7 Projection of Myanmar's Rice Supply and Demand

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I   Introduction

The development of the economy of Myanmar has been largely depending on the agriculture sector. The sector contributes 30 to 40 % of GDP and around 30% of the export earning. Moreover, it employs more than 60 % of the total labor force. In particular, rice is considered as the most important crop for daily food consumption. Myanmar's rice cultivated area in 19989/2000 was about 6.2 million ha, which covered 49% of the total cropped area and total production was about 20 million MT. In the demand side, according to the household expenditure survey conducted by Central Statistical Organization of Myanmar in 1997, 16 % of the total household expenditure of urban family and 22% of the total household expenditure of rural family are spent on rice.

Therefore it is significant for the national economy of Myanmar to have appropriate policy measures for food security and rural development in order to cope with growing rice demand as well as to promote export earning from rice. In this study, we review the evolution of supply and demand of rice in Myanmar, evaluate the effect of procurement price on rice supply and demand and also conduct an econometric study on its future projection with some simulations to provide basic information for policy making.

II   Overview of Rice Sector Development in Myanmar

During 50 years after the independence in 1948, there were two

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increasing periods of rice production in Myanmar. The first period was from mid-1970s to mid-1980s and the second period was from 1992 to 1999. (see Figure 1) During the period from 1975 to 1985, rice production increased 55% with the average annual growth rate of 4.5%. This growth of rice production was mainly achieved by the yield increase as a result of the promotion of modern technologies and HYVs in rice farming.

Myanmar's economy started to stagnate with less than 3% of annual growth rates of real GDP in 1985-86 and recorded negative growth rate in 1986, 1987, 1988 and 1991. Poor performance of the national economy with continuing foreign currency shortage and high inflation rate forced the Myanmar government to apply unattractive government procurement price of rice. As a result rice production stagnated throughout the period from 1986 to 1991. Rice (unhusked) production decreased nearly 8 % from 14 million MT in 1985 to 13 million MT in 1991. During the second increasing period (1992-1999), rice production augmented 36 % from 14.8 million MT in 1992 to 20 million MT in 1999 with the annual growth rate of 4.3%. The main reason of growth realized in this period was the expansion of rice-sown area produced by the introduction of the summer paddy program, land reclamation activities and the improvement of irrigation system. Myanmar's overall rice yield has averaged about 2.9 MT per ha and no significant improvement of rice yield was found throughout the period from 1980 to 1999.

The average annual total domestic use of rice in Myanmar during the period from 1980 to 1991 was 13 million MT and during the period from 1992 to 1998, it was 16.5 million MT. Per capita domestic use of rice in Myanmar gradually declined during the period from 1986 to 1991 due mainly to the decreasing production and per capita income (Figure 2). Myanmar's per capita domestic use of rice increased again from 1992 to 1996 as a result of increase in per capita income and higher rice production. Myanmar's domestic use of rice decreased in 1997 and 1998 because of severe flooding in 1997 and draught in 1998. Annual export of rice from Myanmar, accounted about 1 million MT to 2 million MT during the period from 1948 to 1962/63, gradually declined after the mid-1960s. Average annual rice exports was 0.45 million MT during the period from mid-1960s to mid-1970s with the

highest volume of 1.13 million MT in 1966/67 and lowest volume of 0.15 million MT in 1973/74. Factors contributed to decreasing export of rice in this period were: ① reducing exportable surplus of rice due to increased domestic consumption; ② decrease in official procurement; ③ diversion of a considerable amount of rice to both internal and external legal and illegal trade; and ④ reducing demand of rice from regular client countries as they gained momentum in their drive to self-sufficiency. A little upward trend of rice export was seen during the period from mid-70s to mid-80s due to higher rice production achieved by the development of Green Revolution Type activities in rice farming. Average annual rice exports in this period was 0.65 million MT with the highest exports of 0.83 million MT in 1983/84 and lowest in 0.35 million MT in 1978/79. Myanmar's rice exports severely declined after 1986/87 due to increase in domestic demand of rice, poor quality control and decrease in amount of government procurement. (Figure 3)
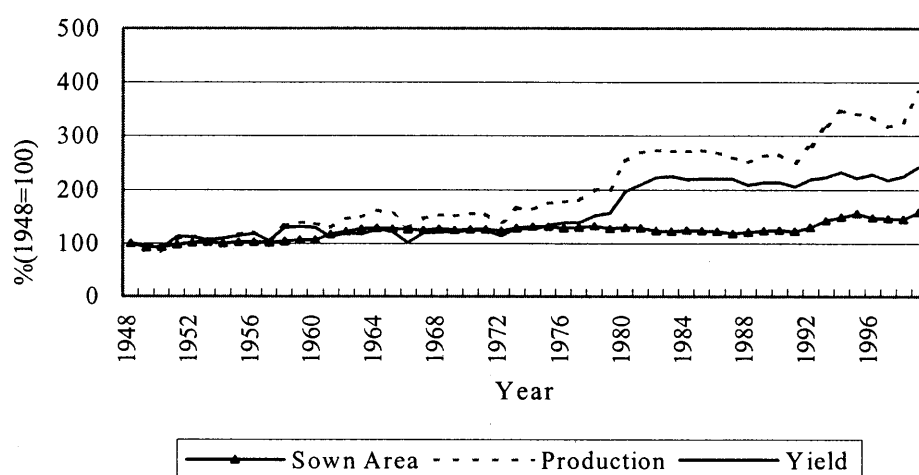

Fig. 1 Sown area, yield and production of rice

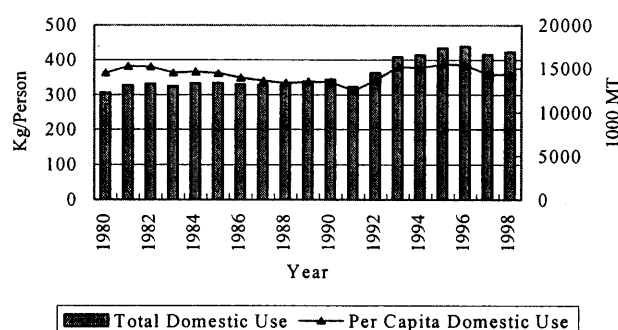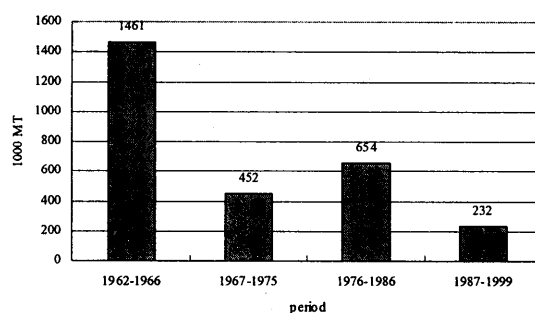Source: Department of Agricultural Planning, Myanmar.

Fig. 2 Trend in Myanmar's domestic use of rice

Source: Statistical Yearbook 1998, CSO (Myanmar)

Fig. 3 Average Annual Rice Exports of Myanmar

by selected Periods

Source: Department of Agricultural Planning, Myanmar.

III Rice Policies in Myanmar

As being an important crop for daily food and source of export earning, agricultural policies practiced in Myanmar have been mainly being concentrated on the rice sector development since the time of British colonial period. There have been several changes of policy issues in agriculture sector particularly emphasized on the rice sector development in Myanmar since the time of British colonial administration. Some policy measures that have been conducted in Myanmar are shown in Table 1.

Table. 1 Rice Policies in Myanmar

Periods	Policy measures
British Colonial period (1885-1948)	- Assisting in transmigration of settlers from Upper Myanmar to Lower Myanmar and in the immigration of Indians to settle in Lower Myanmar to develop the Delta Region for rice - Providing tax exemption for 12 years on newly cleared lands - Providing legal protection for private moneylenders and other investers to support the development of rice sector - Providing a secure land ownership system
Independence Government Period (1978-1961)	- Improving consumer welfares by subsidized sale of basic food grains, particularly rice - Practicing the "Minimum Guaranteed Price" for the procurement price of rice by providing access to credit and by supplying certain inputs at subsidized price - Issuing government's loans for agricultural production and land reclamation purposes with resaonable interest rate through the State and Village Agricultural Banks
Socialist Government Period (1962-1988)	- Changing the private land ownership system to state land ownership system and private land holding right to "land tilling right" - Prohibiting the buying,selling and transferring of agricultural land by land tenure act and rule - Practicing government procurement system under the "Compulsory Quota System" with fixed price - Carring out the distribution of rice for domestic consumption through the government's cooperative stores - Providing subsidized sale of inputs with subsidized price, freeprovision of agricultural extension services and cheap agricultural credits - Introducing scientific methods and improved cultivation practices - Conducting government's monoplolized rice export policy - Classifying rice as planned crop and cultivation of rice was supervised by the government agencies concerned
State Peace and Development Council Period (1988 to at present))	- Abolishing "Compulsory Quota System" in government procuremnet of rice - Inviting private investment in agricultural activities - Reducing controls on domestic rice trading expect rice exports - Reducing subsidized sale of agricultural inputs to farmers - Carring out the distribution rice only for government employees - Improving government irrigation system to ensure the availability of water supply for agricultural purposes - Encouraging the regional authorities to ensure the self-sufficient rice production - Introducing the summer paddy cultivation program in various regions

Rice policies under the British administration were intended to increase the production of rice for the purpose of export promotion. British colonial government practiced the policy of assisting in the transmigration of settlers from Upper Myanmar to Lower Myanmar and in the immigration of Indians to settle in Lower Myanmar to develop the Delta region by reclamation of new agricultural lands for rice cultivation with the tax exemption for 12 years on those newly cleared lands. As the result, Myanmar rice-sown area had increased 2.4 times from 1.5 million Ha in 1885 to 3.5 million Ha in 1900. On the other hand, ensuring the private land ownership and protecting the private moneylenders and other investors were major policy issues for

the improvement of rice production in Myanmar. Main characteristic of policy issues in this period is development of rice sector with minimal government interventions in the process of production, trading and marketing. But, the policies under British colonial period led the way to appear social and economic inequalities due to higher interest rate and fee of rent charged by the landlords to their tenant farmers. These inequalities, then, led to increased government interventions after independence.

Main objectives of rice policies after independence were food self-sufficiency, food security and promotion of rice exports. Government intervention started to introduce especially in the procurement and export of rice. There was some intervention in domestic retail marketing to improve the consumer welfare by subsidized sale of rice. Government procurement of rice with fixed price was practiced and volume of rice procured by the government was determined by the government's sale of rice and level of targeted export earning. Government procurement price of rice was fixed by the domestic cost of production and world price. Government encouraged farmers by minimum guaranteed price by providing access to credit and by supplying certain inputs at subsidized prices. Therefore, rice sector in this period was a profitable farm enterprise despite the low procurement price.

Rice policies under socialist government period centered on the consumer's welfare with extensive use of food subsidies and prohibiting of private marketing. Private land ownership system changed to state land ownership system and private land holding right was replaced by "the land tilling right". Government intervention and controls were introduced to cover almost all activities of food grain production, procurement, distribution, milling, storage, transportation and domestic wholesale and retail trade. The most important changes in policy measures which helped to gain the success in increased rice production were: ①providing the subsidized sale of inputs, free provision of agricultural extension services and cheap agricultural credits; and ② introducing the scientific methods and improved cultivation practices. Government practiced the "Compulsory Quota System" and fixed procurement price system with the objective of maintaining the fair price for both producers and

consumers. The main objective of domestic rice price policies in this period was to keep the price of rice at low level in order to maintain low cost of living. Government was the sole agent to provide the agricultural loans and private moneylenders are declared illegal. The government monopolized exports of rice and carried out the distribution of rice for domestic consumption through the government cooperative stores. These government's subsidized policies faced the difficulties after mid-1980s due to shortage of export earnings to import the agricultural raw material, such as fertilizers and became the unfavorable policies to improve the rice production.

After the economic transaction in 1988, there is a fundamental shift towards growth and export expansion, although self-sufficiency in food is still emphasized in agricultural policy of the government. Government allows the farmers to cultivate crops of their choice and to process, transport and trade freely except the rice exports. On the other hand, government allows the private enterprises to invest in agricultural activities, especially for the reclamation of waste and fallow lands to agricultural lands. The system of government's subsidized sale of rice became limited only to the government employees and controlling of price and providing of input supplies to farmers were reduced. Government policy emphasized on the promotion of rice production was expansion of rice-sown area by providing water supply facilities and reclamation of lands. Government provides the 2 to 8 years land revenue exemption and 3 years income tax exemption from the year of commencement until commercial production or servicing stage is attained for those who invest in agricultural activities. Since land utilization policy remains unchanged, farmers are often forced to produce rice especially in the government's irrigated area. Although the Compulsory Quota System has been abolished, farmers have to sell the certain amount of rice to government agency with fixed price, especially for the rain-fed rice cultivation. Higher production of rice in this period was achieved by the area expansion and there is no significant improvement in yield. It is considered that some government intervention policies still played the important role to increase the rice production to meet the domestic consumption and promotion of rice exports, as long as the shortage of foreign exchange, continuing high inflation rate and constraints in

foreign aids is being occurred. (Table. 1)

IV　　Rice Production By Regions

Myanmar can be divided into five regions according to agro-ecological and topographic conditions. They are Delta region, Lower Myanmar region, Central Myanmar region, Coastal region and Hilly region. Delta region and Lower Myanmar region are the country's largest rice-sown area accounting for 62% of the total rice cultivated area and rice production in these two regions covers 65% of country's rice production. Central Myanmar region locates in the dry zone area and rice cultivation in this region depends upon the availability of water supply. This region is the country's largest irrigated rice cultivated area and rice-sown area covers 18 % of the total rice-sown area and 17 % of the national production. Main crops of this region are oilseeds and pulses covering 85% and 57% for country's oilseeds and pulses cultivated area. In the remaining two regions, rice cultivated area covers about 20 % of country's rice sown area. Hilly regions is country's biggest rice deficit region and Coastal region lies just only on the line of self-sufficient level due to the limitations of geographic conditions. (Table. 2)

Table. 2 Sown Area of Selected Crops in Myanmar By Regions (1999/2000) (1000 HA)

Regions	Paddy	other cereals	Oilseeds	Pulses	Spices and condiments	Fibre	Vegetables & Fruits	others	Total
Delta Region	1,991	3	43	389	16	27	85	26	2,582
Lower Myanmar Region	1,926	2	123	550	3	21	193	209	3,026
Central Myanmar Region	1,120	185	1,580	1,421	120	329	167	161	5,083
Coastal Region	466	0	17	27	8	-	95	77	691
Hilly Region	781	125	87	125	18	2	121	153	1,413
Union	6,284	315	1,851	2,512	165	379	661	628	12,795

Source: Central Statistical Organization, Myanmar.

Due to the development of irrigation system and introducing summer paddy cultivation, rice-sown area has significantly increased in every region after 1991/92. Between the period 1980/81 to 1991/92 and 1992/93 to 1999/200, average annual rice sown area in Myanmar increased about 19% with the contribution of 77% increase in irrigated

rice farming and 7% increase in rainfed rice cultivation. Within these two periods, irrigated rice-sown area increased about 14 times in Delta region, about 2 times in Lower Myanmar region and 25% in Central Myanmar region. In the Coastal region and Hilly region, irrigated rice cultivated area increased about 3000 hectares and 2000 hectares respectively. (Table 3)

Table. 3 Changes of Rice Sown Area By Regions

Regions	1980/81-1991/92			1992/93 - 1999/2000			Changes		
	Total Sown Area (1000 Ha)	Irrigated (1000 Ha)	Rainfed (1000 Ha)	Total Sown Area (1000 Ha)	Irrigated (1000 Ha)	Rainfed (1000 Ha)	Total Sown Area (%)	Irrigated (%)	Rainfed (%)
Delta Region	1309	32	1278	1814	460	1354	38.5	1357.4	6.0
Lower Myanmar Region	1623	57	1566	1808	158	1650	11.4	176.4	5.4
Central Myanmar Region	848	481	367	1035	600	435	22.0	24.8	18.4
Coastal Region	414	2	412	441	5	436	6.5	159.7	5.7
Hilly Region	698	275	422	724	277	447	3.8	0.7	5.8
Union	4892	847	4045	5822	1501	4322	19.0	77.2	6.8

Data source: Settlement and Land Records Department, MYANMAR

As the effects of deterioration in politic and economic situations in Myanmar, production of rice in every region had declined during the period from mid-1980s to 1991/92. Significant development of rice production had been obtained in various regions after 1991/92 by introducing summer paddy programs and by ensuring sufficient water supply. Between the periods from 1980/81 to 1991/92 and 1992/93 from 1999/2000, average annual rice production increased about 42% in Delta region, 39% in Central Myanmar region, 19%, 17%, 10% in Hilly region, Coastal region and Lower Myanmar region respectively. However, there were no remarkable growth of yield was seen especially in the Delta and Lower Myanmar regions, where Myanmar's biggest rice sown area is located. Except these two regions, about 10 to 15 percent of growth in average yield per sown area of rice were obtained in other regions. It is considered that this growth was achieved from the ensuring water supply since the development of crops production in these regions usually depend upon the availability of water supply. (Table. 4)

Table.4 Changes of Average Yield and Production of Rice By Regions

Regions	Yield (MT/Ha)			Production (1000 MT)		
	1980/81 to	1992/93 to	Changes (%)	1980/81 to	1992/93 to	Changes (%)
Delta Region	3.25	3.32	2.30	4,254	6,037	41.92
Lower Myanmar Region	3.13	3.08	-1.42	5,079	5,583	9.92
Central Myanmar Region	2.34	2.64	12.99	1,978	2,741	38.58
Coastal Region	2.56	2.81	9.83	1,056	1,239	17.29
Hilly Region	2.17	2.49	14.72	1,516	1,809	19.36

Data source: Settlement and Land Records Department, MYANMAR

V   Estimation of Supply and Demand Parameters

In this study, supply price elasticities for each region of Myanmar are estimated by using the time series data from 1980 to 1997 to evaluate the effect of price response on rice production in each region. These estimated elasticities are used as the parameters for future rice production in Myanmar. Supply price elasticities are estimated as a function of farmgate price for each region. On the contrary, the demand income elasticity and demand price elasticity are computed as a function of per capita income and market milled rice price for national level due to the limited availability of information on rice demand in each region. On the other hand, annual domestic use of rice is computed by subtracting the exports from production for each year. Double log form is applied for the above estimations and Ordinary Least Square method is used. In addition, market price of milled rice is estimated as a linear function of the farmgate price.   The equations used in the estimation of parameters are shown as bellows:

$$\log A_{i,t} = a1_i + a2_i \times \log (FP_{t-1}) + a3_i \times DM \qquad \text{-----------------(1)}$$

$$\log PC_t = b1 + b2 \times \log MP_t + b3 \times \log PI_t + b4 \times DM \qquad \text{-----------------(2)}$$

$$MP_t = c1 + c2 \times FP_t + DM \qquad \text{-----------------(3)}$$

Where,

$A_{i,t}$ = Rice-sown area of "i" region in year t (1000 Ha);

FP_t = Farmgate price of unhusked rice in year t (Kyats/MT);

PC_t = Per capita domestic use of unhusked rice (Kg);

MP_t = Market price of milled rice in year t (Kyats/ MT);

PI_t = Per capita income in year t (Kyats)

DM   = Dummy value.

Table. 5 Estimated Elasticities for Rice Supply and Demand in Myanmar

	Elasticity
Supply price elasticity by regions	
Delta region	0.20
Lower Myanmar region	0.07
Central Myanmar region	0.09
Coastal region	0.01
Hilly region	0.01
Demand price elasticity	-0.09
Demand income elasticity	0.59

In general the estimated supply elasticities are high as shown in Table 5. Particularly Delta region is more responsive to price change as compared to the others. It is significant to emphasize that price response has become a more important factor for rice producers since the reduction of government control on rice price in 1987. In contrast Coastal region and Hilly region have very limited ability to change their rice sown area in response to price change. It is also pointed out that the income elasticity is still significant at 0.59.

VI Projection of Rice Production and Consumption toward 2010

As already mentioned, due to insufficient availability of data regarding regional rice consumption, demand projection is made only for the national level while the supply side projection is performed for respective five regions. The projections are conducted by applying the following six equations.

Sown Area (i region, t year): $A_{i,t} = S_{i,t-1} \times (FP_{t-1}/FP_{t-2})^{\alpha}$ -----------(1)

Yield (i region, t year): $Y_{i,t} = Y_{i,t-1} \times (1 + GY_i)$ ------------(2)

Total Production (t year): $S = \Sigma (A_{i,t} \times Y_{i,t})$ -----------(3)

Per capita domestic use (t year): $PC_t = PC_{t-1} \times (MP_t / MP_{t-1})^{\beta} \times (1 + GI)^{\delta}$ ----------- (4)

Total Domestic use (t year): $\qquad D \quad = \quad PC_t \times P_t$ ------------(5)

Market price (t year): $\qquad MP_t = b_1 + b_2 \times FP_t$ -------------(6)

Where,

$A_{i,t}$ = Rice sown area of i region in year t (1000 ha)

$Y_{i,t}$ = Yield per sown area of i region in year t (MT/ha)

GY_i = Average annual growth rate of yield in i region

GI = Growth rate of per capita income

PC_t = Per capita domestic use of unhusked rice (Kg/person)

MP_t = Market price of milled rice in year t deflated by CPI (Kyats/MT)

FP_t = Procurement price of rice in year t deflated by CPI (Kyats/MT)

P_t = Population (in thousand)

α = Supply price elasticity

β = Demand Price elasticity

δ = Demand income elasticity

In order to evaluate the effects of the government procurement price on the supply and demand situation, we conduct different projections for four scenarios shown in Table 6. Scenario 1 assumes that the government procurement price of rice will increase with the average annual growth rate from 1990 to 1997, 4.5% per year. In Scenario 2 the government procurement price of rice is supposed to increase at the rate of 1 % annually. In Scenario 3 it is supposed to decrease at the rate of 1 % annually. Finally in Scenario 4 it is supposed to increase by 11% every year. The same income growth rate of 3.9%, the average annual growth rate from 1990 to 1999, is applied to all the four scenarios. The population projection of UN is used as the future population figures and we assumed that the growth rates of

yield, under the same condition of technological progress and growth of input supply, increase with the average annual growth rate from 1995 to 1999 in each region.

Table. 6   Assumptions used in simulation

Scenarios	Assumptions
Scenario 1	Government procurement price of rice increase with the average annual growth rate from 1990 to 1997 (4.5%) and per capita income increase with the average annual growth rate from 1990 to 1999 (3.9%)
Scenario 2	Government procurement price of rice increase 1% annually and per capita income increase with average annual growth rate from 1990 to 1999 (3.9%)
Scenario 3	Government procurement price of rice decrease 1% annually and per capita income increase with average annual growth rate from 1990 to 1999 (3.9%)
Scenario 4	Government procurement price of rice increase 11% annually and per capita income increase with the average annual growth rate from 1990 to 1999 (3.9%)

Major findings from our projections are as follows. According to Scenario 1, if the government increases the procurement price of rice by 4.5% annually, Myanmar's rice sown area will reach 6.6 million hectares and the rice production will be about 25 million MT in year 2010 (Table 7). In the same scenario the demand for rice in year 2010 is expected to reach about 27 million MT and the situation of rice shortage will be projected at about 2 million MT. If the government raises its procurement price by 1 % annually, rice deficit in year 2010 will be 3.5 million MT and if procurement price decreases by 1 %

Table. 7 Estimated rice (unhusked) supply and demand situation of Myanmar in 2010

Scenarios	Sown area (1000 Ha)	Production (1000 MT)	Total domestic use (1000 MT)	(+) Surplus/ (−) Deficit (1000 MT)
Scenario 1	6,600	24,902	27,191	(−) 2,289
Scenario 2	6,377	24,034	27,571	(−) 3,537
Scenario 3	6,250	23,540	27,761	(−) 4,220
Scenario 4	7,030	26,579	26,321	(+) 257

Note: Domestic use of rice consists of seeds, wastes, stock changes and unpredictable amount of illegal exports to neighbouring countries

annually, the estimated rice shortages will climb up to about 4.0 million MT. Scenario 4 shows that the annual 11 % increase of procurement price in real term will result in more or less balancing the domestic supply and demand of rice in Myanmar in 2010. It should be, however, pointed out that in Scenario 4 the future rice demand level would be much lower as compared to the other scenarios.

VII   Conclusion

According to the projection, it is expected that higher demand of rice in Myanmar will appear during the coming decade along with the progress of per capita income and growth of population. Therefore, Myanmar has probability to face rice shortage problem within the coming decade especially from year 2005. This study also investigated the effects of the government procurement price change on the future supply and demand situation. It is considered that proper adjustment policy for supply and demand of rice should be carried out to avoid the rice shortage problem. On the other hand, present growth rate of rice yield is significantly low and it is also considered that present policy measures concentrating on the development of rice production by increasing rice-sown area have many constraints to get the continued successes in future rice production. It is shown that the technological progress in rice farming, such as expansion of HYVs rice area and promotion of extension services, improvement of mechanized farming, will become the most effective solution for balancing supply and demand of rice in the future.

It is also concluded that the present rice export control policy still has certain importance because of the unstable future situation discussed above and the fact that this policy has been playing an important role in stabilizing domestic rice price and the rice consumption level, particularly of low income class.

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