and red lateritic.

- Alluvial soils are generally deep and variable in structure, ranging from clays to sandy loams, occupying approximately 50% of the total cultivated area. These soil types are common in areas along Ayeyarwady, Chindwin and Thanlwin river basins and have good agricultural potential.
- Black soils (Vertisols) have high clay content and irrigation is necessary. Most of these soil types are found in the dry zone where annual rainfall is between 500 and 100 mm, occupying some 30% of the total cultivated area.
- Red lateritic soils are generally found in Shan State where the topography is undulating and annual rainfall is from 1000 to 2500 mm.

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\* Myanmar Agricultural Services, Yangon, Myanmar.

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These soils cover about 20% of the total cultivated area and require intensive management because erosion can be serious.

The soils of Myanmar are generally low in organic matter and nitrogen, with the exception of alluvial flats along the major river systems and the delta areas, but fairly high in available phosphorus and potash.

#### *Land utilization*

Myanmar has a total land mass of about 67.69 million hectares, of which 8.859 million hectares are under cultivation in 1995/96. However, if the double cropping areas (about 4.201 million hectares) are taken into consideration, then the total cropped land in 1995/96 would be 13.06 million hectares.

#### *General agricultural situation*

Myanmar as an agricultural country, is capable of growing different kinds of crops since it possesses both tropical and temperate climates. The different agroecological zones, comprising the vast deltaic region, the long coastal strips, central dry zone and hilly regions, support cereal crops, oilseed crops, pulses, industrial crops, vegetables, fruits and flowers under different cropping systems.

The diversity of different agroecological zones within the country results in the grow the over 60 different crops. The most important crop group is the cereals with an area constituting more than 51% of the total crop sown area of 32,259 thousand acres (13,055 thousand ha.) in 1995/96. Among the cereal crops, paddy is widely grown throughout the country and its share is about 47% of the total crop sown area. Oilseed crops occupy the second most important position next to cereals, followed by pulses in the third place and industrial crops in the fourth.

### **Production situation**

#### *Major crops*

In Myanmar, it is feasible to grow tropical, subtropical and temperate crops. Paddy is the most important crop in Myanmar. It dominates the agricultural sector, which is the largest and most productive part of the economy; changes in paddy production have a direct and profound influence on the entire economy of the country. Therefore, much

emphasis and priority has been given to increasing food production especially paddy. Consequently, summer paddy was introduced on a large scale in 1992/93 with an area of 0.82 million acres and it reached 3.16 million acres in 1995/96.

In the total crop sown area, cereal crops, especially paddy and pulses are being rapidly promoted year by year. Summer paddy, oil seed crops, cotton and pulses are the most competitive crops in area expansion. As a result, pulses also become an important source of foreign exchange earnings among agricultural commodities.

#### *Pulses*

Generally, the cultivation of pulses does not pose much difficulty and is feasible on a large scale, on both upland (Ya) and lowland (paddy land). For many years, the pulse sown area was about 0.81 million ha, but, due to the trade liberalization policy, the area under pulses has increased to 5.03 million acres in response to the market demand.

With a relatively favourable land to population ratio, Myanmar still has an enormous potential for expansion of pulse production for export if the market is reliable and the price is reasonable and stable.

Myanmar possesses at least 17 food legume cultivars, of which 9 show ample promise of future improvement. The botanical, common English and Myanmar names of pulses as well as area, yield and production of these legumes are also shown in Table 1.

Regionwise, 90% of the total area under food legumes is concentrated in Ayeyarwady, Magway, Bago, Mandalay, Sagaing, and Yangon Divisions. The season-wise distribution of food legume cultivation also shows a very wide range. The cultivation of these crops is determined by the status of moisture in the soil and its depletion so they are almost entirely dependent on monsoon rains as the moisture source. Early monsoon crops like pigeonpea are planted with onset of the rains. Mid-monsoon crops like lima bean and cowpea benefit from the receding monsoon rains, and late-monsoon crops like chickpea and lentil are grown on conserved soil moisture. In Lower Myanmar, almost all of the pulses are grown in the late monsoon season or winter season. Harvesting time may vary 1 to 2 months due to agroecological conditions of the region.

**Table 1 Names of major food legumes of Myanmar and their yield and production in 1995/96.**

No.	Botanical Name	English Name	Myanmar Name	Harvested Area (acre)	Yield (basket/acre)	Production (basket)
1	<i>Cicer arietinum</i>	Chickpea	Kalape	442,810	8.74	3,868,007
2	<i>Cajanus cajan</i>	Pigeonpea	Pe-sin-gon	592,484	7.8	4,622,942
3	<i>Vigna mungo</i>	Black gram	Mat-pe	1,110,808	9.78	10,866,231
4	<i>Vigna radiata</i>	Green gram	Pedisein	1,170,986	9	10,542,764
5	<i>Vigna umbellata</i>	Indian rice bean	Peyin	35,518	8.09	287,401
6	<i>Vigna unguiculata (cylindrica)</i>	Cowpea	Pelun	210,820	8	1,687,596
7	<i>Vigna unguiculata (unguiculata)</i>	Cowpea	Bocate-pe	195,389	9.18	1,793,671
8	<i>Phaseolus lunatus</i>	Butter bean,	Htawbutpe	88,680	10.52	932,914
		Lima bean,	Pegya	34,227	7.74	264,984
		Duffin bean	Pebyugale	8,178	8	65,451
			Sultani	18,247	10.52	191,983
9	<i>Phaseolus vulgaris</i>	Sultapya		106,437	8.42	896,171
		Myehtaukpe				
10	<i>Lablab purpureus</i>	Haricot bean,				
		French bean.				
11	<i>Dolichos biflorus</i>	Kidney bean	Pegyi			
		Indian bean,				
12	<i>Lens esculenta</i>	Lablab bean		173,855	7.26	1,262,143
		Horse gram	Pebizat			
13	<i>Glycine max</i>	Lentil	Peyaza	6,601	4.38	28,920
14	<i>Pisum sativum</i>	Soybean	Peboke	191,111	10.21	1,951,363
		Garden pea	Sadawpe	96,246	8.5	818,091
15	<i>Pisum arvense</i>	Pea				
		Field pea	Sadawpe			
16	<i>Vicia faba</i>	Field bean,	Bosape			
		Broad bean				
Other pulses				202,082	9.35	1,890,046

Pigeonpea is mainly a dry zone crop grown as a component of mixed-cropping or intercropping systems with crops such as sesame, groundnut, cotton and mungbean. Long duration varieties are mostly grown at the onset of the monsoon (May-June) and harvested in January-February. In the 1980s, the area under pigeonpea represented less than 200,000 acres. After the trade liberalization policy, pigeonpea area increased dramatically up to 600,000 acres.

Chickpea is mainly grown as a relay or sequential crop with rice. There are some upland areas where chickpea follows sesame, maize and green gram. Sowing of chickpea on upland farms begins between late September and October while on rice land it starts 2 weeks before harvest in a relay cropping system and by mid-November to early December in a sequential-cropping system. During the last 20 years, the chickpea area varied from 300,000 acres to 500,000 acres.

Black gram is sown as the mid-rain crop in Sagaing and Mandalay divisions. It is mainly sown in winter in the Ayeyarwady, Bago and Yangon divisions as the second crop after paddy and also

on river banks when the water subsides. In the 1960s, black gram occupied about a hundred thousand acres. As a result of the market economy, the area under black gram increased to 1 million acres in the 1995/96 crop year.

Green gram is mainly sown as a second crop after paddy in Bago, Yangon and Ayeyawady divisions. With the onset of the monsoon, the crop is grown in the upland areas of Central and Upper Myanmar. Due to the attractiveness of the price, the sown area has dramatically increased to 1.2 million acres within a short time span.

Lentil is mainly sown in the Sagaing Division as a winter crop, and is normally sown after the end of the monsoon rains, from late October to December to utilize residual soil moisture. The area under this crop is not more than 10,000 acres. It prefers cold weather and good soils. The productivity of this crop is very low in Myanmar due to the low genetic production potential of the varieties grown and poor agronomic practices. Hence, the lentil cultivation area cannot be increased in the short term.

### Cost of production for selected pulses

Average per acre cost of production is an important socio-economic factor for farmer's decision making in their choice of cropping system. The average per acre costs as well as farm-gate prices and net return of major crops and for selected pulses are shown in Table 2 for the 1995/96 crop year. This information was collected in the major pulse growing areas. Fertilizer and insecticide costs are included in this calculation. The costs of production for pulses are still lower than for the other competitive crops such as groundnut, maize, cotton, wheat and summer paddy. This is an important encouraging factor for growing pulses by resource poor farmers.

**Table 2 Farm-gate prices, cost of production and net return of major crops and pulses in Myanmar 1994/95.**

Crop	Farm-gate price (kyat/mt)	Yield (basket/acre)	Cost of production (kyat/acre)	Net return (kyat/acre)
1 Black gram	28,272	10	2,538	6,693
2 Green gram	32,125	10	2,738	7,751
3 Chickpea	32,457	10	2,522	8,076
4 Pigeonpea	28,807	7	2,185	4,399
5 Summer paddy	10,518	70	7,717	7,643
6 Wheat	21,737	15	5,783	4,863
7 Maize	16,610	25	4,408	5,949
8 Groundnut	29,571	40	7,555	5,855
9 Sunflower	31,008	20	4,650	4,352
10 Cotton (long staple)	36,742	200 viss	5,073	6,927

Source: Myanmar Agriculture Service.

### Major factors affecting production of pulses

#### Policy

Before 1988, under the government of the Socialist Republic of the Union of Burma, pulse production was low due to low yielding varieties, poor agronomic practices, low levels of inputs and especially low levels of profitability for the farmers.

After the economic transitions in 1988, the government (State Law and Order Restoration Council, SLORC) laid down the following agricultural policy measures:

- farmers were permitted to cultivate crops according to their choice and to process, transport and freely trade their products;
- state, cooperative and private enterprises were allowed to claim and to utilize fallow and culturable waste land for the enhancement of agricultural production;

- exports were diversified through the introduction of new products and semi-processed and processed goods were emphasized;
- direct foreign investment was allowed; and
- price controls were abolished and subsidies reduced.

Among the above-mentioned policy measures, trade liberalization in agriculture commodities permits farmers to get market prices instead of fixed prices. As a result of the market reform, farmers want to grow more profitable crops like pulses and pay attention to higher yields. Therefore, pulse area, production and export have rapidly expanded in Myanmar after the agricultural liberalization. The area under pulses reached 5 million acres in the 1995/96 crop year. The export of pulses, due to substantial growth in private sector exports, became the country's major foreign exchange earning agricultural export commodity since the beginning of 1990s.

#### Area expansion

The area under pulses fell from around 2.2 million acres in 1984/85 to about 1.8 million acres in 1988/89, but has dramatically risen to 5.0 million acres in 1995/96. Most of the area expansion comes from double cropping after monsoon paddy in the lower part of the country, mostly utilizing residual soil moisture. The most significant area growth was achieved in the cultivation of green gram, black gram and pigeonpea varieties. From the 1988/89 to the 1995/96 crop year, the area under green gram, black gram and pigeonpea increased 9 times, 6 times and 3 times, respectively.

Area expansion is limited because of land resources. On the other hand, a major constraint on the expansion of multiple cropping or increasing cropping intensity is the limitation in both irrigation as well as drainage systems. The irrigated area has dramatically increased within a relatively short period from 12 to 17% of the total sown area between 1987/88 and 1993/94. About 83% (3.93 million acres) of the irrigated area was under paddy and other crop groups accounted for about only 17% in the 1994/95 crop year.

#### Low yielding varieties

Low genetic yield potential is one of the main constraints for production. Research and development are basic to increasing agricultural productivity. In Myanmar, very little research has

been done to produce high quality seed. Most farmers are still using local varieties. Supplying good quality seed of adapted genotypes for the region can be an important input for improving crop yield. Therefore, Myanmar Agriculture Service has distributed high quality seed to farmers but the quantity provided is very low compared to the pulse sown area.

#### *Agro-technology and inputs*

Most of the pulses are sown in the winter season with residual moisture or in the rainy season with the onset of the monsoon rain. Therefore, time of sowing is very important for the success of the crop. Productivity of pulses is mostly influenced by agro-technology (agronomic management) such as land preparation (tillage), fertilizer use, weeding, water management, pest and disease control and post-harvest technology. Because of socio-economic problems, farmers cannot follow good agronomic management. The use of fertilizers and insecticides is very low in pulse production.

#### **Pulse consumption**

Peas and beans constitute very important daily protein intake for the people of Myanmar, especially for the low income group. At least 17 food legume cultivars are sown in Myanmar under the different agro-ecological zones. Among these cultivars, chickpea, peas (sadaupe), lablab bean (pegyi), lima bean (sultani/pya), cowpea and soybean are the most preferred among the people of Myanmar (Table 3).

**Table 3 Composition of food legume consumption in the Myanmar diet.**

Food Legume	Percent
Chickpea	29.0
Peas	16.9
Sultani/pya (coloured lima bean)	10.3
Lablab bean	9.3
Pebyugale (white lima bean)	8.0
Pigeonpea	6.4
Soybean	4.7
Black gram	3.6
Cowpea (pelun & bocate)	4.7
Others	7.1

Most of the chickpea production is used for domestic consumption. Chickpea is consumed in many forms including whole dry seed, dry split seed (dhal) and as a flour used in cooking. In Myanmar, chickpea has two major culinary uses: one is dhal

soup and the other is dhal meal. Hard tofu, soft tofu, pea noodle and varieties of snack food are made with chickpea. Chickpea is popular with all classes of people in Myanmar because of its taste, flavor, and usefulness. Most of the chickpea in Myanmar is dark yellow-brown color. There is no information on per capita chickpea consumption.

Green gram and black gram are mostly used in the bean sprout industry. Indian people in Myanmar mostly used pigeonpea, black gram and green gram as their food. Rural people and Myanmar physicians value pigeonpea for its medicinal properties. In the central dry zone, the high rice price area, rural people used to cook rice mixed with pigeonpea to reduce the amount of rice. At present, the pigeonpea price is higher than that of rice.

Boiled garden pea with edible oil and rice or glutinous rice are commonly eaten for breakfast by rural and urban people. Lablab bean is also a preferred pulse and fried lablab bean is consumed as snack food in various part of Myanmar. Cowpea and lima bean are also used the same as garden pea. Lentil soup with pea noodles is very famous among the urban people and the lentil price is always higher than that of other pulses.

Harvest trash (pods, cracked seed, and leaves) of legumes is widely used for animal feed in Myanmar. In the dry zone, the pigeonpea plant (stem after harvest) is used as a source of fuel for domestic purposes.

No detailed statistics are available for both human and animal consumption of pulses in Myanmar. In 1978, it was estimated the per capita consumption of grain legume was 7.13 kg (3.35 pyi) per year, which works out to a daily intake of 19.52 gm. In general, the differences between production and export can be assumed as local use. Local needs can be divided to seed and waste and domestic consumption. The seed rate is calculated at 0.75 basket (12 pyi) per acre sown for the next year and wastage is estimated at 2% of the production. The production, consumption and export situation of pulses can be calculated (Table 4).

#### **Marketing**

The food grain trade has been a state monopoly in Myanmar since before independence, represented by the State Agricultural Marketing Board (SAMB) established in 1948. However, the distribution for domestic consumption at both wholesale and retail levels was largely carried out

by free market agents. In 1963, the trading of eleven agricultural products (rice, wheat, maize, pulses and selected crops) was brought under direct control of government in line with the centrally planned economy. For many years the dominant

agencies in agricultural marketing under the centrally planned economy have been the Myanmar Agricultural Produce Trading (MAPT) and Myanmar Export and Import Services (MEIS).

**Table 4 Production, consumption and export situation of pulses.**

Year	Production (mt)	Seed & Waste (mt)	Export (mt)	Population (million)	Annual Consumption (kg/yr/capita)
1985/86	620,842	63,205	92,747	37.07	12.5
1986/87	611,757	61,780	92,314	37.80	12.1
1987/88	565,572	55,485	75,326	38.54	11.3
1988/89	370,692	51,849	17,477	39.29	7.7
1989/90	453,002	69,589	59,867	40.03	8.1
1990/91	552,393	87,645	226,051	40.79	5.8
1991/92	720,492	105,062	203,589	41.55	9.9
1992/93	888,499	109,729	525,576	42.33	6.0
1993/94	869,788	123,101	514,291	43.12	5.4
1994/95	1,109,769	145,561	424,880	43.92	13.0
1995/96	1,352,906	154,462	577,505	44.74	13.9

Source: Myanmar Agriculture Service.

On assumption of power by the State Law and Order Restoration Council (SLORC) in September 1988, a market-oriented economy was adopted and procurement, marketing, transport and storage of crops were liberalized. In order to maintain socio-political and economic stability, the government has made a concerted effort to increase production of food grains, paddy, oil seed crops and food legumes for the purposes of food security and export revenue. The government is also encouraging private sector participation in agricultural production. As a result, the volume of pulse export increased dramatically during a couple years.

#### *Market structure*

The present market structure consists of state economic enterprises under various ministries, cooperatives, joint ventures and private traders. The State economic enterprises purchase pulses from all available sources - traders, cooperatives, middlemen and farmers. The cooperatives, joint ventures and traders have their own brokers (commission agents) and they also buy from individual traders.

Farmers sell their products to brokers who come to the village to buy the products or farmers themselves go to the nearest town to sell their products at the broker's house or market. Most farmers keep seed for the next season and the rest is sold to the market. There is no regulatory market

for food grains in Myanmar. Some poor farmers have to sell their products before harvesting time regardless of the price.

Most of the products (mungbean, pigeonpea, black gram, chickpea and lentil) are handled by private traders. Although the private sector is still operating under various limitations and constrained by lack of infrastructure, capable man-power, and financial as well as technical support and services, its role in domestic and export trade for agricultural commodities is increasingly expanding.

#### *Price, marketing cost, and margin*

The difference between the farm-gate price and the consumer price is the marketing margin. It includes labour, packing material, tax, storage, transportation and processing costs. Large marketing margins can occur with either high real marketing costs or when monopolistic elements in the marketing system are earning excess profits. In Myanmar, the private sector seems to have more appeal to the farmers, most probably due to higher offer prices and efficient undertaking of business operations with reasonable marketing costs.

It is interesting that the domestic marketing system operates with considerable efficiency despite limited physical facilities. As a result, the marketing cost is reasonable and producers' share of the wholesale price is very high. However, the variation of retail prices is very high even in the same township. Seasonal variation of selected

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pulses, especially black gram, green gram and pigeonpea, is very high due to deficiencies in the knowledge of crop prospects, market information, private speculative forces and fluctuation of foreign exchange rates. Seasonal price fluctuations generally do not exceed storage and wastage costs, though they might surpass these substantially in some months of the year. Although farmers know about price fluctuations, most of them are not able to hold their products. Therefore, some people estimate that less than 10% of farmers can enjoy the maximum market price. However, market prices reflect the supply and demand situation to a considerable degree.

#### *Export market*

Before 1988, Myanmar Export and Import Services (MEIS) under the Ministry of Trade controlled the export of all agricultural commodities. After 1988, the government liberalized all crops as free commodities for local trading as well as for export (except for exporting paddy). There are no restrictions for export of pulses except for chickpea. Chickpea exporters have to sell a portion of their export volume to the government at a fixed price. Chickpea is the most preferred and useful pulse in Myanmar, so the government wants to stabilize the price of chickpea. This policy has been used since the 1994/95 budget year. In the long term, this policy may encourage farmers to switch to other more profitable crops and consequently the production of chickpea will tend to decline in the future.

Most of the pigeonpea, black gram, green gram, chickpea, and lentil is exported to India, Pakistan, Singapore, Japan, Malaysia, Indonesian, Bangladesh, UAE, Korea, Hong Kong and the Philippines. Experienced traders estimate that the volume of border and sea-borne trade may be 10% of the total regular trade.

#### **Conclusions**

Myanmar is an agricultural country and its economy will continue to depend on agricultural production in the foreseeable future. About 53% of the total GDP in 1995/96 came from the agricultural sector. At present, pulses play an important role in earning foreign currency. Therefore, trade expansion in pulses coincides with our country's policy of increasing production in pulses for both export and local consumption. In this region, Myanmar, with its relatively favourable land and population ratio, has a potential for increasing pulse

production. However, increased production still faces several problems related to varieties, agrotechnology, post-harvest technology, storage, processing and marketing systems.

It is clear that increased production in Myanmar is mainly dependent on the export market. The most encouraging factor for farmers to grow pulses is the profitability of growing such crops. Therefore, price and market stability are essential for increased production. Up to now, the increased production of pulses was mainly due to horizontal expansion (expansion of sown area). Area is limited because of land resources and other competitive crops. Therefore, it is important to emphasize vertical expansion (increased land productivity). This cannot be done without research and development programs on pulses. In pulse research, the approach to productivity problems should be strongly based on varietal improvement and reducing post-harvest losses.

Area, production and yield are highly responsive to cost and benefit of producing pulses. Costs of production are getting higher and higher due to increasing costs of inputs and labour. Increased productivity is the only way to reduce the cost of production. Otherwise, farmers cannot compete in the international market and finally they have to switch to other more profitable crops.

An efficient marketing system is also essential for competing in the international market. The government should encourage the establishment of regulated markets and marketing where modes of transaction are regulated and also encourage investment in improving market facilities, services and infrastructure. The situation of transport, storage and processing and associated problems suggest that there is no easy remedy except massive infusion of capital investment and improvement of the management system to overcome problems and raise efficiency of pulse marketing in Myanmar.

Therefore, the following points should be considered to improve the pulse trade:

- Increase the productivity of pulses by using improved agrotechniques and reduce post-harvest losses.
- Improve storage methods and storage facilities.
- Establish regulated markets for regulating and standardizing the weight and quality of products.
- Improve the market information system for both producers and traders.
- Support modernization of the processing industry.

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- Explore the market for semi-processed and processed food made from pulses.
  - Make medium term sales contracts with importing countries for market assurance.
  - Support the establishment of regional market centers for pulses, which should handle problems encountered between exporters and importers.
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## CGPRT Centre News and Activities

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### Regional Conference on Upland Products: MPUPA TRADELIB Pulses Project

The Centre has completed the project Market Prospects of Upland Crop Products and Policy Analysis in Selected Asian Countries (MPUPA). The research was carried out in China, India, Indonesia, Pakistan, the Philippines, Thailand and Vietnam. To disseminate the research results, the project conducted an international workshop in Bogor, 24-27 February 1997. The conference was attended by high ranking officials and economists from twelve countries: India, Indonesia, Japan, Korea, Lao, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam. The national experts of the project presented important issues related to upland crop products of their respective countries using an identical research framework. The country reports have been printed and are now available at the Centre. The reports on India, Indonesia, China, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, contain analyses of medium trends of consumption of and demand for upland crop products. Case studies of successful developments and failures, and the scope and role of government intervention are included, based on a wealth of statistical sources. During the conference the first phase of the trade liberalization project, which will start in April 1997 was discussed. This project will draw on the country reports. Case studies on international trade in pulses covering India, Pakistan, Myanmar and Sri Lanka were presented and also discussed.

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### SUASA-2

The interim meeting for the project Economic Assessment of Selected Resource Management Techniques in Marginal Upland Agriculture (SUASA-2) was held at the Centre from 18 to 19 March 1997. The meeting focused on the work schedule of the project. Four national experts and a regional adviser, Dr. Vute Wangwacharakul, presented their work plans and suggestions for the study. Dr. Mahander Singh and Dr. Gour Chandra Munda from India and Dr. Ni Hongxing and Dr. Gu Shuzong from China explained the conditions of the study sites in their respective regions. The meeting produced a more viable work plan for the project.

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### DIVAPOL

A regional seminar on A Tool for Measuring Policy Impact in Rural Areas: the Multi Level Analysis Tool for Agriculture (MATA), was held on 25, 26 and 27 March 1997, at ESCAP headquarters in Bangkok. The seminar was organized in cooperation with researchers and staff of many organizations: CGPRT Centre, Bogor; Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France; ESCAP, Bangkok, Thailand; the Office of Agricultural Economics (OAE), Bangkok, Thailand; and the National Institute of Agricultural Science and Technics (INSA), Vietnam. The regional seminar was attended by sixty eight senior officials and researchers from India, Indonesia, France, Lao PDR, Myanmar, Pakistan, Philippines, Thailand and Vietnam. Modeling activities were presented as examples of the use of the MATA model as a tool to analyze consequences of policy measures.

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## Information Services

From 14 to 17 January 1997, 2 staff from the CGPRT Centre (Mr. Harry Zulfikar and Ms. Fetty Prihastini) attended a training programme sponsored by IDRC (International Development Research Center) in Singapore.

There were 25 participants coming from different organizations from various parts of Asia (Bangladesh, Cambodia, Indonesia, Maldives, Nepal, PNG, Philippines, Singapore, Sri Lanka and Viet Nam).

In this training programme, the participants were given an introduction to and hands-on training on basic web building and design. The future activities and plans of the PAN Program were also discussed.

The CGPRT Centre Home Page can be accessed at:

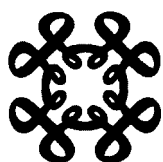
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## Announcements

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*Pan Asia Networking is an initiative of the  
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Jalan Gatot Subroto 12930 Jakarta  
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or  
Editions Didier Millet  
593 Havelock Road #02-01/02  
Singapore 169641  
Tel. 65 735 7990; fax. 735 8981

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## Fourth Asia-Pacific Conference on Agricultural Biotechnology: To Field and Market

**13-17 July 1998,  
Darwin, Australia's Northern Territory**

The Fourth Asia-Pacific Conference on Agricultural Biotechnology will be held in Darwin, the capital of Australia's Northern Territory and gateway to the magnificent wilderness of Kakadu and Uluru National Parks.

The Conference will be held in the modern Northern Territory University, with accommodation ranging from cheap to luxurious in Darwin City itself.

Genetic engineering is emerging from the laboratory. The Darwin conference will focus the attention of agricultural biotechnologists on the issues of this exciting transition:

### **To Field and Market**

- Regulatory experiences and trends - regional differences and directions.
- Food safety and public acceptance.
- Commercialization of genetically-engineered food and fibre - case studies and lessons.
- Biotechnology contributing to agricultural production which is environmentally neutral and even restorative.
- Agricultural biotechnology making a difference to productivity, sustainability and safety.

The Northern Territory is still developing agriculturally with pastoral production for the live cattle trade to South-East Asia, tropical horticulture and aquaculture being growth industries.

Field trips from the Conference will show delegates the trade opportunities and levels of technology presently being used.

For further information, contact:  
Dr K.C. Woo,  
Fourth Asia-Pacific Conference on  
Agricultural Biotechnology,  
Northern Territory University,  
Science Faculty,  
Darwin NT 0909 Australia

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## 11<sup>th</sup> International Course on Seed Production and Seed Technology

**International Agricultural Centre  
Wageningen/the Netherlands April 12 - July 16,  
1998**

A secure supply of quality seeds is a key condition for future agricultural and horticultural growth in the developing world. Productivity-led growth in agriculture depends on the application of advanced technology. Successful introduction of advanced technology is in turn largely dependent on farmers' access to seed of desired genetic composition, adequate purity and optimal physiological stage.

The high priority that seed programmes deserve in agricultural development strategies is confirmed by the fact that improved seed offers the highest economic and social returns among all agricultural inputs.

The Netherlands has a well-developed seed industry with a private sector and actively co-operating governmental services.

The International Agricultural Centre, in co-operation with the Wageningen Agricultural University, governmental institutions and private industry, organizes an International Course on Seed Production and Seed Technology, offering relevant Dutch knowledge and experience in the curriculum.

Through the course, the International Agricultural Centre proposes to harness relevant knowledge and available experience in the Netherlands towards the training of seed agronomists and seed technologists in developing countries.

For further information, contact:  
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P.O. Box 88  
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### CGPRT Centre

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

### Objectives

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

### Programmes

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

### Palawija News

Contributors are invited to submit concise summaries of significant social research related to CGPRT crops for publication. Figures (graphs or tables) may accompany the article. All articles are subject to editing to meet space limitations.

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

*Palawija News* is distributed free of charge to interested individuals and institutions. Please send address corrections and additions to the Distribution Officer, Publications Section.

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