ARKANSAS GLOBAL RICE MODEL

International Baseline Projections For 1998 – 2010

Eric J. Wailes, Gail L. Cramer,
Eddie C. Chavez and James M. Hansen

ARKANSAS AGRICULTURAL EXPERIMENT STATION
Division of Agriculture University of Arkansas
August 1998 Special Report 189

Editing: N.G. Wyatt; cover design: Elaine Williams.

Arkansas Agricultural Experiment Station, University of Arkansas Division of Agriculture, Fayetteville. Milo J. Shult, Vice President for Agriculture and Director: Charles J. Scifres, Associate Vice President for Agriculture - Research. PS1.1M898.

ISSN:0571-0189 CODEN: AUARAN

ARKANSAS GLOBAL RICE MODEL

INTERNATIONAL BASELINE PROJECTIONS FOR 1998-2010

Eric J. Wailes
Professor
Dept. of Agricultural Economics
and Agribusiness

Gail L Cramer
L.C. Carter Chair Professor
Dept. of Agricultural Economics
and Agribusiness

Eddie C. Chavez
Research Specialist II
Dept. of Agricultural Economics
and Agribusiness

James M. Hansen
Research Associate I
Dept. of Agricultural Economics
and Agribusiness

Arkansas Agricultural Experiment Station
Fayetteville, Arkansas

PREFACE

This report on the world rice economy presents recent and projected trends in consumption, production, trade, stocks and prices. The Arkansas Global Rice Model (AGRM) baseline projections have been developed in collaboration with the Food and Agricultural Policy Research Institute (FAFPI) at the University of Missouri-Columbia and Iowa State University. The rice baseline model results presented in this report were developed with FAPRI in January 1998. The AGRM baseline is generated within an international multi-market framework that includes wheat, feed grains, oilseeds, livestock, fiber, fruits and vegetable models. Revisions in production, consumption, trade and price data since January 1998 have been included in the projections of this report. Updates of this report can be found at the web site http://www.uark.edu/campus-resources/ricersch/.

The general structure of the model and the estimating equations for each country are presented in an unpublished paper by Wailes, et al., 1997b.

The Arkansas Global Rice Model is subject to constant development and refinement. This research has benefitted from previous discussions with colleagues throughout the world and in workshops on the global rice economy conducted in the Unite States, Japan, South Korea, China, Philippines, Taiwan and Spain. The research presented in this report has been funded by the U.S. Department of Agriculture, Economic Research Service, Agreement No. 96-34351-2537, “Rice Modeling Project-Marketing and Policy”.

An English/Metric conversion table is provided on the last page of this report.

CONTENTS

List of tables vi
List of figures vii
Abbreviations used in this report viii

INTRODUCTION 9
WORLD RICE CONSUMPTION, PRODUCTION, TRADE AND PRICES 11
- Consumption 11
- Production 11
- Trade 12
- Long Grain (Indica) Markets 13
- Medium Grain (Japonica) Markets 13
- Stocks 14
- Prices 14
- Summary 15

MAJOR EXPORTING COUNTRIES 15
- Thailand 15
- United States 17
- China 25
- India 26
- Pakistan 29
- Myanmar (formerly Burma) 30
- Vietnam 33
- Australia 34
- Egypt 36
- Argentina 37
- Uruguay 39

MAJOR IMPORTING COUNTRIES 41
- Brazil 41
- European Union 41
- Indonesia 46
- Iran 46
- Iraq 48
- Saudi Arabia 50
- Japan 50
- South Korea 51
- Taiwan 53
- Rest of the World 55

LITERATURE CITED 57
TABLES 58
APPENDIX TABLES 70

LIST OF TABLES

Table 1. World Rice Supply and Utilization
Table 2. Total World Rice Trade (Combined Medium and Long Grain
Table 3. World Rice Net Trade
Table 4. World Long Grain Rice Trade
Table 5. World Medium Grain Rice Trade
Table 6. World Rice Prices and Price Relationships
Table 7. Thailand Rice Supply and Utilization
Table 8. Detailed U.S. Rice Supply and Utilization (in English Units)
Table 9. U.S. Long Grain Rice Supply and Utilization
Table 10. U.S. Medium Grain Rice Supply and Utilization
Table 11. U.S. Rice Supply and Utilization (in Metric Units)
Table 12. Arkansas Rice Supply by Type
Table 13. Louisiana Rice Supply by Type
Table 14. Texas Rice Supply by Type (Aggregate; Mostly Long Grain)
Table 15. Missouri Rice Supply by Type (Long Grain)
Table 16. Mississippi Rice Supply by Type (Mostly Long Grain)
Table 17. California Rice Supply by Type (Aggregate; Mostly Medium and Short Grain)
Table 18. China Rice Supply and Utilization
Table 19. India Rice Supply and Utilization
Table 20. Pakistan Rice Supply and Utilization
Table 21. Myanmar Rice Supply and Utilization
Table 22. Vietnam Rice Supply and Utilization
Table 23. Australia Rice Supply and Utilization
Table 24. Egypt Rice Supply and Utilization
Table 25. Argentina Rice Supply and Utilization
Table 26. Uruguay Rice Supply and Utilization
Table 27. Brazil Rice Supply and Utilization
Table 28. European Union Rice Supply and Utilization
Table 29. Italy Rice Supply and Utilization
Table 30. Spain Rice Supply and Utilization
Table 31. Other EU Rice Supply and Utilization
Table 32. Indonesia Rice Supply and Utilization
Table 33. Iran Rice Supply and Utilization
Table 34. Iraq Rice Supply and Utilization
Table 35. Saudi Arabia Rice Supply and Utilization
Table 36. Japan Rice Supply and Utilization
Table 37. South Korea Rice Supply and Utilization
Table 38. Taiwan Rice Supply and Utilization
Table 39. Rest-of-the-World (ROW) Rice Supply and Utilization
Appendix Table 1. Population
Appendix Table 2. Real Gross Domestic Product (GDP)
Appendix Table 3. Gross Domestic Product (GDP) Deflator
Appendix Table 4. Consumer Price Index (CPI)
Appendix Table 5. Exchange Rate
English/Metric Conversion Table

LIST OF FIGURES

Fig. 1. Arkansas Global Rice Model 1998 Projections: World Rice
Fig. 2. Arkansas Global Rice Model 1998 Projections: World Rice Consumption
Fig. 3. Arkansas Global Rice Model 1998 Projections: World Rice Area
Fig. 4. Arkansas Global Rice Model 1998 Projections: World Rice Average Yield
Fig. 5. Arkansas Global Rice Model 1998 Projections: World Rice Production
Fig. 6. Arkansas Global Rice Model 1998 Projections: World Rice Trade
Fig. 7. Arkansas Global Rice Model 1998 Projections: Major ROW Importers, 1991-97
Fig. 8. Arkansas Global Rice Model 1998 Projections: World Rice Stocks
Fig. 9. Arkansas Global Rice Model 1998 Projections: World Rice Price
Fig. 10. Arkansas Global Rice Model 1998 Projections: Rice Prices
Fig. 11. Arkansas Global Rice Model 1998 Projections: Rice and Wheat Prices
Fig. 12. Arkansas Global Rice Model 1998 Projections: Thailand Rice
Fig. 13. Arkansas Global Rice Model 1998 Projections: United States Rice Supply
Fig. 14. Arkansas Global Rice Model 1998 Projections: Harvested Area of Select States in the United States
Fig. 15. Arkansas Global Rice Model 1998 Projections: Arkansas Rice Supply by Type
Fig. 16. Arkansas Global Rice Model1998 Projections: Louisiana Rice Supply by Type
Fig. 17. Arkansas Global Rice Model 1998 Projections: Yield of Select States in the United States
Fig. 18. Arkansas Global Rice Model 1998 Projections: Production of Select States in The United States
Fig. 19. Arkansas Global Rice Model 1998 Projections: Detailed U.S. Total Rice Use
Fig. 20. Arkansas Global Rice Model 1998 Projections: U.S. Rice Trade and Stocks
Fig. 21. Arkansas Global Rice Model 1998 Projections: Nominal and Real U.S. Rice Prices
Fig. 22. Arkansas Global Rice Model 1998 Projections: U.S. Rice Season Average Farm Prices by Type
Fig. 23. Arkansas Global Rice Model 1998 Projections: China Rice
Fig. 24. Arkansas Global Rice Model 1998 Projections: India Rice
Fig. 25. Arkansas Global Rice Model 1998 Projections: Pakistan Rice
Fig. 26. Arkansas Global Rice Model 1998 Projections: Myanmar Rice
Fig. 27. Arkansas Global Rice Model 1998 Projections: Vietnam Rice
Fig. 28. Arkansas Global Rice Model 1998 Projections: Australia Rice
Fig. 29. Arkansas Global Rice Model 1998 Projections: Egypt Rice
Fig. 30. Arkansas Global Rice Model 1998 Projections: Argentina Rice
Fig. 31. Arkansas Global Rice Model 1998 Projections: Uruguay Rice
Fig. 32. Arkansas Global Rice Model 1998 Projections: Brazil Rice
Fig. 33. Arkansas Global Rice Model 1998 Projections: European Union Rice
Fig. 34. Arkansas Global Rice Model 1998 Projections: Italy Rice
Fig. 35. Arkansas Global Rice Model 1998 Projections: Spain Rice
Fig. 36. Arkansas Global Rice Model1998 Projections: Other EU Rice
Fig. 37. Arkansas Global Rice Model 1998 Projections: Indonesia Rice
Fig. 38. Arkansas Global Rice Model 1998 Projections: Iran Rice
Fig. 39. Arkansas Global Rice Model 1998 Projections: Iraq Rice
Fig. 40. Arkansas Global Rice Model 1998 Projections: Saudi Arabia Rice
Fig. 41. Arkansas Global Rice Model 1998 Projections: Japan Rice
Fig. 42. Arkansas Global Rice Model 1998 Projections: South Korea Rice
Fig. 43. Arkansas Global Rice Model 1998 Projections: Taiwan Rice
Fig. 44. Arkansas Global Rice Model 1998 Projections: Rest of the World Rice

ABBREVIATIONS USED IN THIS PUBLICATION

AGRM	-	Arkansas Global Rice Model
AMS	-	aggregate measure of support (South Korea)
ASEAN	-	Association of Southeast Asian Nations
CAP	-	Common Agricultural Policy (European Union)
CORRA	-	Council for Parnership on Rice Research in Asia
CRRI	-	Central Rice Research Institute (India)
cwt	-	hundredweight
EEP	-	Export Enhancement Program
EMU	-	Economic and Monetary Union (European Union)
EU	-	European Union
FAIR	-	Federal Agriculture Improvement and Reform
FOB	-	free on board
G-7	-	Group of Seven (European Union)
GATT	-	General Agreement on Tariffs and Trade
GDP	-	gross domestic product
GOM	-	Government of Myanmar
GSM	-	Export Credit Guarantee programs
ha	-	hectares
HYV	-	high-yielding variety
IARI	-	Indian Agricultural Research Institute
ICAR	-	Indian Council of Agricultural Research
IMF	-	International Monetary Fund
IRRI	-	International Rice Research Institute
MAFF	-	Ministry of Agriculture, Forestry and Fisheries (Japan)
MAP	-	Market Access (promotion) Program
MARD	-	Ministry of Agricultural and Rural Development (Vietnam)
MEIS	-	Myanmar Export Import Services
mmt	-	million metric tons
MOA	-	Ministry of Agriculture (Myanmar)
mt	-	metric ton
NPQ	-	Nominal Price Quotes (Bangkok, Thailand)
NRBN	-	National Rice Biotechnology Network (India)
OECD	-	Organization for Economic Cooperation and Development (European Union)
OGL	-	open general license
ROW	-	rest of the world
SAFP	-	season average farm price
SBS	-	simultaneous buy and sell
US	-	United States
USDA	-	United States Department of Agriculture
WEFA	-	Wharton Econometrics Forecasting Associates
WTO	-	World Trade Organization

ARKANSAS GLOBAL RICE MODEL

INTERNATIONAL BASELINE PROJECTIONS FOR 1998-2010

Eric J. Wailes, Gail L. Cramer, Eddie C. Chavez and James M. Hansen

INTRODUCTION

Rice is an important world commodity, accounting for over 21 percent of global calorie intake. While production and consumption are concentrated in Asia, rice is an important crop in specific regions in North and South America, Africa and Europe.

The international rice economy is becoming more market-oriented due to a number of changes over the past several years. Foremost among these changes is the implementation of the General Agreement on Tariffs and Trade (GATT) accord. The agreement requires 1) market access, the opening of markets to imports in Japan, South Korea and other countries, 2) reductions in aggregate support levels and 3) reduction in export subsidies, notably in the European Union (EU) and the United States (US). A regional initiative, which is already changing global rice trade, is the free trade agreement in South America, the Mercosur, which includes Argentina, Brazil, Paraguay and Uruguay (Bierlen et al., 1997).

The Federal Agriculture Improvement and Reform (FAIR) Act of 1996 of the US is another important policy initiative. This legislation changed US rice industry policy significantly by 1) eliminating supply control mechanisms, 2) decoupling farm income support (deficiency) payments from production decisions and 3) reducing export subsidies more quickly than the bound rate in the Uruguay Round agreement. Unilateral actions of other countries include adjustments in rice production infrastructure such as in Japan, Korea and Taiwan. National policy programs resulting in the diversification of cropping patterns in traditional rice production countries in Southeast Asia are responding to changes in consumer demand and dietary patterns. Prospects for higher resource productivity for rice based on research and extension programs are being led by the International Rice Research Institute (IRRI) and its linkage to national rice research programs such as CORRA, Council for Partnership on Rice Research in Asia. Finally, fundamental demand-determining factors of income and population growth, as well as dietary changes, continue to influence the world rice economy.

The baseline projections of consumption, production, trade, stocks and prices presented in this paper reflect the latest developments in the international rice industry. The current baseline projections include changes relative to previous projection reports (Wailes et al., 1996a,b; 1997a,b). The major changes include 1) updated macroeconomic data and population forecasts from Wharton Econometrics Forecasting Associates (WEFA) and Project LINK, together with recent macroeconomic developments, 2) current rice supply and utilization data (USDA/ERS, 1998a,b), and other pertinent rice industry information and 3) new supply and demand estimates for India by region. Throughout this report data through 1997 are actual, and Arkansas Global Rice Model (AGRM) projections are for 1998 and beyond.

Arkansas Global Rice Model projections are based on a multi-country econometric model framework that provides projections for a set of 20 major rice producing and/or trading countries and one aggregate rest of world (ROW) region. Projections include national levels of production (area harvested and yields), utilization, net trade (exports less imports), stocks and prices. Historical data for these variables are from the Economic Research Service, US Department of Agriculture (Gudmunds, 1998). Estimates for these variables are based on a set of explanatory variables including exogenous macro-

economic factors, such as income, population, inflation rate, technology development and, especially, government-determined policy variables that reflect the various mechanisms by which countries intervene in their rice sector economy (Wailes et al., 1997b). Macroeconomic data are based on forecasts from WEFA and Project LINK (Appendix tables 1-5).

An updated baseline projection for the world rice economy is valuable because it provides a benchmark against which it is possible to evaluate the impacts of policy reforms on rice and changes in supply and/or demand on world rice prices. The need for a revised baseline is reinforced by continuous changes around the world that directly or indirectly influence the rice market. The set of countries or regions explicitly included in the model are the US, Thailand, Pakistan, China, India, Myanmar, Vietnam, Australia, Egypt, Argentina, Uruguay, Japan, South Korea, Indonesia, the EU, Iran, Iraq, Saudi Arabia, Taiwan and Brazil. Projections for the US are separated by state and rice type (i.e., long grain and medium grain). EU's rice supply is divided among Italy, Spain and Other EU. Production and consumption projections for India are separated by region: North, East, West and South. All other countries not listed above are included in the ROW region. All data on rice quantities in the following discussion and tables are on a white milled basis, except where noted.

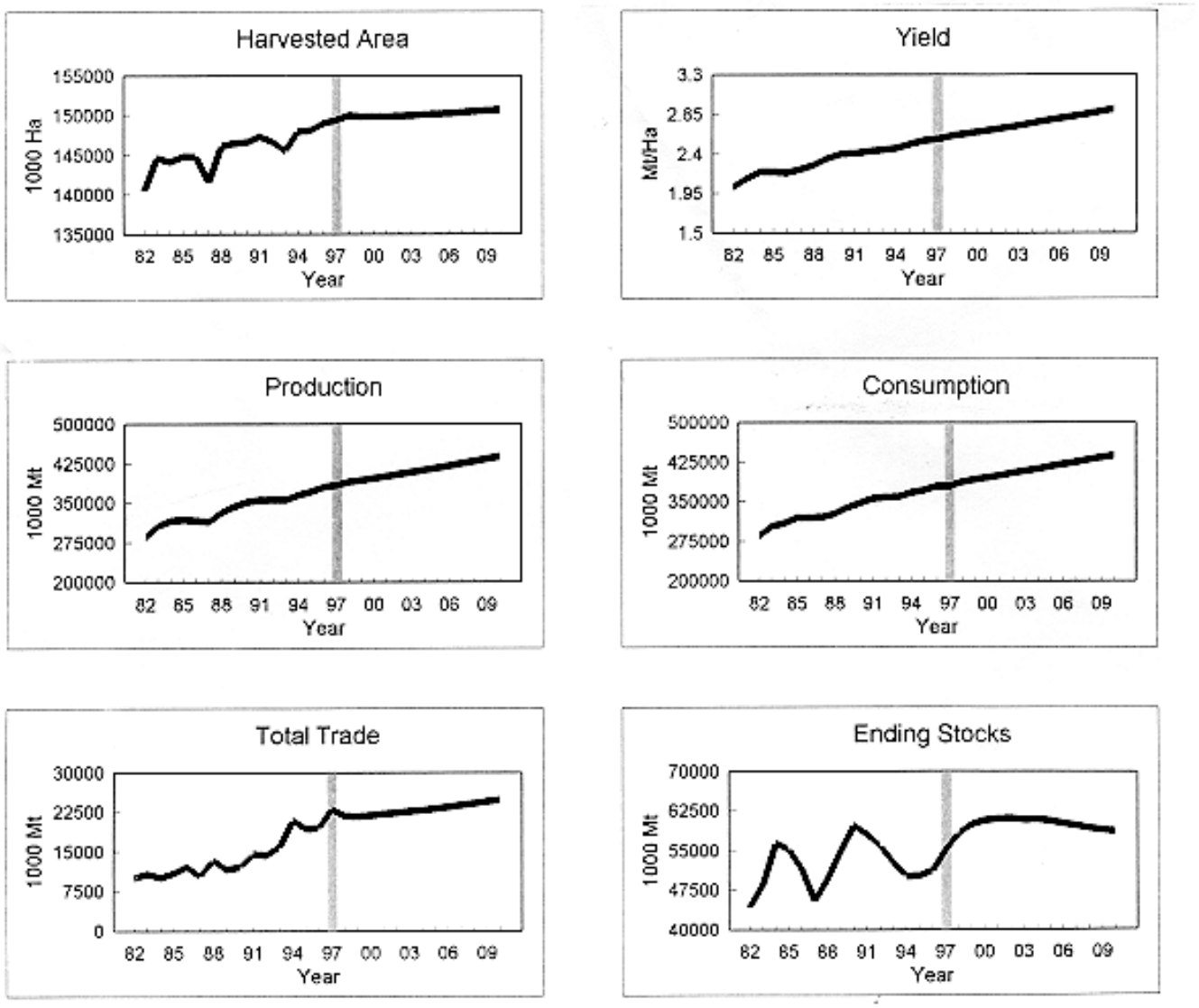

Fig. 1. Arkansas Global Rice Model 1998 projections: World Rice.

WORLD RICE CONSUMPTION, PRODUCTION, TRADE AND PRICES

Consumption

Changes in world rice consumption are determined primarily by population and income growth and relative food grain prices. Total utilization of rice is projected to increase from 379 mmt in 1997 to 438 mmt by 2010 (Table 1 and Figure 1) at a rate of 1.11 percent annually. This growth rate is slightly lower than the 1.24 percent annual growth rate experienced over the 1991-96 period but is much lower than the growth in rice consumption over the previous 20 years at 2.27 percent (Figure 2).

Several factors are contributing to the rapid slowdown in world rice consumption. These factors include 1) projected reductions in population growth rates in many Asian countries (Appendix Tables 1) and 2) diversification in the food consumption patterns as a result of changing lifestyles and spending patterns, especially in Asian countries that have experienced rapid industrialization. For some Asian countries, rice has become an inferior good (i.e., rice consumption declines as incomes rise, implying negative income elasticities). In less industrialized Asian nations and a few non-Asian industrialized market economies, such as the US, rice consumption increases with income growth.

Production

The growth in world rice production necessary to satisfy the projected consumption levels over the next 13 years (1998-2010) will mainly come from yield increases, as has been the case for the past 20 years (Figure 3 through Figure 5). Area harvested is projected to increase only slightly to 150.7 million hectares (ha) by 2010 from 149.4 million in 1997 (Table 1). This increase is equivalent to an annual growth rate of only 0.07 percent. Projected area expansion is considerably lower than the annual growth rate observed for the past six years (1991-96) and for the past 20 years at 0.23 percent (Figure 3). World rice area harvested has increased by approximately 300 thousand ha per year since 1975, considerably less than the 1.9 million ha increase per year during the 1966-75 period. World rice area harvested is expected to

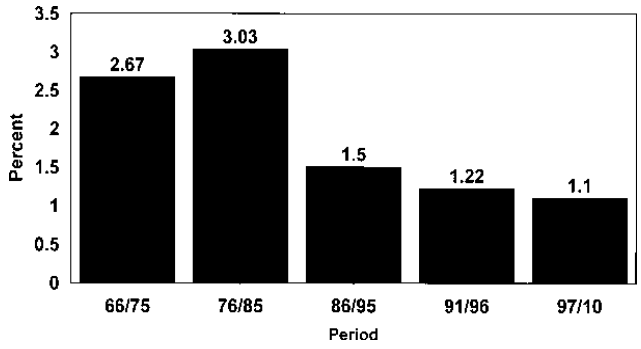

Fig. 2. World rice consumption: annual growth rates.

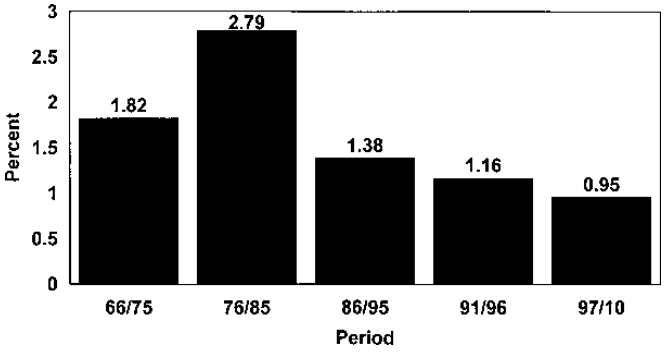

Fig. 4. World rice average yield: annual growth rates.

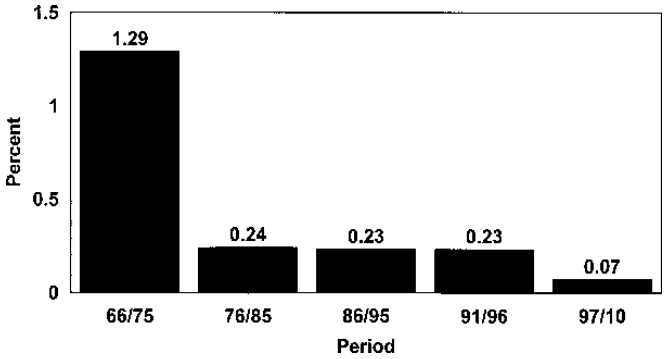

Fig. 3. World rice area: annual growth rates.

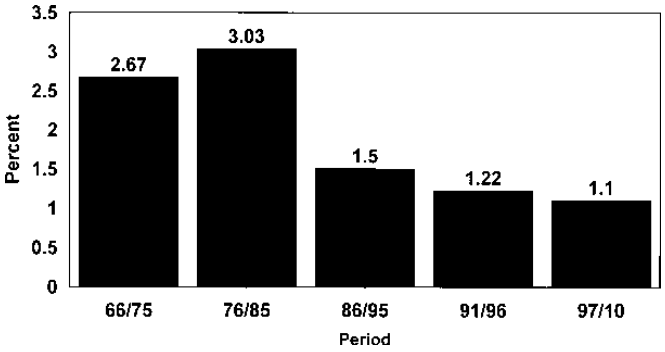

Fig. 5. World rice production: annual growth rates.

increase to nearly 150 million ha in 1998 as a result of relatively high rice prices in 1997.

The world average rice yield was 2.57 metric tons (mt) per ha in 1997 and is projected to increase to 2.90 mt by 2010, a 0.95 percent increase per year. This rate of growth is comparable to the level experienced for the past six years at a 1.16 percent growth rate. This projection, however, is much lower than the 2.04 rate observed for the past 20 years (Figure 4). IRRI research reports on the potential of new "super" rice varieties suggest that farmers will be able to increase yields by 20-25 percent, with the projected release of these varieties beginning at the end of the 1990s (New York Times, 1997). Thus, the projected annual yield growth of 0.95 percent is realistic. To the extent that yield growth exceeds the 0.95 percent growth rate, fewer land resources will be needed to accommodate the consumption projections.

These yield projections do not include weather variables and therefore reflect, implicitly, an assumption of average weather. However, the authors recognize that a major source of volatility in world rice prices, production and trade is the monsoon climate of many Asian countries. (See box below on Impact of El Nino.) As such, the year-to-year accuracy of these projections is not expected to be high. However, the long-term estimates are clearly consistent with the historical trends.

Total production is projected to increase from 383.2 mmt in 1997 to 437.3 mmt by 2010 (Table 1). This increase represents an annual growth rate of 1.02 percent (Figure 5). Since it is slightly lower than the consumption growth rate, a gradual decline of global stock levels is expected towards the end of the projection period. World rice production has increased by only 1.4 percent per year since 1991, well below the 2.28 percent annual growth for the 1976-96 period.

Trade

Total world rice trade has expanded at an annual growth rate of 6.0 percent over the past six years (comparing the 1991-92 average with the 1996-97 average). This expansion has been the result of 1) weather-related production shortfalls (e.g., in Indonesia, China, Philippines and Bangladesh), 2) improving political stability in some rice-consuming countries (e.g., Iraq and Iran) and 3) growth in population and incomes. Total world rice trade is projected to grow by 0.6 percent per year from a 23-mmt average for 1997-98 to an

Impact of El Nino

Weather accounts for the largest variability in production, consumption and trade in the world rice economy. Consistent weather anomalies associated with El Niño, which are well known, affect some major Asian rice producing countries. The climates of these Asian countries are typically influenced by oceanic conditions. In the Pacific region, the Philippines, Indonesia, eastern Malaysia and Australia are most greatly affected and Vietnam to a lesser degree; and in the Indian ocean region, all of India and Sri Lanka are affected. El Niño usually results in abnormally dry conditions and warmer climates for these countries. The drought of 1982-1983 in these regions was the result of El Niño climatic conditions, which was the strongest El Niño in this century.

El Niño was first defined in the late 18th century. Until the early 1960's, El Niño was used to describe only the local warming of ocean currents that moves southward along the Peruvian coast. This usually occurs around Christmas time. The term "El Niño" today describes the warming of the tropical Pacific surface waters, which occurs every two to seven years. Recent El Niños have occurred in 1972-73, 1976-78, 1982-83, 1987, 1991-93 and 1997-present. The two most severe were 1982-83 and 1997-present.

Rice production, consumption and trade in regions affected by El Niño have a significant impact on the world rice market. The combined countries of India, Malaysia, the Philippines, Indonesia and Australia accounted for one-third of world rice production and consumption over the past five years 1991-1996. Indonesia, the Philippines and Malaysia have imported 14 percent of world rice trade; and India and Australia have shipped 15 percent of world rice exports over the past five years. India and Indonesia are among the major rice exporting and importing countries of the world. Simultaneous adverse weather conditions due to El Niño in these countries could have a significant effect on the world rice market as a result of increased imports for Indonesia, the Philippines and Malaysia and decreased exports by India and Australia (Hansen et al., 1998). There could also be a significant effect on world rice stock levels since these countries account for one-third of the world's rice inventory. Indonesia has been affected most severely by the current El Niño with record imports of 5 mmt in 1997, an increase of 4.2 mmt from last year. Philippine imports increased by 684 thousand mt from last year. The total increase in imports for the two countries from the previous year is 4.88 mmt, which is 21 percent of total world imports. The combined total imports for the two countries in 1997 account for 28 percent of world rice imports.

El Niño had little effect on Indian or Australian rice exports. India's exports were 541 thousand mt more than the previous year at 2.5 mmt for 1997. This is quite exceptional since India has a consistent history for being very adversely affected by El Niños. Australia's exports were the same as in the previous year at 700 thousand mt.

average of 24.8 mmt for 2010-11 (Table 2). This projection reflects a significant slowdown in the growth of rice trade compared to the recent average annual increase (Figure 6). The trade projection reflects a situation in which the major effects of unilateral, regional and multilateral rice trade liberalization have been substantially realized. Increased political stability, especially in the Middle East, has meant a return to more normal trade volumes in that region. The rapid growth in world rice trade over the past six years has also been the result of production shortfalls in consecutive years in a number of major Asian rice-consuming nations (Figure 7). Yield shocks have dramatically influenced trade volume and variability from year-to-year, such as in 1993, 1994 and 1995.

The total world rice trade forecast for 1998 is 21.8 mmt (Table 2). Rice trade will remain thin (i.e., a small percent of world consumption). Trade accounted for only 5.6 percent of consumption in 1997 and remains at this level over the projection period. Major exporters in 1997 were Thailand, Vietnam, US, Pakistan, India and China. Major importers in 1997 were Indonesia, Philippines, Bangladesh, Brazil, the EU, Iran, Saudi Arabia and Iraq. Indonesia is expected to remain the largest importer over the projection period, followed by EU, Iran, Brazil and Saudi Arabia.

World net rice trade (exports less imports, or vice versa) is projected to decrease from 20.3 mmt in 1997 to 19.5 mmt in 1998 and increase steadily to 22.2 mmt in 2010 (Table 3). In the case of the EU, for example, total imports in 1997 were 1.472 mmt, and total exports were 1.139 mmt, resulting in a net trade (imports) of 333 thousand mt. For the US, on the other hand, exports (2.728 mmt) substantially exceeded imports (0.318 mmt) in 1997.

Long Grain (Indica) Markets

Indica (long grain) rice trade is given in Table 4. Nearly 90 percent of total trade is long grain and aromatic types, such as jasmine and basmati. Major exporters are Thailand, Vietnam, US, Pakistan and India. The US is projected to lose market share in the long grain export market over time because of reduced production. Major long grain rice importers are Indonesia, Brazil, the EU and the Middle East countries. The US is a rapidly growing market for aromatic rice imports, which are projected to increase continuously over the projection period. The ROW accounted for 36 percent of imports in 1997; and this share is projected to increase to 49 percent in 1998, assuming that the impact of El Niño on Indonesian imports subsides. ROW imports would range from 46 to 50 percent over the rest of the projection period.

Medium Grain (Japonica) Markets

The world medium grain (japonica) rice trade is presented in Table 5. Japonica trade numbers are rough estimates and are likely overstated because not all trade from China, Italy, Australia and Japan is japonica rice. The major sources of japonica rice exports are Australia, China, US and Italy. While China is the world's largest producer of japonica rice, it is not expected to dominate this export market as China's own domestic demand for japonica rice expands with production. Other sources of japonica rice exports include Japan, Taiwan and Egypt. The major importers of japonica are Japan and South Korea due to market access requirements of the GATT accord. The projection for Taiwan assumes a minimum access requirement will apply once admitted into the World Trade Organization (WTO). Total japonica trade, however, is expected to account for only 14 percent of total world rice trade if market access rules are not increased for the years beyond 2002 for Japan and 2005 for South Korea. While indica rice trade is projected to grow annually at 1.5 percent over the 1997-2010 period, japonica rice trade would decrease annually by 3.3 percent over the same period.

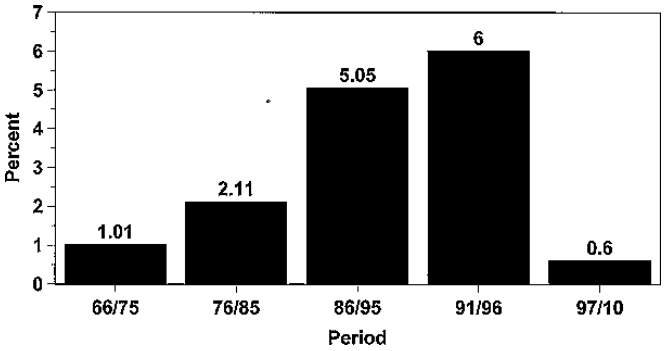

Fig. 6. World rice trade: annual growth rates.

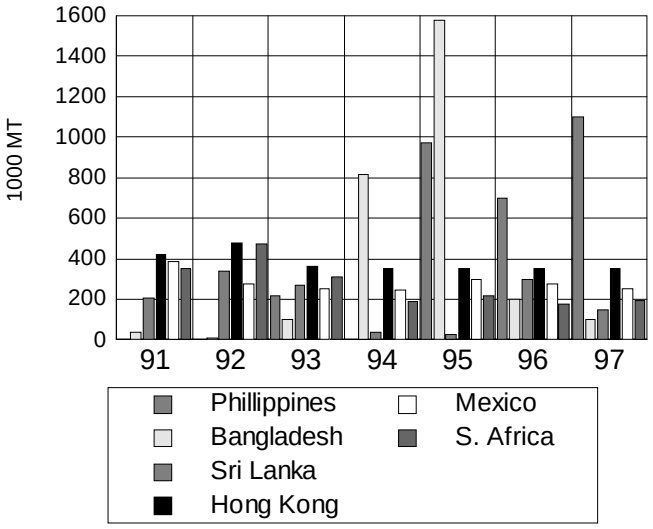

Fig. 7. Major ROW (rest of the world) importers, 1991-97.

Stocks

World ending stocks are projected to range from 58 to 61 mmt over the projection period (Table 1). After having declined by an annual average of 510 thousand mt (or 0.9 percent per year) for the past seven years from 58.6 mmt in 1990 to 55 mmt in 1997 (Figure 8), a modest recovery in global rice stocks is projected, increasing to 61 mmt by 2002 before declining to 58.5 mmt by 2010. Relative to consumption, world stocks are projected to decline slightly, with the stocks-to-use ratio decreasing from 15 percent to 13 percent over the projection period (which is equivalent to only 1.6 to 1.8 months of global rice consumption).

Prices

The international reference price for long grain rice (Thai 5% NPQ FOB) is expected to decrease, in nominal terms, to US$285 per mt in the 1998 marketing year from $295 in 1997 (Table 6). The first half of 1997 was characterized by strong international rice prices due mainly to the tight long grain rice stocks; strong demand for Asian fragrant (jasmine) rice; growing demand from Central and South American countries for US rice; and a strong US domestic market. However, international rice prices deteriorated during the second half of 1997 due to the devaluation of the Thai baht (see further discussion on this topic under the heading "Thailand" on page 15). The world indica price is projected to average within the range of $289 to $327 per mt from the period 1998 through 2010, depending on the dynamics of world rice supply and demand. In real terms (1985 dollars), however, the world price is projected to decline steadily from $197 per mt in 1997 to $151 by 2010 (Figure 9).

The reference price for medium rice is the No. 2 California FOB price. It is projected to increase and remain over US$400 per mt from 1998 through 2010 from $396 in 1997 and gradually increase to $433 by the end of the forecast period. The relationship between the indica and japonica rice prices is important where substitution in production is possible. A comparison of the Houston US no. 2 long grain FOB price to the California no. 2 medium grain price gives an indication of the relationship. Long grain enjoyed a price premium of nearly 6 percent in 1997 over medium grain with strong long grain prices. The long grain price is projected to maintain a premium over the medium grain, but the premium is expected to decline to about 1 percent in 1999–before gradually increasing to about 8 percent in 2010 (Figure 10).

The other price projected is the lower-quality Thai FOB 35% broken long grain. Its relationship with the US wheat no. 2 FOB price (Table 6 and Figure 11) is relatively important in explaining substitution of wheat for rice in the ROW rice consumption projection. The substitution relationship has an elasticity of demand in the ROW with respect to the price ratio of rice to wheat of -0.27. High wheat prices in 1996 resulted in an unusually high ratio to the Thai 35% price of 71 percent. The strength in rice import demand in 1997 pushed rice prices in the same direction as wheat, with the ratio declining to 61 percent in 1997. Because the wheat supply response to own price is generally believed to be more elastic than rice supply to prices, the rice to wheat price ratio is

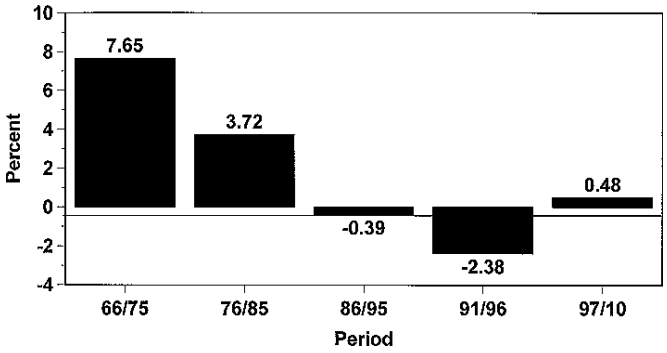

Fig. 8. World rice stocks: annual growth rates.

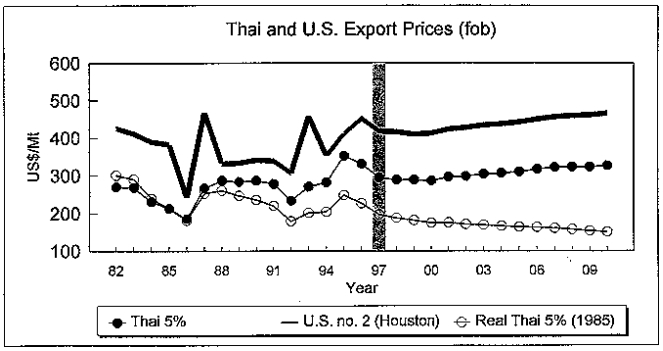

Fig. 9. Arkansas Global Rice Model 1998 projections: world rice price.

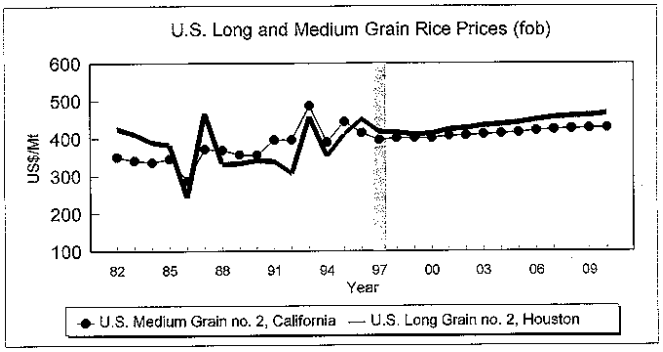

Fig. 10. Arkansas Global Rice Model 1998 projections: rice prices.

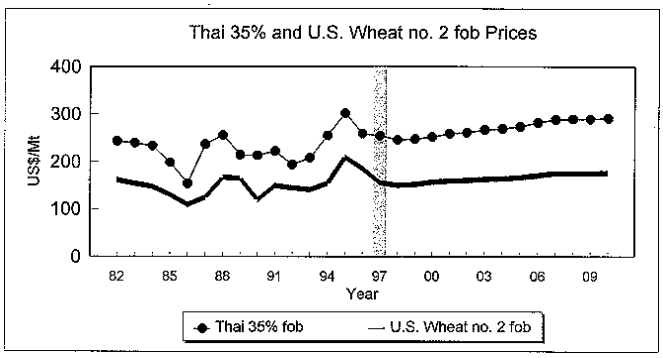

Fig. 11. Arkansas Global Rice Model 1990 projections: rice and wheat prices.

expected to remain in the more typical range of 60 to 62 percent throughout the projection period.

Summary

Changes in international and domestic agricultural and trade policies are increasingly shaping the future of the world rice economy. Recent agreements at international, regional and national levels have made the rice industry more market-oriented. This means that the major rice producing countries face an increasingly competitive global rice marketplace.

Relative prices, income and population growth and dietary changes are expected to continue to determine rice demand. This baseline is influenced by the Asian financial crisis, but an assumption was made that more normal growth rates will resume in three years. Weather, assumed to be normal for the baseline, will especially, in the monsoon-dependent Asian countries, continue to be an important determinant of the seasonal variability in the supply and demand for rice. This baseline provides the basis to conduct a wide variety of market and policy analyses on the rice economy, including evaluating and comparing alternative macroeconomic, policy, weather and technology scenarios.

Annual growth rates for global rice trade are expected to slow from a recent growth rate of 6.0 percent to only 0.6 percent. Likewise, growth in global rice consumption is expected to be smaller in the future due to shifts in Asian diets towards protein-based foods as incomes rise. Gains in production to meet additional consumption needs will mainly come from yield growth, with only minor increases in area harvested. While nominal world rice prices are projected to increase, real prices would continue to decline. Presented below is a detailed discussion for each exporting and importing country included in the model.

MAJOR EXPORTING COUNTRIES

Thailand

Thailand is projected to harvest 9.20 million ha of rice in 1998, slightly lower than the 1997 total of 9.27 million (Table 7 and Figure 12). The harvested area is expected to decline slightly to 8.68 million by the end of the projection period. Yields in the longer term for Thailand will be determined by further adoption of high-yielding varieties, relative costs of production and weather factors. Under the assumption of normal weather, yields are projected to increase from 1.56 mt per ha in 1997 to 1.80 mt in 2010. As a result of changes in area harvested and yield, rice production is projected to increase gradually from 14.5 mmt in 1997 to 15.7 mmt by 2010.

Rice demand in Thailand is price inelastic. Per capita rice use in Thailand is projected to decrease slightly from 144.7 kilograms in 1997 to 129.7 kilograms by 2010. Real income growth slowed down in 1997 to 1.2 percent because of the financial crisis and is projected to be flat in 1998 before increasing to 3.3 percent in 1999 (and stabilizing around 6.6 over the rest of the projection period). Based on a negative relationship with income, per capita rice consumption declines as income increases and dietary habits change. Reflecting the country's relatively low population growth (1.01 percent in 1997 and declining to 0.74 percent by 2010), the total rice consumption increases only slightly from 8.6 mmt in 1997 to 8.7 mmt by 2000 and then declines gradually to the 1997 level by the end of the forecast period.

Thailand's economy is export-oriented, supported by a free market philosophy. In line with WTO and Association of Southeast Asian Nations (ASEAN) commitments, the country instituted tariff reductions beginning in January 1995. By early 1997, the total number of tariff rate categories was reduced to 6 from 39. Barriers to imports of farm products are being eased. The government of Thailand ratified the Uruguay Round agreements in December 1994. Thailand, however, maintains several programs that benefit manufactured products or processed agricultural products and that may constitute export subsidies. These programs include subsidized credit on some government-to-government sales of Thai rice; preferential financing for exporters in the form of packing credits; tax certificates for rebates of packing credits and rebates of taxes and import duties for products intended for re-export. Thailand's economy has changed from one primarily based upon agriculture, with some light industries, to one dominated by manufacturing and services. One concern is the lack of skilled managers and workers, aside from inadequate infrastructure needed for a smooth transition into higher-tech industries. (US Department of State, 1997).

Recently, the country's finance sector has experienced serious difficulties. Based on an agreement with the Interna-

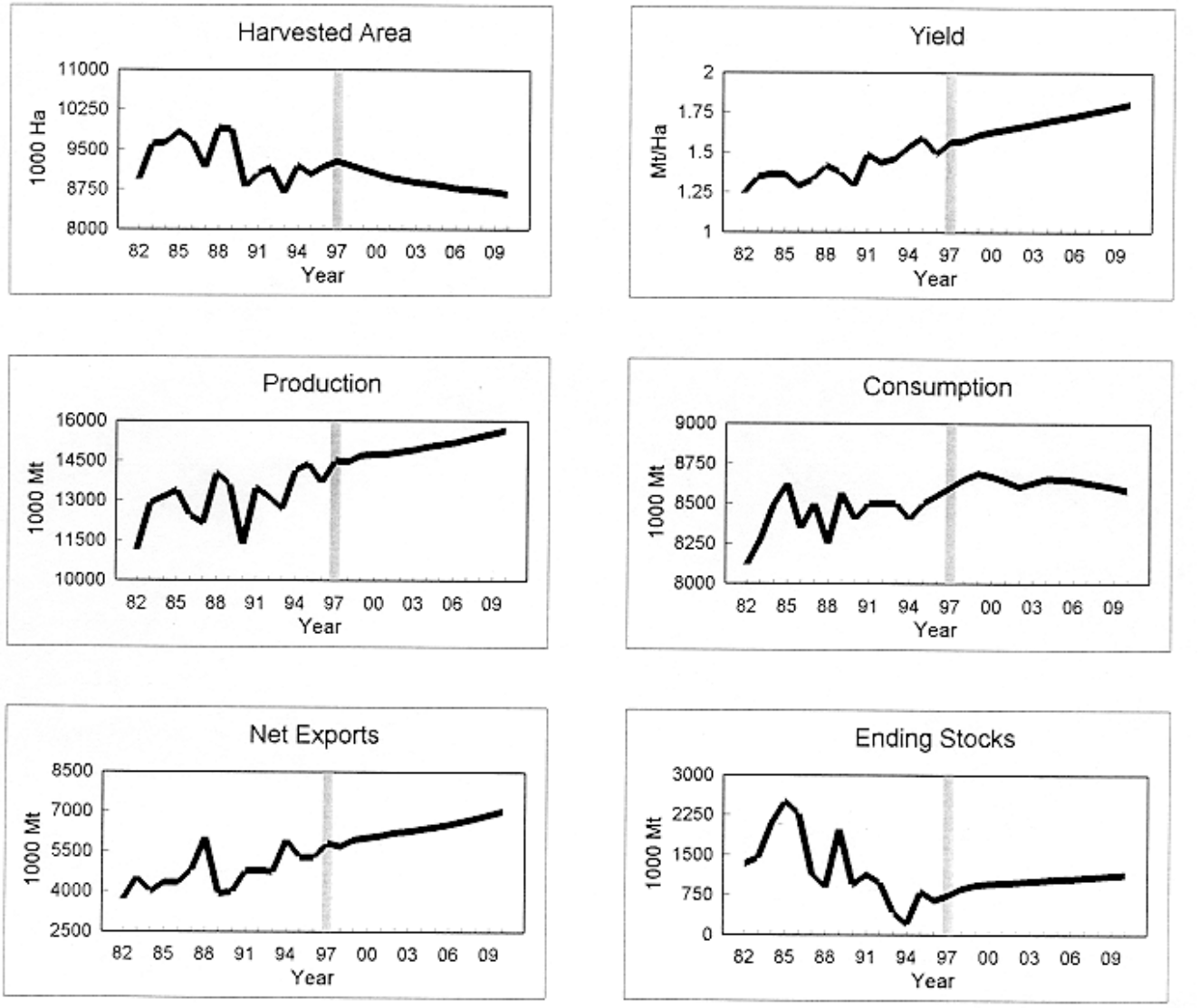

Fig. 12. Arkansas Global Rice Model 1999 projections: Thailand rice.

tional Monetary Fund, the country suspended 58 troubled finance companies. The Thai baht began a "managed float" in July 2, 1997, immediately falling in value–declining more than 40 percent by December 1997. The cheaper currency did not boost exports because many of the country's products are assembled with imported components that come at higher prices. The tight credit situation did not help the recovery efforts of the business sector. The growth of the country's gross domestic product substantially slowed down from 6.5 percent in 1996 to 1.5 percent in 1997. The country also experienced a budget deficit in fiscal 1997, the first in a decade (US Department of State, 1997).

Against the bleak economic backdrop presented above, Thailand remains the world's largest rice exporter. The country's rice industry is becoming more market-oriented. Export taxes and quotas were eliminated in 1986, boosting its exports. The government also provides discounted credit to exporters. Thailand is projected to maintain its status as the largest rice-exporting country over the projection period. The country expects to increase its share of the Japanese rice imports as a result of World Trade Organization agreements. Thailand, however, is expected to experience increasing competition from Vietnam and Pakistan. Projected total exports in the 1998 marketing year increase slightly to 5.9 mmt from

5.8 mmt in 1997 and increase steadily to 7.3 mmt by 2010. Under the GATT accord, Thailand is supposed to import 239 thousand mt of rice in 1996, increasing to 250 thousand mt in 2004 and remaining at that level over the rest of the projection period. The USDA Foreign Agricultural Service, however, reported that actual imports in 1996 were only 107 mt of rice from the US. Ending stocks are expected to increase steadily to 1.1 mmt 2010 from 734 thousand mt in 1997.

United States

The US rice farm program for the period of 1974 through 1995 included three sets of policy instruments to support prices and incomes of rice producers. These included 1) supply control mechanisms through limitations on or incentives to reduce acreage planted to rice, 2) price supports through a price floor, known as the nonrecourse loan rate and 3) income supports through deficiency payments, which were coupled to the production of the rice farmers when they voluntarily participated in the government rice program. Due to relatively favorable target prices, the rice program typically attracted a high participation rate, i.e., over 94 percent of eligible production. Deficiency payments were important to rice producers, accounting for nearly 30 percent of the gross income of US rice producers from 1990 to 1995. The average annual government cost of the rice program during the same period was approximately $550 million.

The 1996 FAIR Act significantly changed the price and income mechanisms for rice and other grains. Supply control mechanisms were essentially eliminated. Income support was decoupled from production of a specific program crop and replaced by a seven-year production flexibility contract that provides annual transition payments to producers who had participated in the commodity programs for at least one of the past five years. The FAIR Act established a seven-year payment contract with farmers and ranchers. The seven-year period covers 1996 through 2002. Eligibility for payments is not influenced by current crop planting, production or prices. The contract payments are allocated among farmers from a fixed but declining amount by making payment on 85 percent of a calculated base acreage times program yields (Table 8). Under this system, rice producers are provided complete flexibility in planting decisions. They receive a rice contract payment whether they produce rice or not. The production decision will be determined primarily by relative market returns. Nonrecourse loans will continue to be available to rice producers at a maximum rate of $6.50 per hundred weight (cwt). For the purpose of projections, the contract payment is assumed in this report to be the same for the period beyond 2002.

The FAIR Act retains export assistance programs for rice and other grains. These programs include Export Credit Guarantee programs (GSM), Market Access (promotion) Programs (MAP), P.L. 480 food aid, and the Export Enhancement Program (EEP). EEP subsidizes exports into markets as a countervailing policy to unfair export competition. Export programs have been traditionally important for the US rice industry as 20 to 40 percent of annual rice exports have relied upon these government programs in the past.

Projections of rice production are based upon planted acreage and yield estimates as influenced by market returns. Acreage is generally determined by net returns to producers, while changes in yields over time are driven by research expenditures. Total US rice area planted decreased from 3.32 million acres (1.34 million ha) in 1994 to 3.09 million acres (1.25 million ha) in 1995. Under the new policy reform, rice acreage declined by 10 percent, resulting in only 2.80 million acres (1.13 million ha) in 1996. Acreage increased to 3.03 million acres (1.23 million ha) in 1997 due to attractive prices and is expected to increase by 5.2 percent to 3.19 million acres (1.29 million ha) in 1998, mainly due to attractive rice prices relative to competing crops. Over the longer run, area harvested is expected to decline gradually to 2.83 million acres (1.15 million ha) due to expected higher returns to other crops and stiffer competition from other major country producers (Table 8 and Figure 13).

Long grain harvested acreage increased to 2.26 million acres (915 thousand ha) in 1997 from 1.96 million acres (795 thousand ha) in 1996 and should increase to 2.48 million acres (1.0 million ha) in 1998 before gradually declining to 1.95 million acres (791 thousand ha) in 2010 (Table 9). Medium grain acreage, on the other hand, decreased to 773 thousand acres (313 thousand ha) in 1997 from 835 thousand acres (338 thousand ha) in 1996 due to relative strength of the long grain rice prices. The medium grain acreage increases steadily by nearly 1.0 percent thereafter, reaching 876 thousand acres (354 thousand ha) in 2010 (Table 10). In contrast, long grain acreage is projected to decline by 1.1 percent per year over the projection period. For purposes of comparison with other countries, Table 11 provides US rice supply and utilization in metric units (milled basis).

US rice acreage by state is presented in Table 12 through Table 17 and Figure 14. Arkansas' total rice area increased to 1.37 million acres (554 thousand ha) in 1997 from 1.17 million acres (473 thousand ha) in 1996 and is expected to increase further to 1.53 million acres (617 thousand ha) in 1998 before stabilizing between 1.23 and 1.27 million acres (498 and 514 thousand ha) over the forecast period. Arkansas long grain area is expected to increase to 1.32 million acres (536 thousand ha) in 1998 before gradually declining to 996 thousand acres (403 thousand ha) in 2010 (a decrease of 1.1 percent per year). Arkansas' medium grain area, however, is expected to increase by 1.1 percent per year over the same period (Table 12 and Figure 15).

Louisiana's total rice area increased by nearly 13 thousand acres (5 thousand ha) in 1997 from 533 thousand acres (216

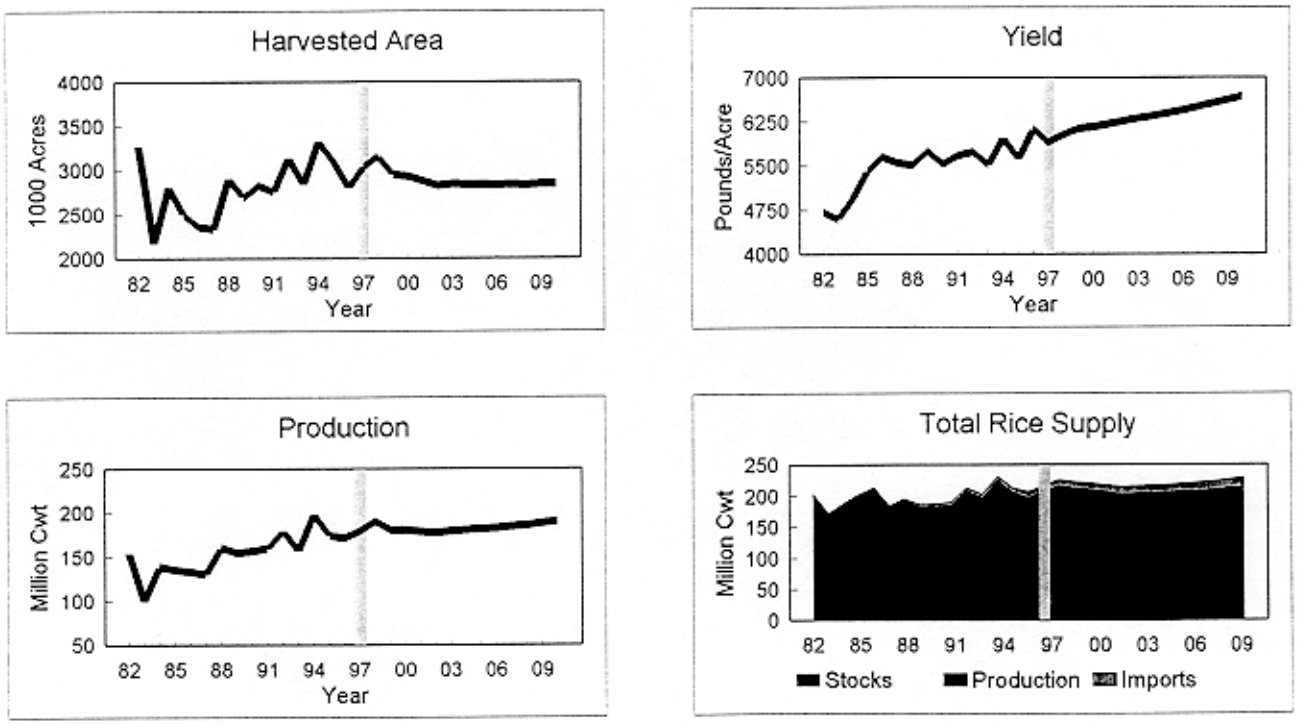

Fig. 13. Arkansas Global Rice Model 1998 projections: United States rice supply.

thousand ha) in 1996, with all the gains coming from long grain area (Table 13 and Figure 16). Louisiana's total acreage in 1998 is projected to increase to 588 thousand acres (238 thousand ha). Texas' area declined to 259 thousand acres (105 thousand ha) in 1997 from 298 thousand acres (121 thousand ha) in 1996 due to late planting and unfavorable weather (Table 14). Total rice area in Texas is expected to be lower than last year at 254 thousand acres (103 thousand ha) in 1998. Missouri's rice area increased to 109 thousand acres (44 thousand ha) in 1997 from 90 thousand acres (36 thousand ha) in 1996 and is projected to increase by more than 15 thousand acres (6 thousand ha) in 1998 (Table 15). Mississippi's harvested acreage increased to 238 thousand acres (96 thousand ha) in 1997 from 208 thousand acres (84 thousand ha) in 1996 (Table 16) and is expected to decrease to 220 thousand acres (87 thousand ha) in 1998. California's acreage increased to 507 thousand acres (205 thousand ha) in 1997 from 500 thousand acres (202 thousand ha) in 1996 and is expected to decrease by nearly 28 thousand acres (11 thousand ha) to 479 thousand acres (194 thousand ha) in 1998. Thereafter, California's acreage would range between 503 to 516 thousand acres (204 to 209 thousand ha) over the projection period. The average annual changes in total harvested area by state over the projection period are as follows: Arkansas, -0.7 percent; Louisiana, -0.2 percent; Texas, -0.9 percent; Missouri, -1.2 percent; Mississippi, -0.9 percent; and California, +0.1 percent.

Acreage declines are expected to be offset partially by yield gains resulting from continued research for rice production (Figure 17). Long grain yields are projected to grow at 1 percent per year while medium grain rice yields are projected to grow about one-half percent per year. The average US rough rice yield decreased to 59.11 cwt per acre (4.77 mt per ha, milled) in 1997 from 61.21 cwt (4.83 mt) in 1996 mainly due to unfavorable weather. Yields are expected to recover slightly in 1998 to 59.80 cwt (4.83 mt) before steadily increasing to 66.63 cwt (5.38 mt) by 2010.

In 1997, the higher acreage (8.4 percent above 1996) offset the decline in yield (-3.4 percent), resulting in a 4.7 percent increase in production at 179.3 million cwt, rough basis (5.86 mmt, milled basis). Production is expected to increase substantially in 1998 to 190.9 million cwt (6.23 mmt) due to increases in both acreage and yields. Thereafter, total rice production would decrease gradually to 175.8 million cwt (5.74 mmt) in 2002 before recovering to nearly the 1998 level by 2010, following the trend in long grain production. On the average, long grain production would decline slightly, while medium grain production is projected to increase by 1.4 percent per year over the projection period. Figure 18 shows total US rice production by state.

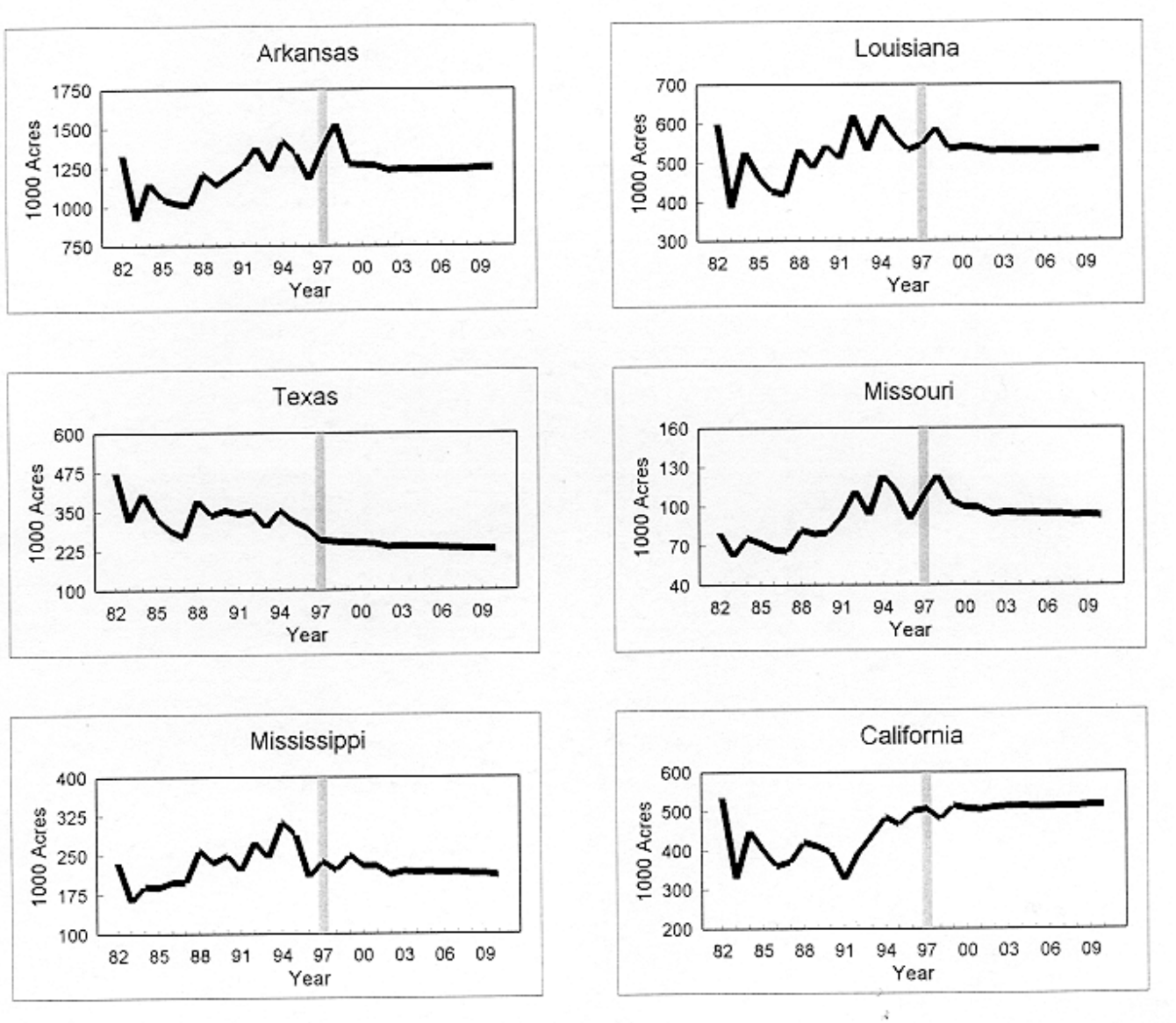

Fig. 14. Arkansas Global Rice Model 1998 projections: U.S. harvest area by state.

Total US rice supply increased to 216.3 million cwt rough basis (7.1 mmt milled basis) in 1997 from 206.3 million cwt (6.58 mmt) in 1996 and would range between 211 and 226 million cwt (6.89 and 7.37 mmt) during the rest of the projection period. Imports grow at 3.3 percent per year, driven by the decline in real Thai 5% fob price and the growth in domestic US rice consumption.

Domestic use of rice increased to 107.0 million cwt (3.51 mmt) in 1997 from 100.7 million cwt (3.21 mmt) in 1996. It increases steadily to 134.6 million cwt (4.39 mmt) by 2010 (Figure 19). With a stable population growth of less than one percent over the forecast period (Appendix Table 1), the expansion in rice consumption is a result of increased per capita direct and processed food consumption. The main processed food uses of rice are cereal, pet food, and package mix. Pet food is the fastest-growing sector in the processed category. The increase in food consumption is driven by growth in income and declining real retail prices, assuming low levels of inflation over the period (Appendix Tables 2 and 4). Socio-demographic factors also have been found to be important in explaining the expansion in US rice consumption (Gao et al., 1995). One of the more important of these variables that contributes to the increase in direct food use is the growing Asian and Hispanic population in the US. Hispanics account

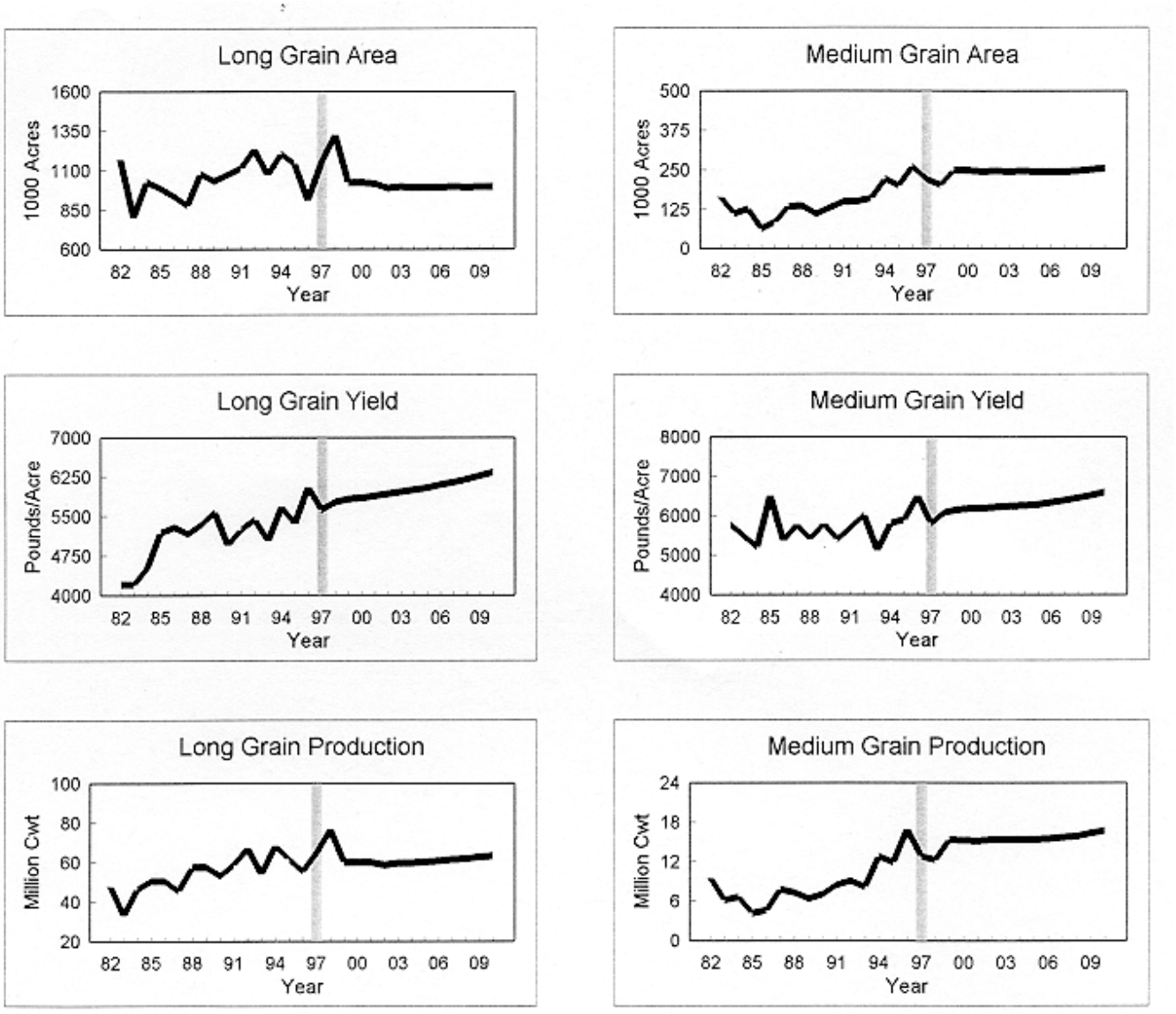

Fig. 15. Arkansas Global Rice Model 1998 projections: Arkansas rice supply by type.

for 10 percent of US total population, and this segment is growing at nearly 4 percent per year. Asians account for 4 percent of total US population, and the Asian population is growing annually at 5 percent.

Other components of domestic rice utilization in the US include seed use and brewery demand. Seed demand is derived primarily from the number of rice acres planted. It declines following the projection of lower rice acreage over time. Small increases in brewing demand are projected based upon relatively stagnant demand growth in the demand for beer in the US.

Exports increased from 78.4 million cwt (2.5 mmt) in 1996 to 83.5 million cwt (2.73 mmt) in 1997 and are projected to increase to 85.8 million cwt (2.80 mmt) in 1998 (Figure 20). Given the relatively inelastic domestic demand for US rice, the availability of domestic rice supply for exports is projected to decline steadily from 79.5 million cwt (2.6 mmt) in 1999 to only 68.2 million cwt (2.23 mmt) by 2010. There has been a significant shift in US exports from milled to rough rice, especially over the past four years. During the four-year period 1990-1993, rough rice accounted for less than 7 percent of total rice exports on the average. The share of rough rice exports started to increase dramatically in 1994, account-

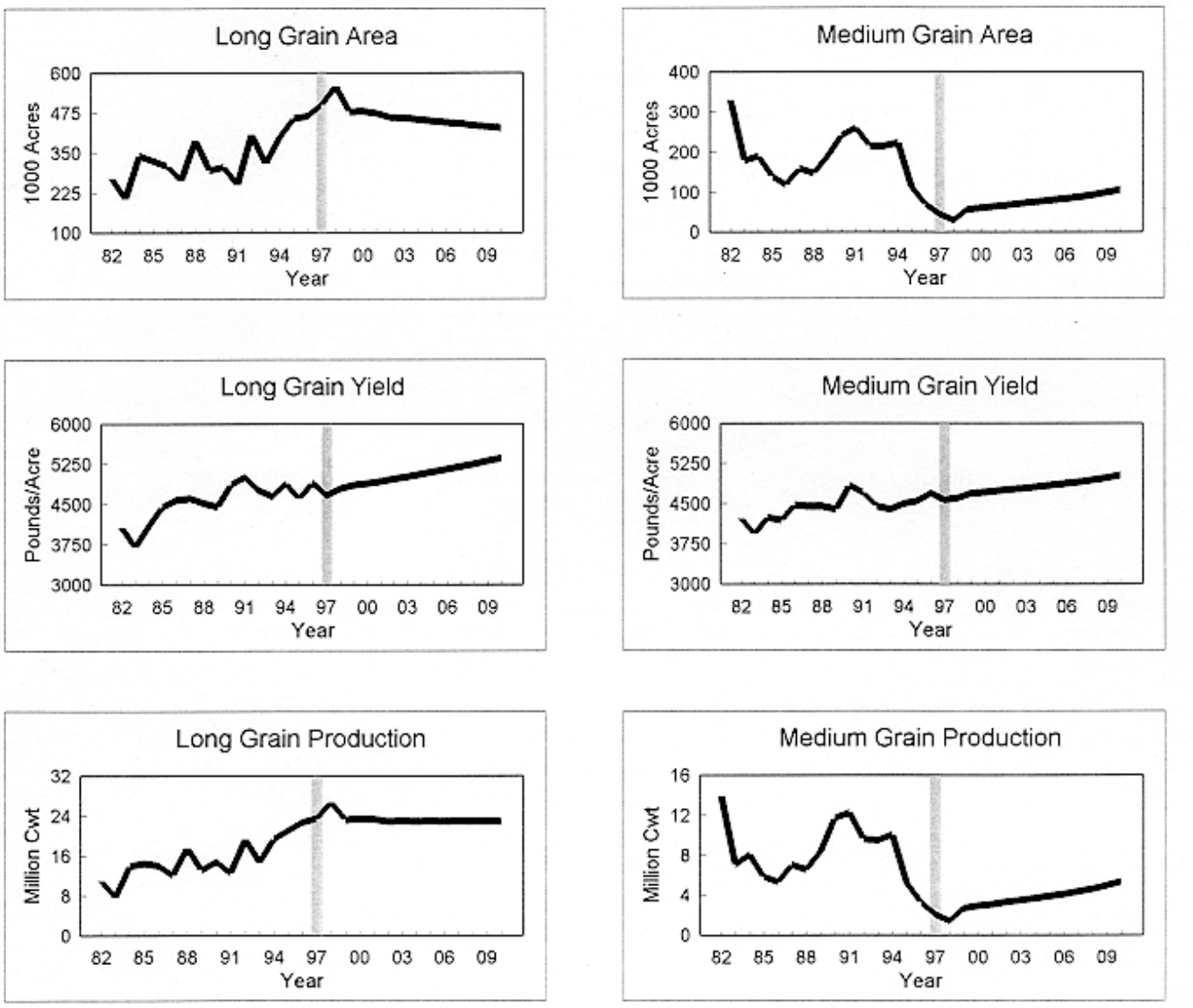

Fig. 16. Arkansas Global Rice Model 1998 projections: Louisiana rice supply by type.

ing for 18 percent of total rice exports, up from 5 percent in 1993. Over the past four years (1994-1997), rough rice averaged about 19 percent of total rice exports. The main reason for this shift is the increased demand for rough rice from a number of Latin American countries, notably Mexico, Brazil, Costa Rica and Venezuela. Other buyers include Colombia, Ecuador, Panama, El Salvador, Honduras, Guatemala and Nicaragua. These countries prefer to import rough rice to improve utilization of their milling capacities. These countries encourage this situation by setting lower tariffs for rough rice compared to milled rice imports. At the expense of the US rice milling industry, US rough rice is well-positioned to maintain its competitive edge in this market segment, not only geographically but because there are only a very few countries that allow rough rice exports. There is no other major rice supplier that exports significant volumes of rough rice.

US long grain exports are projected to decrease to 43.5 million cwt (1.42 mmt) in 2010 from 64.6 million cwt (2.11 mmt) in 1997 as both real Thai 5% FOB price and US export supply decline. Medium grain exports, on the other hand, would increase from 19.0 million cwt (619 thousand mt) in 1997 to 24.7 million cwt (807 thousand mt) in 2010, mainly due to the increase in exportable supply, which more than

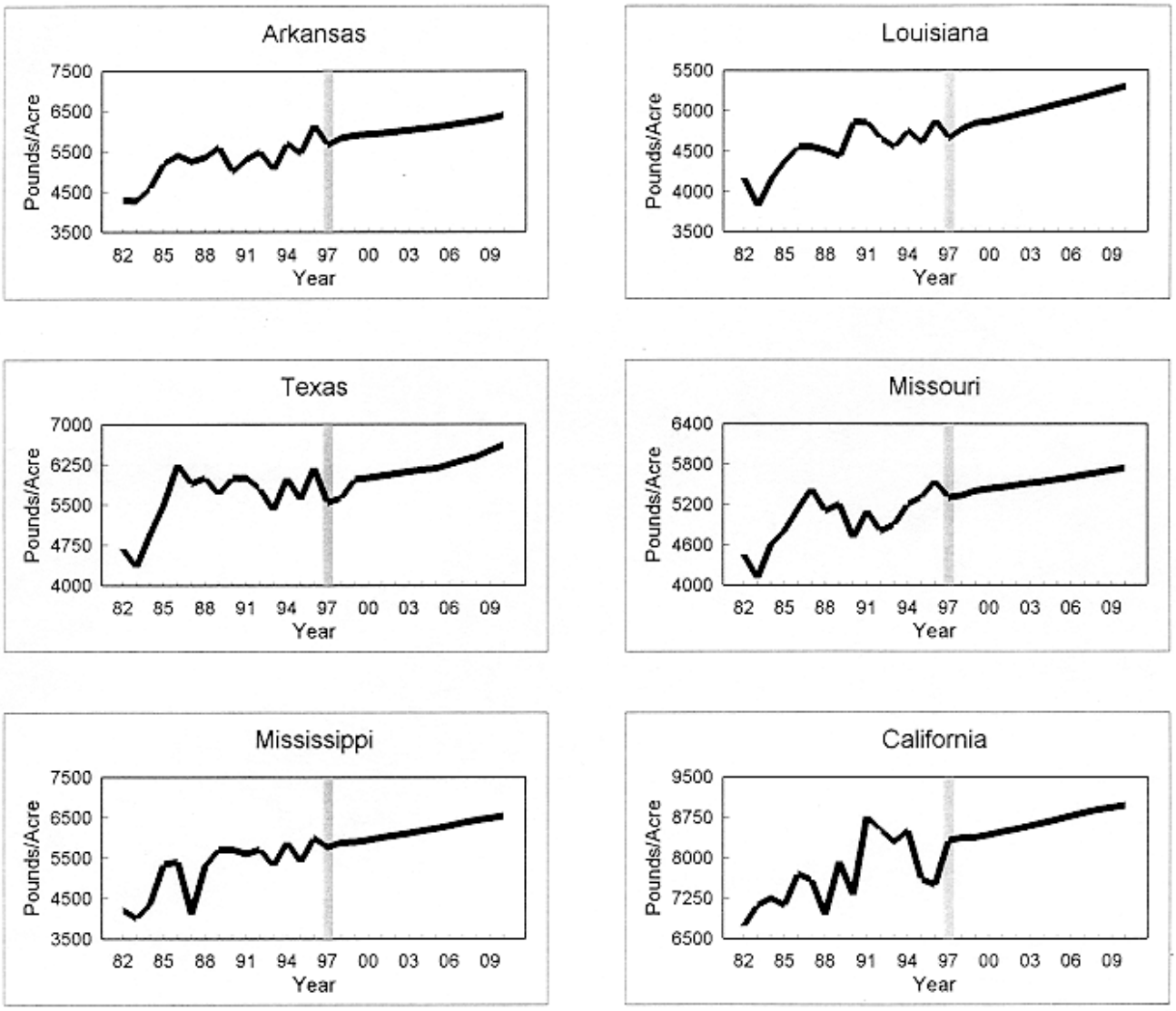

Fig. 17. Arkansas Global Rice Model 1998 projections: U.S. rice yield by state.

compensates for the decline in real medium grain export price. The WTO minimum access requirements for export markets in Japan and South Korea also support the growth of medium grain exports.

Ending stocks are projected to range between 21 and 30 million cwt (672 and 964 thousand mt) over the forecast period. This translates to a stocks-to-use ratio of 0.11 to 0.15. The relatively large expected crop in 1998 would increase stocks in 1998 to 30.3 million cwt (964 thousand mt) from 25.8 million cwt (817 thousand mt) in 1997, which is equivalent to a stocks-to-use ratio of 0.15.

The nominal season average farm price (SAFP) decreased slightly to $9.88 per cwt, rough basis ($218 per mt rough basis) in 1997 from $9.96 per cwt ($219 per mt) in 1996 and is projected to decline to $9.54 per cwt ($210 per mt) in 1998 due to the expected larger US production and ending stocks and weaker international prices. Farm prices decline over the 1999 to 2001 period but then increase from $9.62 per cwt ($212 per mt) in 2002 to $10.36 per cwt ($228 per mt) by 2010 (Figure 21). The average long grain farm price increased slightly to $10.40 per cwt ($229 per mt) in 1997 (from $10.32 per cwt or $227 per mt in 1996) because of strong rough long grain rice export demand. It is expected to decline to $9.69 per cwt ($214 per mt) in 1998 as a result of larger supplies. Long grain prices range from $9.49 to $9.86 per cwt ($209 to $217 per mt) for the 1999-2003 period.

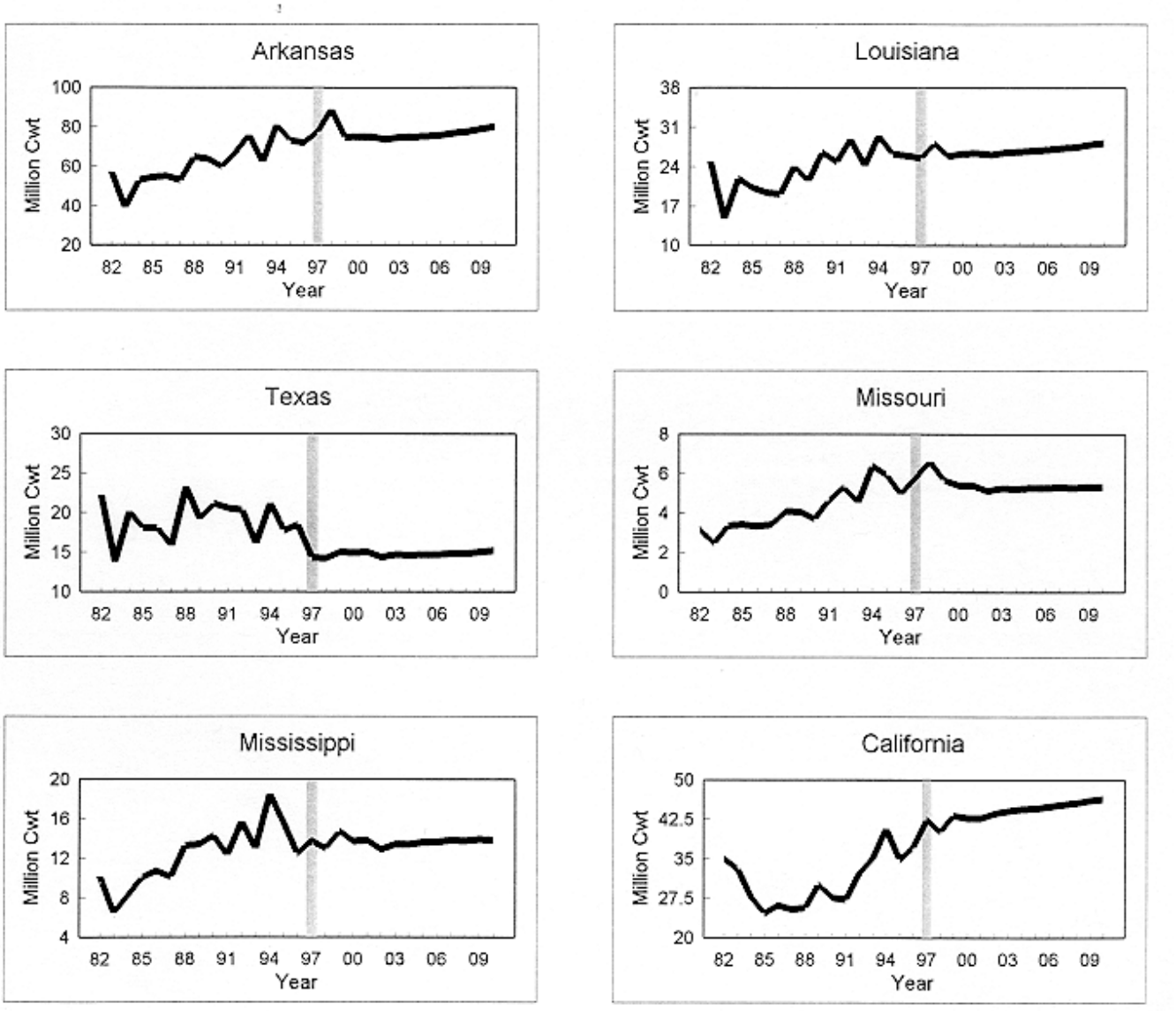

Fig. 18. Arkansas Global Rice Model 1998 projections: U.S. rice production by state.

Thereafter, the long grain price increases from $10.02 per cwt ($221 per mt) in 2004 to $10.54 per cwt ($232 per mt) by 2010.

The average medium grain farm price decreased from $9.25 per cwt rough basis ($204 per mt rough basis) in 1996 to $8.79 per cwt ($194 per mt) in 1997 due to weaker export demand for high-quality japonica rice. The average medium grain price increases steadily by nearly 1 percent per year over the projection period (Figure 22). The long grain farm price maintains a premium over the medium grain farm price throughout the entire projection period. The price premium narrows from $1.61 per cwt ($35 per mt) in 1997 to $0.50 per cwt ($11 per mt) by 2010.

The long grain export price (FOB Houston) decreased to $18.96 per cwt, milled basis ($418 per mt) in 1997 from $20.43 per cwt ($450 per mt) in 1996, and should decrease to $18.57 per cwt ($409 per mt) in 1999 before steadily increasing to $21.10 per cwt ($465 per mt) by 2010 (Table 8). The medium grain export price (FOB California) decreased to $17.94 per cwt ($395 per mt) in 1997 from $18.79 per cwt ($414 per mt) in 1996 and should increase steadily to $19.64 per cwt ($433 per mt) in 2010. In real terms, both US farm and export prices steadily decline over the projection period.

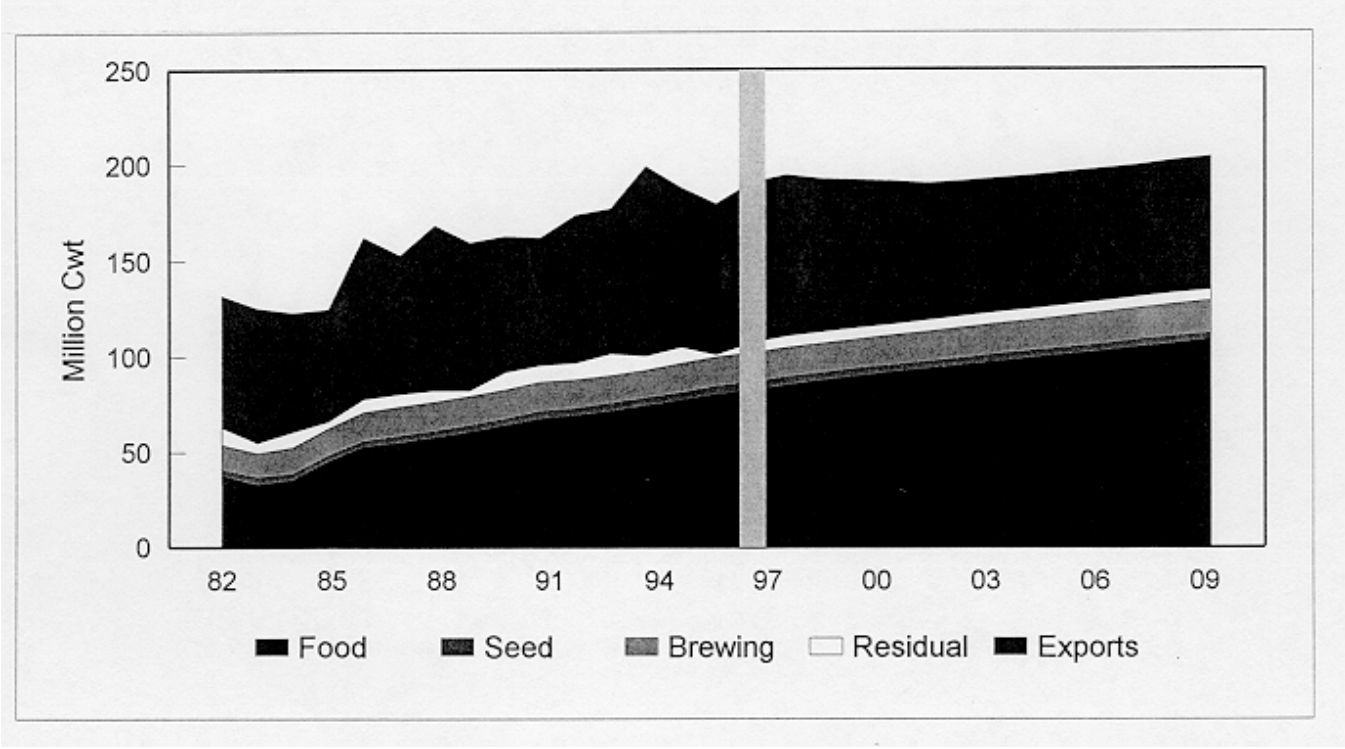

Fig. 19. Arkansas Global Rice Model 1998 projections: detailed U.S. total rice use.

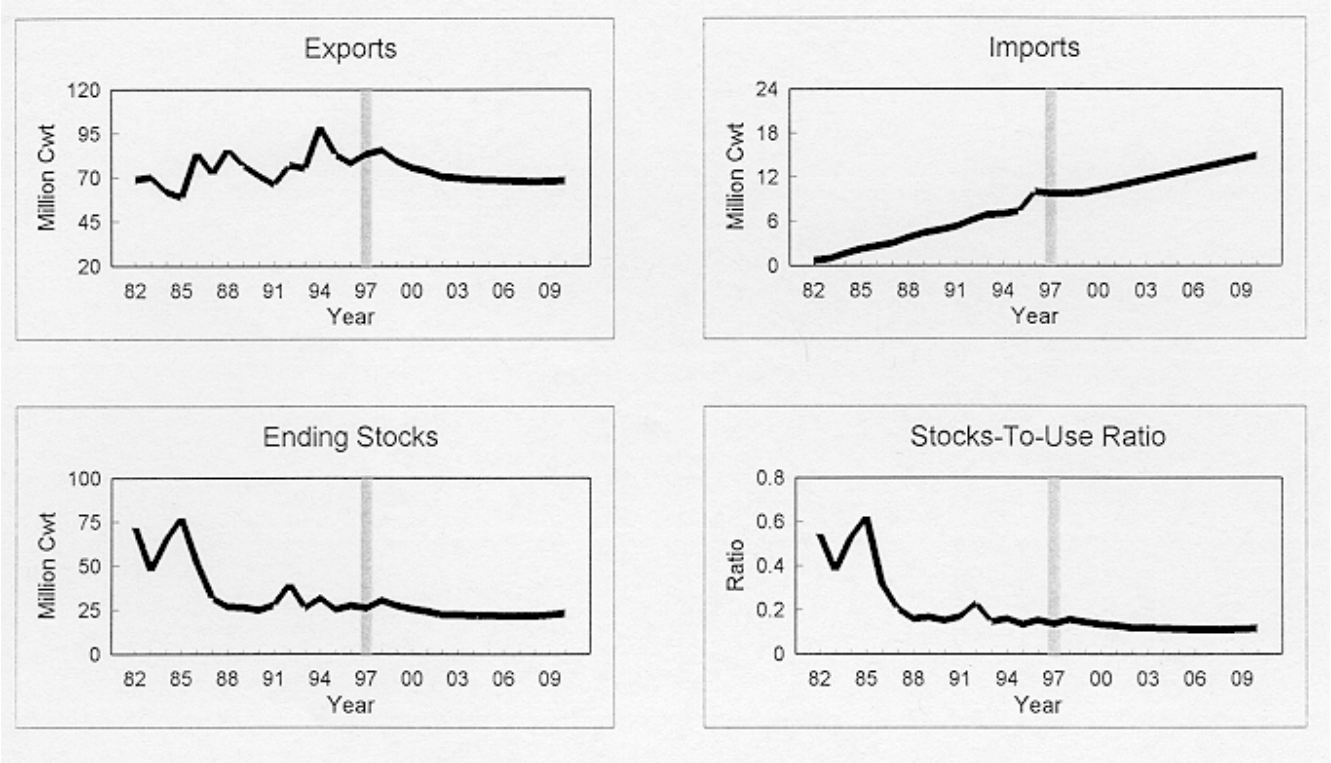

Fig. 20. Arkansas Global Rice Model 1998 projections: U.S. rice trade and stocks.

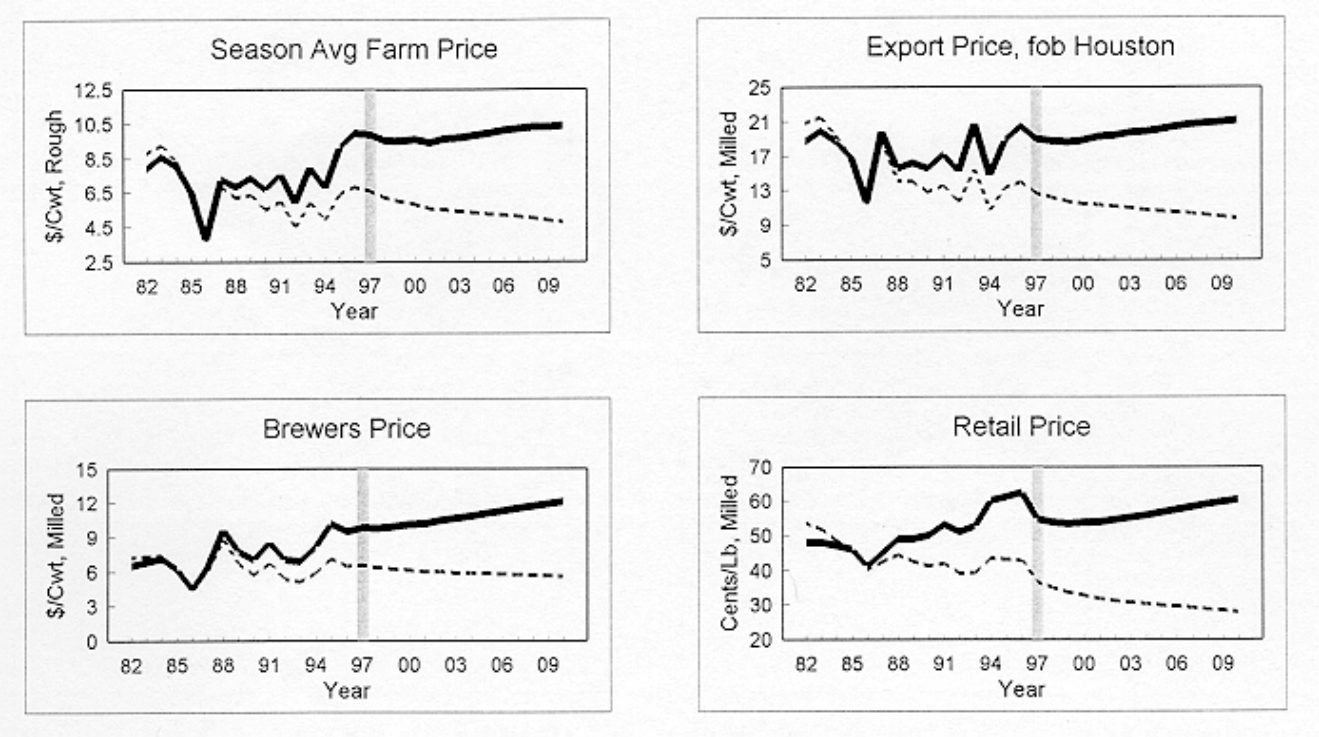

Fig. 21. Arkansas Global Rice Model 1998 projections: nominal and real U.S. rice prices.

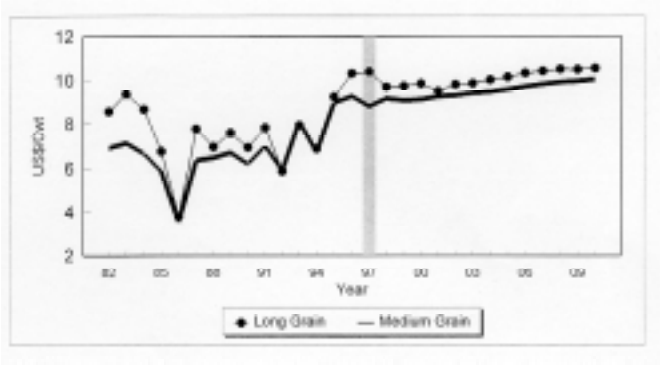

Fig. 22. Arkansas Global Rice Model 1998 projections: U.S. rice season average farm price by type.

China

China's government policies significantly influence its rice economy. Economic reforms and opening of trade to the outside world are central to China's development formula. However, the Five-Year Plan for 1996-2000 also reconfirmed the role of state-owned enterprises, which still directly account for 40 percent of total industrial output. About one-half of state-owned enterprises were reporting losses in 1997. The plan targets an 8 percent annual growth in the gross domestic product (GDP) through 2000 and a further doubling of GDP during the period 2000-2010. China made substantial adjustments to its import tariff schedule in April 1996 and in October 1997. Average import tariff had decreased from over 40 percent in 1995 to 17 percent in late 1997. China, however, continues to impose barriers to US exports, although trade-liberalizing reforms are being undertaken. Liberalization of China's import regime has not kept pace with liberalization of its export regime. Aside from high tariffs, numerous non-tariff measures restrict imports. These measures include import licensing requirements; import quotas, restrictions and controls; tendering requirements; and standards and certification requirements. China's restrictive system of trading rights severely limits domestic and foreign-invested enterprises' ability to directly import and export. This system raises the cost of imported goods by channeling imports through fee-collecting Chinese foreign trade companies. In most cases, US suppliers are restricted to sell directly to their ultimate customer. Information on itemized import quotas is not yet published. While announcement was made in early 1996 that tariff-rate quotas would apply, effective April 1996, to imports of rice, wheat, corn, soybeans and vegetable oils, no detailed rules and quota volumes had been announced as of late 1997. China abolished direct subsidies for exports on January 1, 1991. However, many of the country's manufactured exports still

receive indirect subsidies through guaranteed provision of energy, raw materials or labor supplies; bank loans that need not be repaid or with preferential terms; and tax rebates (US Department of State, 1997).

In the early 1990's, the government of China pursued a policy toward a free market for grains. But from 1994 to 1996, government policies for greater control over grain markets have been asserted, largely driven by inflationary pressure on food prices as well as a decrease in area sown to grain and international concerns that China may not be capable of producing sufficient grain supply of domestic consumption. The Grain Bag Policy was initiated in late 1994 and implemented in 1995. This policy gave provincial governors specific responsibilities for grain supply and demand at the provincial level. Governors must stabilize grain area and production, increase production if necessary for self sufficiency, maintain stock levels, control grain trade among provinces and ensure adequate supplies at the regional level. The basic objective is to attain a nationwide aggregate balance of grain on the basis of regional balance of grain (Crook, 1996).

Under the ongoing economic reforms, farmers determine their rice acreage based not only on the government procurement prices but also on expected free market prices and the adoption of new technologies. The government promotes research in producing high-yield rice varieties. Currently Chinese scientists have reported a new high-yield variety that will yield 13.26 mt per ha in test plots and maturity yield of 120 days (USDA/FAS, 1997 and 1998**)**. Rice yields currently average 6 mt per ha. Most of this research is not expected for commercial use until early next century.

In China rice production has an early, middle and late crop. The middle crop or single crop is the largest with 40 to 45 percent of the production. The remainder of production is during the early and late seasons, which are nearly equal in output. Indica rice is grown in the Southern provinces and along the Yangtze river. Indica accounts for approximately three-quarters of rice production and japonica the rest. Early Indica crop accounts for about one-fourth of total rice area. Japonica rice is grown north of the Yangtze river (Crook 1996).

Following two years of declining production, rice harvested area started to increase in 1995, reaching 31.8 million ha in 1997 from 30.3 million in 1994, partly due to favorable government policies and market prices. The area harvested in 1998 is projected to decline by 247 thousand ha to 31.8 million and would decrease steadily to 29.7 million by the end of the projection period. One reason for this decrease is the decline in real procurement prices, with growth in CPI ranging from 10 to 12 percent over the forecast period. Nominal rice procurement price was raised in 1996, by an average of 30 percent in grain-producing provinces such as Jiangxi, Anhui and Sichuan. Real input prices remained stable. Rice yields in China are influenced by the free market price and the flow of the new technologies, as well as by government price policies. Yields are projected to increase slightly to 4.38 mt per ha in 1998 from 4.37 mt per ha in 1997 and steadily increase to 4.83 mt per ha by 2010. However, the decline in area will pull total production slightly down to 139 mmt in 1998 from 140 mmt in 1997, before increasing steadily to 143.4 mmt by 2010 (Table 18 and Figure 23). Off-farm employment has become a problem for China's grain production as farmers find better-paying industrial jobs and rural industrial development uses an increasing amount of farmland.

Chinese annual per capita rice consumption is projected to remain relatively flat in 1998 at 110.8 kilograms and continue declining steadily to 106.6 kilograms by 2010. With a negative income elasticity, per capita consumption declines slightly as real income grows. Real GDP is projected to grow between 8 to 9 percent per year over the projection period, one of the fastest growth rates (second only to Vietnam) among the rice economies. Total consumption, however, is projected to continue to increase as population grows slightly (0.9 percent in 1998 and slowing to 0.6 percent by 2010). The USDA Foreign Agricultural Service (1997) reported that consumer preferences may be shifting away from the traditionally grown rice varieties in China. Consumers in Shanghai are said to prefer japonica and other high-quality short grain rice varieties compared to early rice. Early rice is fed to hogs. The area planted to japonica in Heilongjiang province, the largest producer, increased by 30 percent in 1996.

In 1994, rice exports were banned, and local governments were given authority to set ceiling prices. The country was a net importer of 1.97 mmt rice in 1994 due to a weather-related production shortfall. China became a significant net exporter of 612 thousand mt in 1996 and increased again to 2.1 mmt in 1997. Thailand dominates China's official rice imports, and Vietnam, which borders China, dominates unofficial trade. In the previous baseline (1997), China was projected to remain as a net importer of rice during the entire projection period. However, the current baseline projects China to be a net exporter throughout the forecast period, with net exports of 1.2 mmt in 1998 but declining steadily to 447 thousand mt by 2010. Ending stocks are projected to range from 29 to 31 mmt over the projection period.

India

India's economy continues to perform well, and long-term prospects remain promising. Real GDP grew at a rate of 5 percent over the past two years and is expected tocontinue growing between 5 and 6 percent over the projection period. The country is attracting sustained interest from the international investment community despite some concerns about inadequate infrastructure, non-transparent government decision-making and large budget deficits (U.S. Department of State, 1997).

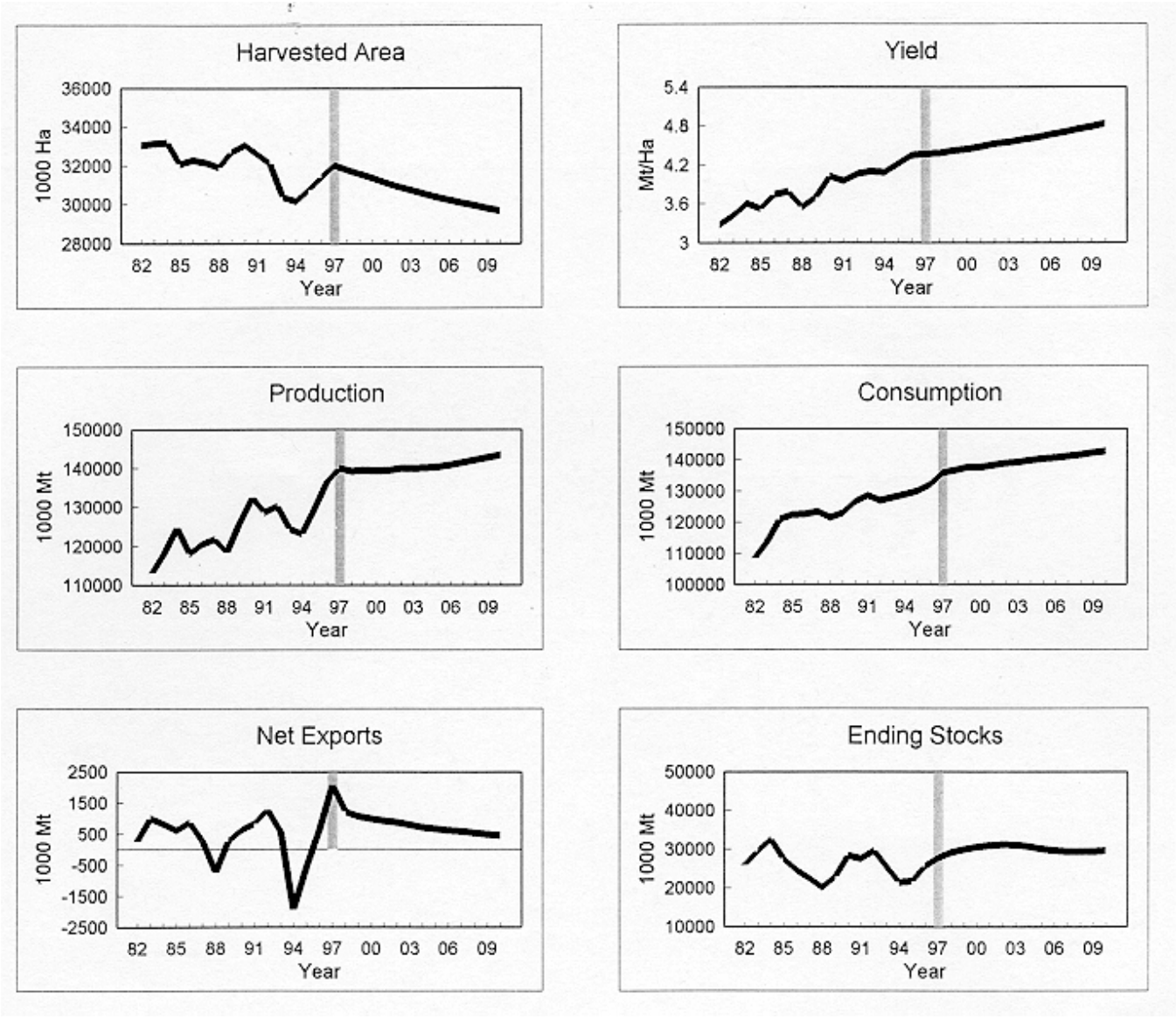

Fig. 23. Arkansas Global Rice Model 1998 projections: China rice.

India is experiencing a trend of diverting area from food grains to commercial crops, which underlies the sharp decline by more than 3 percent in India's food grain production in the 1995 marketing year. While wheat area declined by over 0.5 million ha, and coarse cereals by nearly 0.5 million ha, oilseeds area is estimated to have increased by nearly 1 million ha. Reduction in the use of fertilizers and the cumulative effect of unbalanced nutrient use over the years have also caused a decline in productivity.

India harvests more rice area than any other country, and it has the second largest production of any country, following China. The area harvested is projected to increase from 42.2 million ha in 1997 to 42.9 million in 1998 and steadily increase to 43.8 million by 2010 (Table 19 and Figure 24). This increase is driven by technology and infrastructure development, which is partly offset by the decline in real farm harvest price.

In the current baseline, India is subdivided into four distinct regions–North, South, East and West.[1] In 1997, 18.5 million ha was harvested in the Eastern region (which is

[1]Eastern Region: Assam, Orissa, Tripura, West Bengal, Bihar; Northern Region: Haryana, Haimachel, Pradesh, Punjab, Uttar, Pradesh, Delhi, Madhya; Southern Region: Karnataka, Kerala, Tamilnadu, Andhra Pradesh; Western Region: Gujarat, Pradesh, Maharashtra.

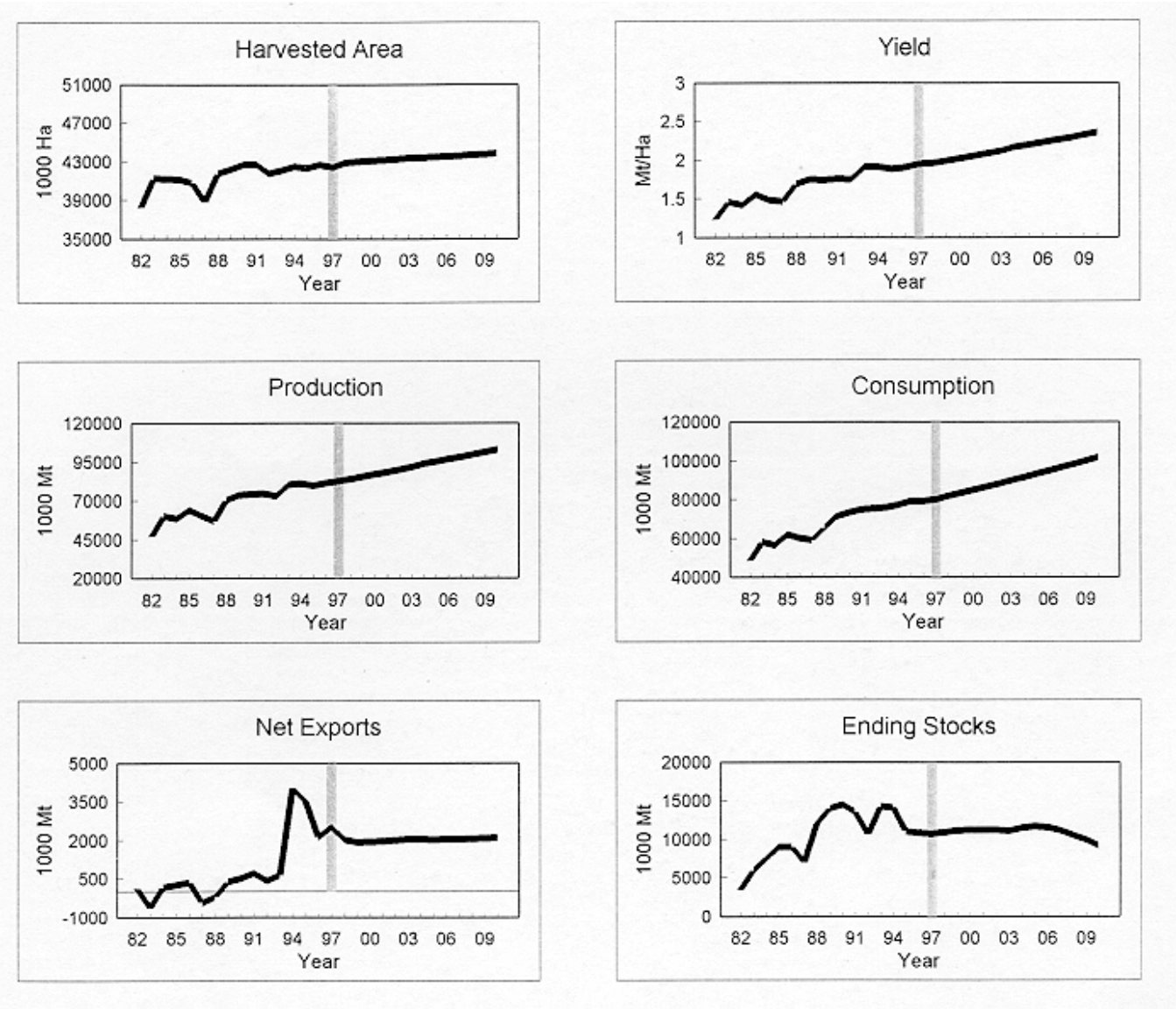

Fig. 24. Arkansas Global Rice Model 1998 projections: India rice.

equivalent to 43.6 percent of the total), 8.6 million in the Northern region (20.2 percent), 7.6 million in the Southern region (17.8 percent) and 7.8 million in the Western region (18.4 percent). Most of the increase in area occurs in the Western region, with area growing over 1 percent per year. By 2010, the Western region is projected to harvest nearly 9 million ha, which would account for 21 percent of total.

The use of hybrid rice is gaining popularity in India, and several research institutions have successfully developed highly promising hybrids. Increasing use of hybrid rice is observed in Punjab; Haryana and Western Uttar Pradesh in North India; and in Andhra Pradesh, Karnataka and Tamil Nadu in the South. The Indian Council of Agricultural Research (ICAR) projects that the area under hybrid rice will expand from the current 50 thousand ha to over 2.0 million ha in four years–or nearly 5 percent of total rice area. ICAR has developed seven location-specific hybrid rice varieties, in addition to the six being marketed by private companies. The Indian Agricultural Research Institute (IARI) in New Delhi has also developed the first nuclease-bred variety (PNR 381) for the upland areas of the country. The early-maturing, semi-dwarf rice gives superior grain quality and is resistant to multiple pests and diseases of rice. PNR 381, which is widely-used in Uttar Pradesh, is found suitable both as a direct-seeded crop in

rain-fed upland areas and as a transplanted crop in irrigated areas. The Central Rice Research Institute (CRRI) of Cuttack has also released four new high-yielding rice varieties suitable for different areas in Orissa. Finally, India plans, through its national rice biotechnology network (NRBN), to develop hybrid rice using biotechnology to improve yields. These developments are indications that technology may provide India's rice industry the competitive edge in the long-run.

More than half of India's rice crop is rain-fed. Hence, it is highly dependent on monsoon rains. The country has experienced favorable weather over the past nine years, boosting its production. Rice yields are responsive to changes in fertilizer prices and the adoption of high-yielding varieties. National average rice yields are projected to increase at an average annual rate of nearly 1.5 percent, from 1.94 mt per ha in 1997 to 2.35 mt by 2010. Total production is projected to increase to 84 mmt in 1998 from 82.5 mmt in 1997 and would increase steadily to 102.9 mmt by 2010.

Given the availability of more detailed information on rice consumption in India by region, per capita rice consumption has been revised. As a result, the national average per capita rice consumption is projected to increase steadily from 82.7 kilograms in 1997 to 86.4 kilograms in 2010. This situation is substantially different from the 1997 baseline, which projected a decline in per capita consumption. The fastest annual growth in per capita consumption is projected in the Northern region at 2.0 percent, driven by income growth; followed by the East (0.34 percent) and the South (0.20 percent). Per capita consumption is expected to be stagnant in the Western region.

Total consumption is projected to grow steadily due to population growth (1.6 percent in 1998 and stabilizing around 1.3 percent by 2008) and income growth (5.3 percent in 1998 and increasing to 6 percent by 2004). Total consumption in 1998 increases to 81.8 mmt from 80.2 mmt in 1997 and increases steadily to 101.6 mmt by 2010, a growth of 1.84 percent per year. The food processing industry is one of the major growth sectors in India. REI Agro Ltd of Calcutta has built a Rs218-million, 72-thousand mt per year basmati rice processing plant at Bewal in Haryana. The company plans to export 90 percent of its production to the US, Korea, Europe, Japan and Australia.

Central and state governments still regulate the prices of most essential products, including food grains, sugar, edible oils, basic medicines, energy, fertilizers, water and many industrial inputs (US Department of State, 1997). India uses procurement prices and open market sales program in order to stabilize prices. The government sets fixed procurement prices that serve as price floors for producers. A procurement price prevents substantial declines in the rice price while an open market sales program prevents significant increases in price. The minimum export price was eliminated both for basmati and non-basmati rice in 1994. In 1995, the government fixed the sales price of rice exports at the open market price. India has used exchange rate policy to improve its export competitiveness. Most of the direct export subsidies have been phased out, but numerous indirect subsidies remain. These include export promotion measures such as exemptions or concessional tariffs on raw materials and capital inputs and access to special import licenses for restricted inputs. Export earnings are tax-exempt. Commercial banks also provide export financing on concessional terms (US Department of State, 1997).

India was the world's fifth largest exporter of rice in 1997. Its primary rice export destinations are Saudi Arabia, UAE, UK, Kuwait, US, Bahrain, Sri Lanka and Oman. Rice exports increased dramatically in 1994, amounting to 4.2 mmt, as the country relaxed its export quota in response to substantial production and stock build-up. Net exports decreased slightly to 4.0 mmt in 1995 but declined substantially to 2.1 mmt in 1996 before recovering slightly to 2.5 mmt in 1997. In the 1995 marketing year, India exported basmati rice valued at Rs8.5 billion, and non-basmati rice worth Rs37.2 billion. Exports are expected to stabilize around 2 mmt over the forecast period. Exports are driven mainly by excess rice supply. The Indian government's recent decision to fully enforce a rule that requires rice millers to sell about 75 percent of rice to state-run food agencies may have a dampening effect on the country's rice exports. The government has decided to fix exports of food grains at 2 percent of India's production every year. The allocation has been reduced for the next two years to 2 percent to give higher priority to domestic food security requirements. At present, there is no quantitative ceiling on export of rice from private stocks, but the ceiling is imposed on non-basmati rice exported from the stocks of the Food Corporation of India.

India and Pakistan have a duopoly over basmati rice exports. The two countries are the only significant producers of high-quality basmati rice in the world. Basmati rice accounts for only 1 mmt or 5 percent of the total world rice trade. The government of India plans to introduce futures trading in basmati rice and non-edible commodities.

With the strong domestic consumption being supported by favorable production, ending stocks are projected to remain between 9 and 12 mmt over the forecast period. The Indian government may decide to impose quantitative restrictions on stocks of non-basmati rice exported on private account, which are now under open general license (OGL). The relatively low level of the country's food grain stocks in the central pool, due to a decline in procurement, has been a cause for concern.

Pakistan

The government, which assumed office in February 1997, has emphasized tax and tariff reforms, government and public enterprise restructuring and downsizing, financial sector

reform and exchange market reform. Economic performance since February 1997 has been mixed, with the general economy remaining sluggish and the outcome of important reforms remaining in doubt. Pakistan's real GDP growth declined to 4 percent in 1997 (from 5.4 percent in 1996) due, in part, to the poor cotton crop and decrease in manufacturing output.

In October 1997, the International Monetary Fund (IMF) provided improved terms on structural adjustment loans. This encouraging development, as well as an expected good crop year, is expected to support the country's potential economic recovery. The exchange rate is determined according to a managed float, with the State Bank of Pakistan making adjustments against a basket of major currencies. The US dollar is used as an intervention currency to determine other rates. Government authorities devalued the rupee by 8.7 percent in October 1997 in the face of domestic inflation, declining exports and foreign exchange reserves and perceived overvaluation relative to competitors' currencies (US Department of State, 1997).

The macroeconomic objectives for the three-year period (1997-2000) are 1) reduction of external current deficit level to 4.0 to 4.5 percent of GDP; 2) improving the real GDP growth rate to 5 to 6 percent; and 3) reducing inflation to about 7 percent. In recent years, Pakistan has implemented significant trade reforms. Import licenses have been abolished on all "freely importable" goods since July 1993.

The basic policy is aimed at increasing rice production through improved yields and government support prices that are adjusted annually to keep pace with increased costs of production. The government support prices are announced prior to planting season. The government support price is assumed to increase steadily over time in real terms. Increases in consumer prices are expected to stabilize at 9.2 percent by 2001, from 10.1 percent in 1997 (Appendix Table 4).

Rice production in Pakistan consists of two main varieties: basmati and IRRI-adapted high-yield long grain varieties. Rice is not a subsistence crop but a cash crop grown for export. Rice is the third largest crop after wheat and cotton. Rice cultivation usually follows the wheat crop. Cotton and rice are substitute crops. For example, rice area was up slightly in 1997 because of pest and disease problems in cotton production in the Punjab province. Two major areas of rice production are Punjab province, with 60 percent of the total rice area, and Sind province, with 31 percent. Approximately 84 percent of Punjab province is basmati rice, and 90 percent of Sind province is IRRI rice (USDA/FAS, 1998).

The rice area harvested in Pakistan is projected to stabilize around 2.3 million ha during most of the forecast period (Table 20 and Figure 25). Rice yields in Pakistan are responsive to input prices and the adoption of high-yielding varieties. Yields per ha in 1998 are expected to increase to 1.94 mt per ha from 1.89 mt in 1997 and increase steadily to 2.21 mt by 2010. Following the yield trend, total production is projected to increase steadily from 4.37 mmt in 1997 to 5.35 mmt by 2010.

Annual per capita consumption of rice in Pakistan is lower than in other Asian countries (19.3 kilograms in 1997) and is projected to remain between 19.3 and 19.5 kilograms over the projection period. However, a relatively high population growth rate results in an increase in total rice consumption from 2.5 mmt in 1997 to 3.3 mmt by 2010.

Pakistan is the fourth largest rice exporter in 1997 and is projected to remain as a major exporter in the long run. Net rice exports in 1998 are projected to remain relatively flat at 1.9 mmt and would range between 1.8 to 1.9 mmt thereafter. Ending stocks are projected to generally remain in the range of 300 to 800 thousand mt over the forecast period.

Myanmar (formerly Burma)

Myanmar is moving away from a centralized economy and trying to re-enter the world community after more than three decades of economic isolation. The economy has potential, given its rich natural resources and relatively low-wage labor, but considerable political constraints still exist. More than 50 percent of its population is within the working ages of 15 through 59. Private corporations are now permitted to participate in infrastructural development projects. More than half of Myanmar's gross domestic product and half of its foreign exchange earnings come from agriculture, forestry, fishing and livestock**.**

A number of foreign investments in Myanmar will have direct benefits to the country's rice industry. Singapore, recognizing Myanmar's potential, invested $584 million in the country by the end of 1995–accounting for 22 percent of Myanmar's total foreign investments. Foreign investments are going to 36 projects, including one that is aimed at improving the output of the country's fragrant rice varieties. Marubeni Corporation has been working on a joint-venture with the Myanmar government to produce rice for animal feed. The venture is expected to produce 150 thousand mt by 2004 and is projected to reach 3.0 mmt per year eventually or about 30 percent of the country's current level of rice production. Rice feed is planned to be exported to other Asian countries beyond the year 2000.

Myanmar was once the dominant rice exporting country in the world, accounting for nearly three-fourths of the world rice exports in the first half of this century. Production was severely disrupted by World War II. Thereafter, Myanmar's exports became less dependable under intervention policies of the new independent government.

Rice production in Myanmar is one of the most diversified in Asia. Approximately 52 percent of the rice area is rain-fed lowland, 24 percent is deepwater rice, 18 percent is irrigated lowland, and about 6 percent is upland, where slash and burn methods typically are used for subsistence production. Irri-

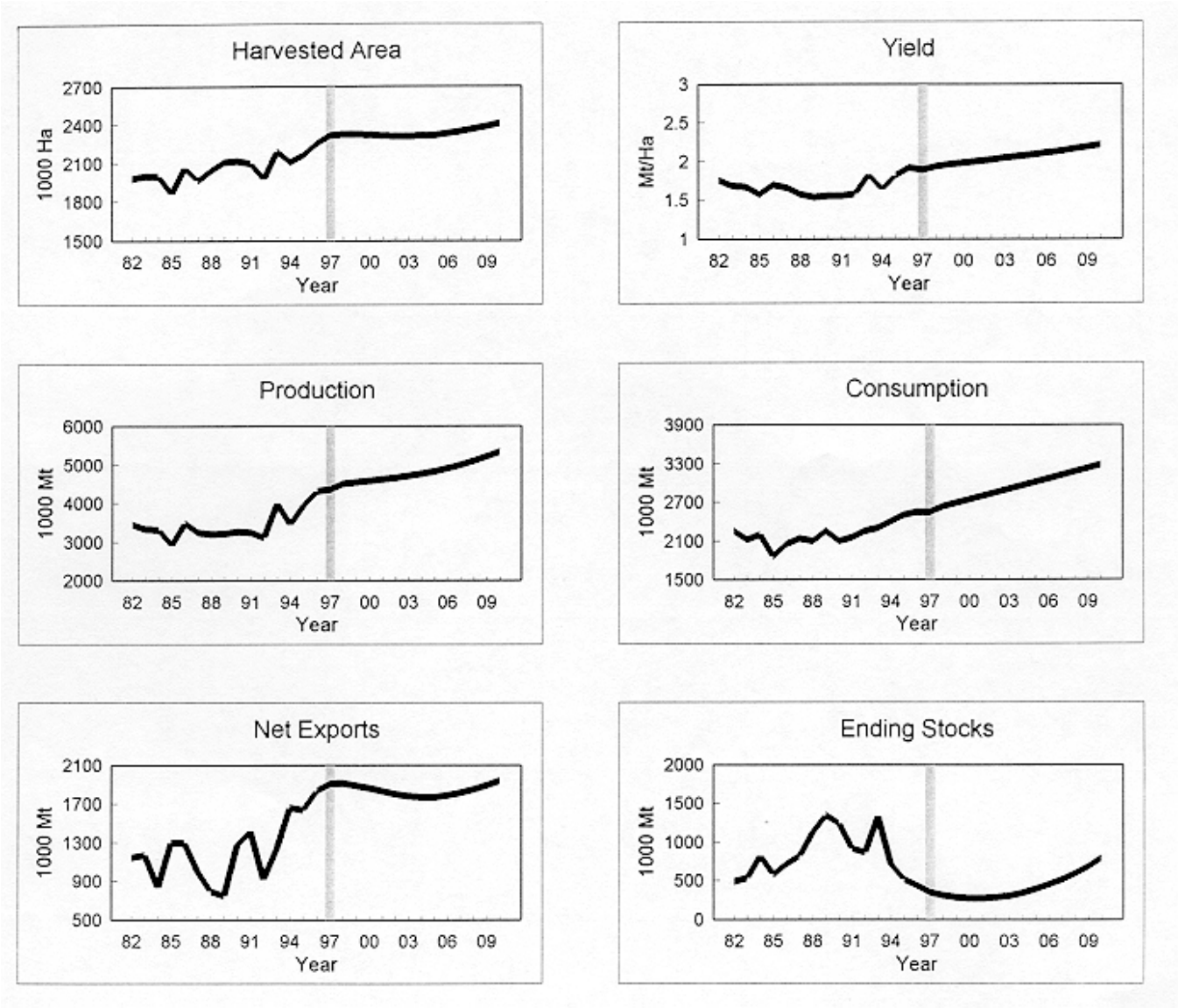

Fig. 25. Arkansas Global Rice Model 1998 projections: Pakistan rice.

gated rice in the dry season has been expanding, and traditional methods such as Taungya, shifting cultivation on hillsides, has been declining (Young et al., 1998).

The government of Myanmar (GOM) has maintained a quota system that requires farmers to sell 12 baskets (20.9 kg/basket) of rice to the government at a procurement price, which is below the market prices. In late 1997 the government proposed a new procurement system that allows higher prices and also targets traders and millers for procurement and not just farmers.

The Ministry of Agriculture (MOA) had very ambitious plans for expanding rice area. In 1995, the country implemented a policy requiring two wet-season rice crops on all designated rice land. In April 1996 the MOA announced plans to expand monsoon paddy area by 800,000 ha within its second five-year plan period. This additional land area would come from culturable waste lands, fallow lands and reclaimed lands. But in 1997 the MOA realized it lacks sufficient input supplies for this expansion in new area. The new policy emphasis is directed towards improving yields. But, due to shortage of foreign currency, there has been a lack of urea fertilizer for the rice crop (USDA/FAS, 1997 and 1998).

Following the current support policies and a more conservative government expansion in irrigated rice area than previ-

ous years forecast, the total harvested area is projected to increase to 6.25 million ha by 2010 from 5.49 million ha in 1997 (Table 21 and Figure 26). The government has developed 800 thousand ha of summer (second crop) irrigated rice. An additional 750 thousand ha is planned to be brought into production over the next decade. Average yields per ha are projected to increase steadily by 1.7 percent per year to 2.01 mt by 2010 from 1.62 mt in 1997. As a result, total production is projected to grow steadily to 12.6 mmt in 2010 from 8.9 mmt in 1997.

Production in 1997/1998 was lower due to a number of different factors, including heavy flooding in a number of regions, pests, disease problems, inferior seed qualities, shortage of fertilizer and low water levels for the second crop in the Irrawady River Delta.

Total rice consumption is projected to increase to 9.4 mmt in 1998 from 9.3 mmt in 1997. Consumption will continue to increase steadily to 11.8 mmt by 2010 due to rapid population growth of 2.1 percent and income growth of 2.5 percent per year. Annual per capita consumption ranges from 192 to 196 kilograms over the forecast period. Per capita consumption, however, may be overstated because of the existence of a substantial amount of unreported trade with China and different ethnic tribes along the borders with Laos and Thailand.

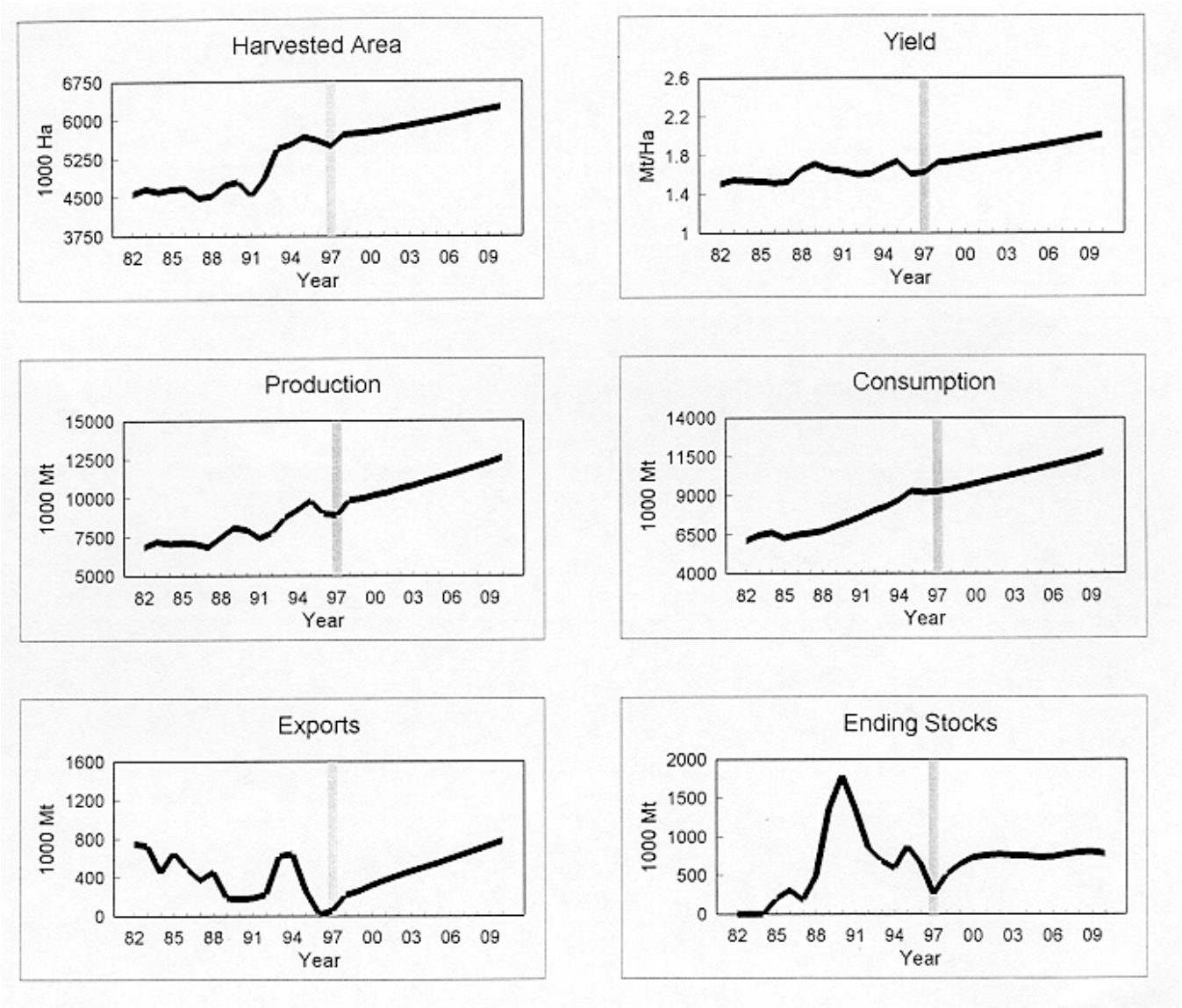

Fig. 26. Arkansas Global Rice Model 1998 projections: Myanmar rice.

While Myanmar is an emerging major exporter in the international rice market, current trade projections are revised downward relative to the previous baseline because the government's original targets for production are unlikely to be attained based on the evidence of the past three years. An increase in exports is driven mainly by available supply.

Rice imports and exports are controlled by the GOM agency Myanmar Export Import Services (MEIS). Rice cannot be exported by the private sector. MEIS establishes export targets based on production data from the MOA. Recently MEIS has lowered export targets because of unreliable data for production and the risk of causing a domestic shortage and increasing the retail price of rice. Rice is the staple food, and the price of rice is a politically sensitive issue. The government needs to maintain sufficient supplies to provide subsidized rice for government employees and military personnel (USDA/FAS, 1998).

Net exports are projected to increase substantially to 216 thousand mt in 1998 from 54 thousand in 1997 and steadily increase to 777 thousand mt by 2010. Exports in 1996 (15 thousand mt) and 1997 are the lowest for Myanmar since 1972 when exports were 152 thousand mt. From 1990 through 1995 net exports averaged 352 thousand mt per year. Projected ending stocks increase to 514 thousand mt in 1998 from 260 thousand mt in 1997 and remain between 600 and 800 thousand mt over the forecast period.

The future time frame for increased rice production and export is difficult to project for Myanmar as governmental intervention in the rice sector distorts operation of the free market and the serious financial problems faced by the government constrain economic development. Despite these constraints, the present government appears to be committed to increasing rice production and export. The rate of expansion in the future will depend largely on the government's continued willingness and ability to invest in the rice sector by improving the infrastructure as well as providing adequate economic incentives for rice production. Although the present procurement price does not cover production cost, the government offsets this apparent inequity to some degree by providing subsidized inputs. This intervention has been reduced over time as the procurement requirement is now only about 12 percent of production. On the other hand, free market price for remaining paddy appears to provide a strong incentive for rice production, e.g., it was over three times the reported farm production cost per metric ton in 1995. Thus, the current main constraint to expanding production seems to be the poor infrastructural support system, including continued problems with the timely and sufficient supply of key inputs for high-yield variety (HYV) production, such as chemical fertilizers (Young et al., 1998).

The major factors other than market price that will determine rice production within the next decade are 1) continued irrigation and drainage development to expand the area of dry-season paddy and to support multi-cropping; 2) increased use of HYV's, which now account for only about half of rice production; and 3) increased use of chemical fertilizer and other modern inputs to achieve higher yields. In the long term, the irrigation and drainage development potentially could be increased to cover virtually all of the rice production areas; multi-cropping potentially could be increased to cover three crops per year; and more land area could be reclaimed or converted from wasteland to possible rice cultivation (Young et al., 1998).

Vietnam

Agricultural production in Vietnam was collectivized from 1976 to 1981. Agricultural output was quite low. From 1982 to 1987 a contract system was utilized. Farmers had contracts with cooperatives to produce a specific quantity. Production in excess of the contract was consumed or sold to private traders. Vietnam's transition to family farming (1988-92) from the contract system (1982-87) supported the agricultural liberalization efforts and provided incentives to producers. Farmers were assigned long-term leases on their land, and the land rights were transferable. Farmers were no longer required to sell a part of their production to the state at prices below those prevailing in the market. The rice retail market was privatized. Food grain subsidies to government employees and army personnel were eliminated.

Vietnam is attracting foreign investment on several fronts–strengthening the foundation of its ongoing economic growth, especially its agricultural sector. Novartis, one of the first major companies to invest in the country, has broken ground for a new agrochemical and pharmaceutical complex in Dong Nai province, near Ho Chi Minh City. The facility will package crop protection chemicals and pharmaceutical products to be marketed in the country. The products include Tilt, a fungicide, and Sofit, a herbicide for rice. Tomen Corporation has a loan agreement of US$215 million to the Vietnam Chemical Corporation to build the first phosphate fertilizer plant in Vietnam. The production capacity of the plant is 330 thousand mt per year of fertilizer intended for rice production. Construction is planned to be completed in 1998. Rabobank Nederland, one of the world's top 40 banks with US$175 billion in assets, has set up an office in Ho Chi Minh City and intends to provide finance, market analysis and other services "to help Vietnam become a major agricultural producer." There are now three Dutch banks with operations in Vietnam, helping to support 27 Dutch projects involving a total investment of US$447 million. Rabobank, however, is the first Dutch bank to concentrate on agribusiness in the country.

Vietnam's rice industry is also attracting direct investments. Mitsui and Co Ltd (Japan) and two Hong Kong partners (Golden Resources Development International Ltd and the

Bank of East Asia) have established a joint venture, Vietnam Resources Rice Processing Industry, to produce refined rice for export. Golden Resources is said to have 70 percent of Hong Kong's retail rice market and initiated the joint venture to diversify its rice supplies. Equity is divided, with four regional Vietnamese municipalities taking 51.5 percent and the foreign companies taking 48.5 percent. The US$10-million project that has been established in My Tho, a major urban center in Mekong Delta, has an initial full processing capacity of 90 thousand mt of rough rice. It will be expanded to 180 thousand mt per year by 2000. The Vietnamese government also has approved a US$2-million investment project for a rice drying system with a capacity of 1 mmt. Another US$18-million project is being undertaken by the governments of Vietnam and Denmark to develop the milling system in Thai Binh, Soc Trang and Can Tho provinces. Vietnam has 5000 rice mills with a total annual capacity of 10 mmt of rice and has facilities that can husk, sort and polish rice with a capacity of 2.3 mmt per year.

Rice production in Vietnam has increased rapidly over the past decade due to the economic reforms instituted by the government, as well as expanded use and improvements in technology. One of the major catalysts of the country's march towards progress is a socio-economic development plan for the Mekong River delta, which will cost US$6 billion over the next five years and US$28 billion over the following 10 years. The 39,600-square-kilometer delta contributes 60 percent of the country's food output and half of its rice exports. Rice accounts for 70 percent of the delta's 2.6 million ha of agricultural land. The goal of the plan is to upgrade the delta's food production through intense cultivation and improve the quality of rice. The country's Ministry of Agriculture and Rural Development (MARD) has implemented a US$120-million program to improve the quality of the country's rice for the period 1997 through 2000. The focus will be on boosting capacity and upgrading facilities for drying, husking, screening and preserving. Another aspect of the program is standardizing and integrating the collection and processing system, which is presently done by the private sector. The country's Planning and Investment Ministry is to use a $20-million grant from the Danish government to improve rice quality and limit post-harvest losses.

Given the favorable developments on the supply side, a high growth rate in rice production is expected to continue in Vietnam throughout the projection period. Total area harvested is projected to increase slightly to 7.16 million ha in 1998 from 7.10 million in 1997 and increase slightly to 7.29 million by 2010 (Table 22 and Figure 27). Yields per ha are projected to continue to increase steadily from 2.54 to 3.04 mt during the same period. Total production is projected to increase to 18.7 mmt in 1998 from 18.0 mmt in 1997 and grow steadily by 1.6 percent annually to 22.1 mmt by 2010.

Due to low but rising per capita incomes, per capita rice consumption is projected to increase to 193.5 kilograms in 1998 from 191.4 kilograms in 1997 and stabilize around 192 kilograms during the rest of the forecast period. Vietnam's economy is expected to have the fastest growth (10.1 percent in 1997 and stabilizing at 9.5 percent by 2000) among the major rice economies (Appendix Table 2). Total rice consumption will increase to 14.8 mmt in 1998 from 14.4 mmt in 1997 and will continue to grow due to population and income growth, reaching 17.1 mmt by 2010.

Vietnam is emerging as a major rice exporter and has overtaken India and the US as the second biggest rice exporter in 1996 and 1997. According to news sources, Iraq agreed to buy 300 thousand mt of Vietnamese rice per year for four years. Vietnam raised its export quota from 2.5 mmt to 3.0 mmt during the 1996 marketing year. The country limits rice exports by a licensing system but has been pressured to liberalize export trade. The country has relaxed the state's monopoly on rice trade by allowing private companies to sell grain abroad. It is also considering replacing its rice export quotas with a system of export taxes to make the rice sector more flexible and competitive in international markets. In order to boost exports, the government may set aside special areas for the production of rice for export. In the Red River Delta, about 100 thousand ha will be reserved to develop improved strains of hybrid rice for export. By the year 2000, close to 1 million ha will be set aside in Dong Thap, An Giang, Soc Trang, Can Tho, Long An and Tien Giang provinces for rice production. Poor quality is identified as a major threat to the competitiveness of its exports and the reason why Vietnamese rice has a lower price compared to rice from other countries. In order to help improve quality, the government is also considering establishing a $20.5 million rice exporting center in Binh Khanh commune, Can Gio province. It has a capacity of 3.7 mmt of rice per year and would include a plant to process bran and rice husks. Currently, while the southern part of the country produces 11.0 mmt per year of rough rice, its milling facilities could process only 1.3 mmt of high-quality rice per year. The rest is crudely processed by farmers, leading to quality problems.

Projected net rice exports in 1998 are expected to increase to 3.9 mmt from 3.6 mmt in 1997 and increase steadily to 5.0 mmt by 2010. Inadequate information on rice stocks is reflected in an assumption of zero change over the forecast period.

Australia

Australia harvested 148 thousand ha of rice in 1997. This was a decrease of 18 thousand ha from 1996 due to shortage of irrigation water. Harvested area is projected to expand to 168 thousand ha in 1998 and gradually increase to 174 thousand ha by 2010, based on expectations of normal level for irrigation water (Table 23 and Figure 28). The dominant rice

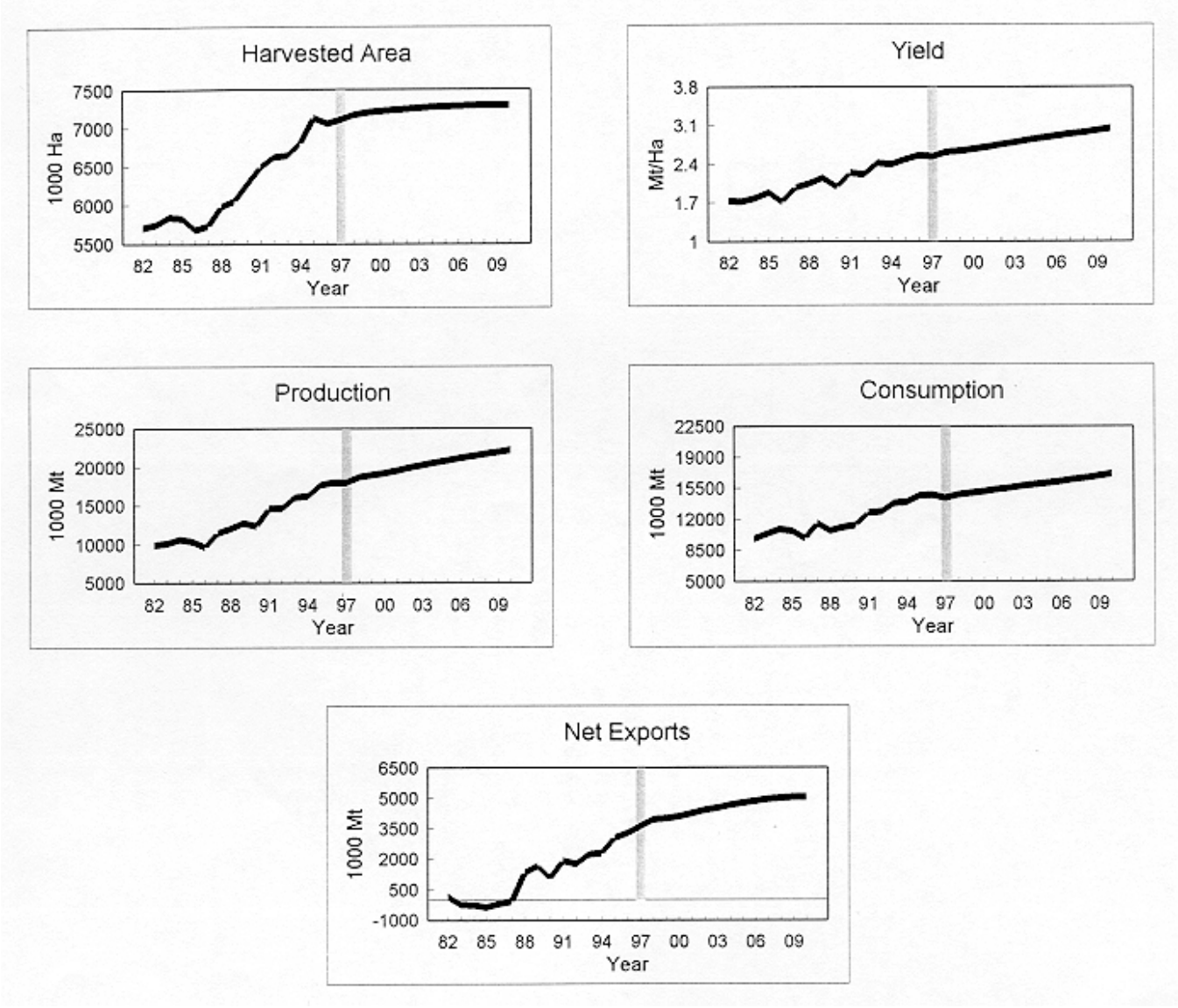

Fig. 27. Arkansas Global Rice Model 1998 projections: Vietnam rice.

growing area is in Murray-Darling basin in New South Wales (NSW). NSW has approximately 1,800 irrigated growers (USDA/FAS, 1998). Rice yields in Australia are influenced by market conditions and the development of new technologies. Average yield per ha is projected to decrease to 6.06 mt in 1998 from 6.21 mt in 1997 before increasing steadily to 6.75 mt by 2010. Total production in Australia is projected to increase to 1.2 mmt in 2010 from 918 thousand mt in 1997.

Per capita consumption is projected to grow steadily at 0.8 percent per year. Per capita consumption has been growing because of an increasing number of Asian immigrants and rising health consciousness among consumers. Total consumption is projected to increase from 290 thousand mt in 1997 to 356 thousand in 2010 due to population growth (0.97 percent in 1997 and ranging between 0.7 and 0.9 percent thereafter). The country's economic growth is projected to stabilize around 3.4 percent. While Australia's economy is dominated by its services sector (65 percent of GDP), agricultural and mining sectors (8 percent of GDP combined) account for the bulk (57 percent) of the country's goods and services exports.

Over 70 percent of Australia's rice production is exported, driven by aggressive international marketing. Papua New Guinea is its biggest single customer. Trade with some Pacific Island nations is sometimes constrained by economic

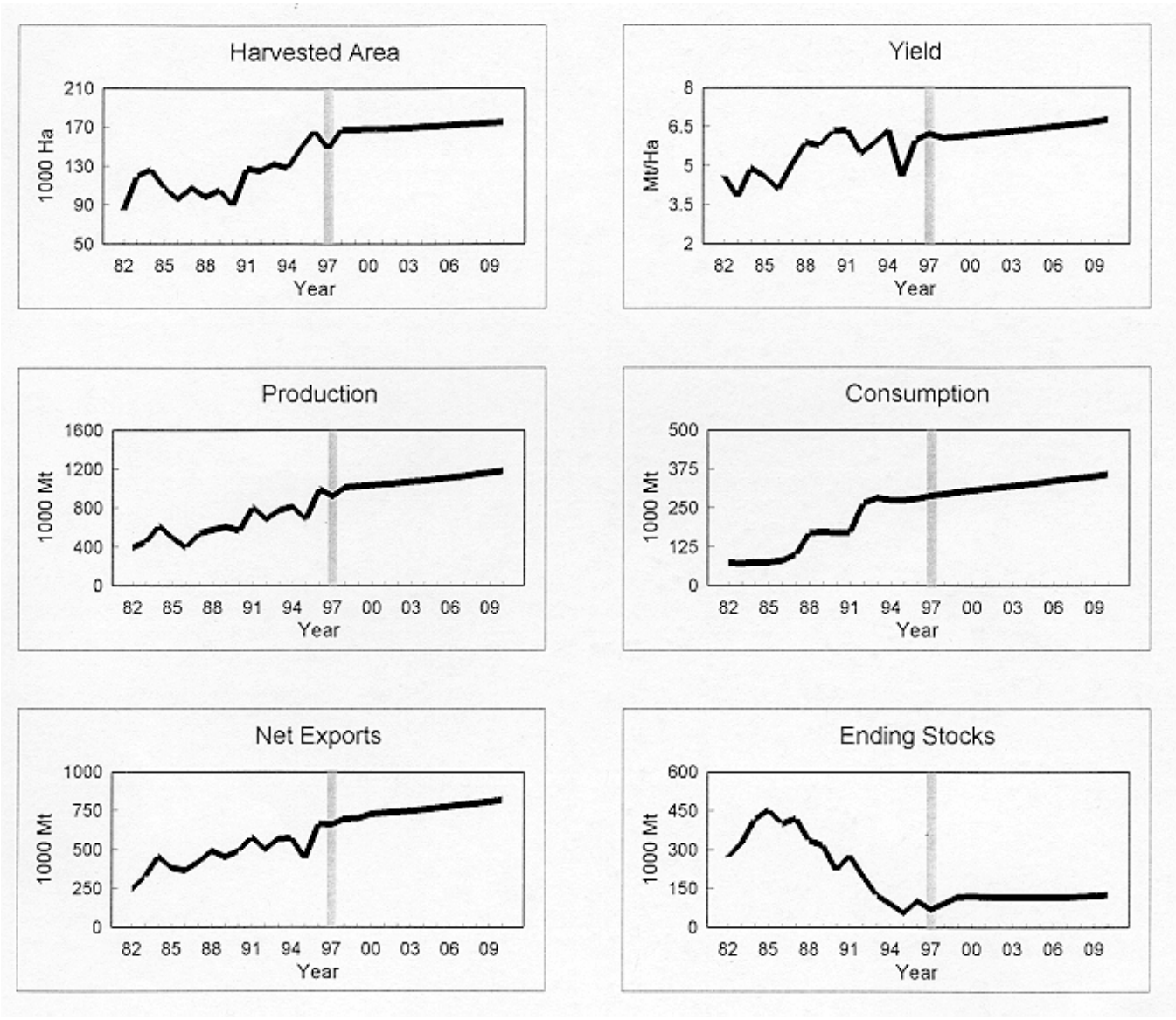

Fig. 28. Arkansas Global Rice Model 1998 projections: Australia rice.

problems and lack of foreign exchange of those countries. Australia provides approximately a quarter of Japanese rice import quota commitments. Australia is producing rice specifically for the Japanese market and currently expects to provide 100 thousand mt. Net exports are projected to increase to 697 thousand mt in 1998 from 661 thousand mt in 1997 and increase steadily to 818 thousand mt by the year 2010.

The Australian market is open to imports with zero tariff. The local industry is concerned that imports are taking an increasing share of the domestic market (currently around 20 percent). Asian immigrants prefer fragrant rice such as jasmine and basmati. Thailand is the largest supplier at 20-25 thousand mt per year. Other suppliers are India, Pakistan, Italy and the US. The rice cooperative has responded to this import demand by promoting production of fragrant rice even though it has a higher cost of production and requires a premium by producers. Ending stocks remain around 100 thousand mt over the projection period.

Egypt

Rice is planted during May-June and harvested in late October. All rice production is irrigated and located in the Nile delta area in lower Egypt. Most of the rice produced is

short grain japonica varieties. Rice is a summer crop grown following winter crops with berseem being the most common. Additional winter crops include wheat, broad beans and sugar beets. Rice is the second largest crop in summer following corn, and cotton is the third largest crop (USDA/FAS, 1998) .

Due to a scarcity of water for irrigation, the government of Egypt has attempted to restrict rice production to an area of 378 thousand ha. Rice production has been more profitable than that of alternative crops, and the government has not enforced the area restrictions through fines. This has resulted in a rice production area far surpassing the government restriction for the past four years. In 1996 and 1997 rice area was 591 and 630 thousand ha, respectively (USDA/FAS, 1998).

A new rice policy was announced in November 1997 with the objective of reducing the area planted to rice. The government of Egypt is promoting new rice varieties that are capable of increasing yields by 40 percent. Rough yield is expected to increase from an average of 8.5 mt per ha to 12 mt per ha. The current level of production could then be achieved with 30 percent less area. This would free up an estimated 3 billion cubic feet of water for the newly reclaimed land. The government plans to have all rice area planted to new varieties by the year 2000. The 3 billion cubic feet of water would be utilized in new agricultural projects to produce high-value horticultural crops (USDA/FAS, 1997 and 1998).

Egypt has been instituting reforms to reduce the State's role and increase reliance on market mechanisms. Some of the reforms instituted in 1991 include lifting of foreign exchange controls, unification of exchange rate, instituting a sales tax, reduction of the budget deficit and freeing interest rates. The government is focusing on improving the country's export competitiveness, liberalizing its trading regime, encouraging the private sector, eliminating obstacles to doing business and improving the investment climate. Egypt reduced tariffs across the board effective October 1, 1996, lowering the maximum tariff from 70 percent to 55 percent and further reducing it to 50 percent in July 1997. Egypt became a member of the WTO in June 1995. Import barriers such as high tariffs and quality control requirements that discriminate against imports still remain. Direct export subsidies do not exist in the country. Under its commitment to the World Bank, Egypt has abolished privileges enjoyed by public sector enterprises (e.g., subsidized inputs, credit facilities, reduced energy prices and preferential custom rates), thus reducing the indirect subsidization of exports (US Department of State, 1997).

The harvested rice area in Egypt is projected to decline to 600 thousand ha in 1998 from 630 thousand in 1997 and stabilize at 500 thousand ha by 2002 (Table 24 and Figure 29) due to government policy limiting the use of water for rice. Rice yields in Egypt, which are one of the highest in the world, are projected to increase to 5.02 mt per ha in 1998 from 4.69 mt in 1997 and grow steadily to 5.81 mt in 2010 (equivalent to an annual growth rate of 1.7 percent). Increases in yields are mainly driven by improvements in development and extension of technology. The yield levels are decreased relative to the 1997 baseline due to uncertainties regarding allocation of water, genetic potential of the varieties under test and soil salinity problems. Total production is projected to remain within the range of 2.7 to 3.0 mmt over the forecast period.

Annual per capita consumption is projected to decrease slightly to 41.8 kilograms in 1998 from 42.1 kilograms in 1997 and decline gradually to 35.1 kilograms by the year 2010 as income grows. The country's economy is forecast to grow by 5.6 percent per year over the forecast period. Due to population growth (1.9 percent in 1997 and stabilizing at 1.6 percent by 2006), total consumption is projected to remain between 2.6 and 2.8 mmt over the forecast period. Net exports are projected to decrease to 124 thousand mt in 1998 from 306 thousand in 1997 and decrease steadily to 78 thousand mt by the end of the projection period. Ending stocks are projected to range from 600 to 800 thousand mt.

Argentina

The comprehensive reform program implemented in Argentina under the Menem administration began in 1991. It has revitalized the country's economy and has transformed the country from a closed, highly regulated economy to one based on market forces and international trade. Price controls on almost all goods and services have been eliminated. Argentina, Brazil, Paraguay and Uruguay established the trade bloc Mercosur in 1991 and in January 1, 1995, formed a partial customs union with a common external tariff (ranging from zero to 23 percent) covering nearly 85 percent of trade. Chile and Bolivia signed a free trade agreement with Mercosur, exclusive of common external tariff, on October 1, 1996, and April 30, 1997, respectively. Argentina became a founding member of the WTO on January 1, 1995. The Argentine government abolished the import licensing system in 1989 and in 1990 cut the average tariff from about 29 percent to less than 10 percent. However, the country's average tariff is now higher (nearly 17 percent) because Mercosur's common external tariff rates are higher (Bierlen et al., 1997; US Department of State, 1997).

Argentina experienced severe flooding during the 1997 crop year, causing substantial declines both in area and yields. Harvested area in Argentina in 1997 dropped to 195 thousand mt from 230 thousand in 1996. Area is expected to recover in 1998 to 232 thousand ha and increase steadily to 364 thousand ha by 2010 (Table 25 and Figure 30). Considerable land area is available to be developed for rice produc-

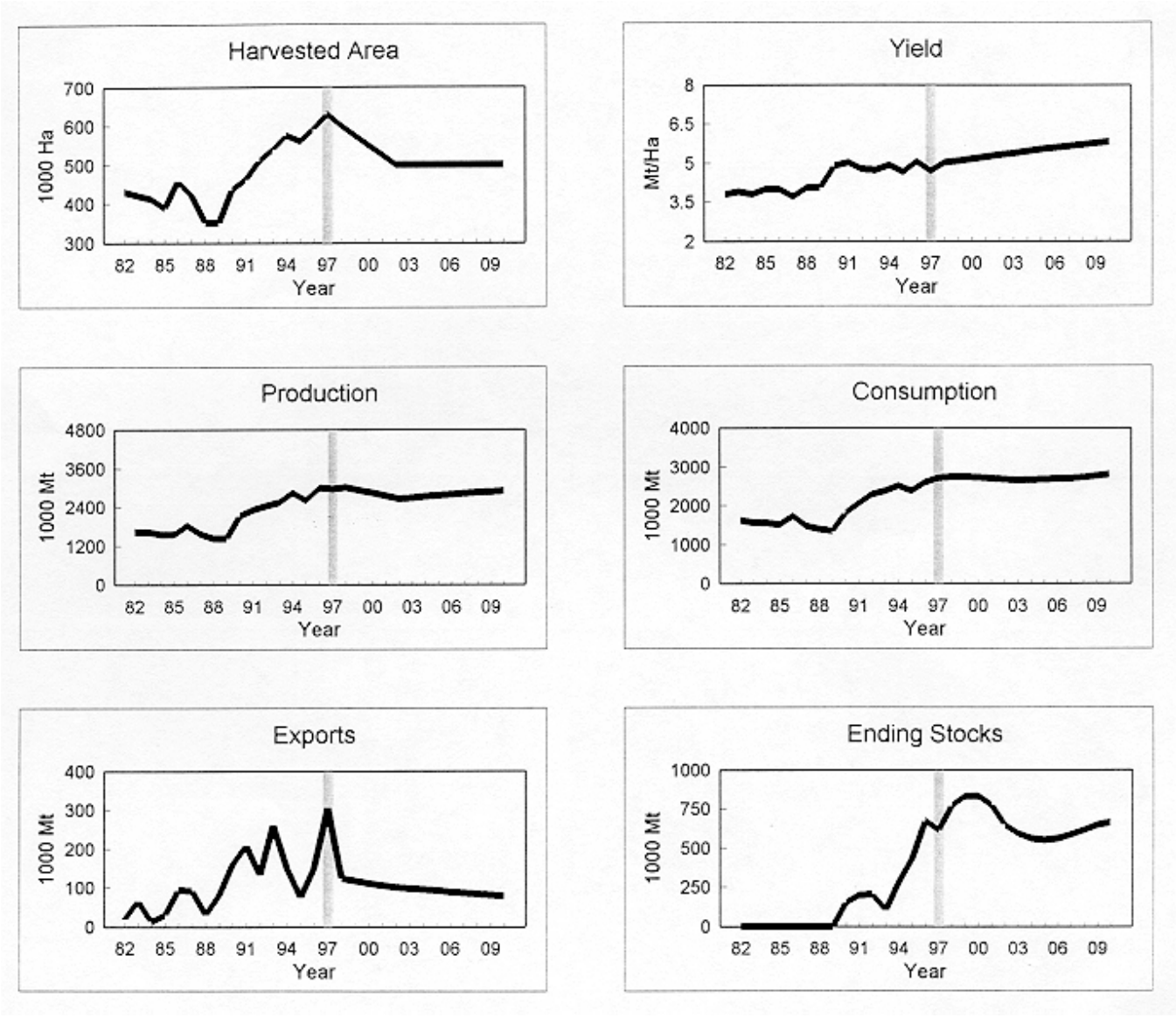

Fig. 29. Arkansas Global Rice Model 1998 projections: Egypt rice.

tion. However, some of these areas, such as in Corrientes, are subject to excessive flooding. Irrigation systems also need to be developed at a reasonable cost to sustain the expansion of rice area. Gains in yield are expected due to improved varieties, technology and fertilizer use. Yields decline by over 11 percent to 3 mt per ha in 1997 due to flooding. The average yield per ha is projected to recover to 3.43 mt in 1998 and increase steadily to 4.15 mt by 2010. With gains in both area and yield, total production is projected to more than double over the forecast period, increasing to 1.5 mmt in 2010 from 583 thousand mt in 1997.

Per capita consumption is projected to increase slightly to 6.62 kilograms in 1998 from 6.59 in 1997 before increasing steadily to 7.81 by 2010, an annual growth of 1.3 percent. Total consumption is projected to increase from 231 thousand mt in 1997 to 313 thousand by 2010. The country's economy is expected to grow between 4 and 5 percent per year over the projection period. Argentina previously maintained export taxes on rice, but starting in 1992 a subsidy of 2.5 percent was implemented.

As a member of the Mercosur, the Argentine rice industry has benefitted by an expansion in Brazilian rice imports with protection of a common external tariff of 20 percent. The

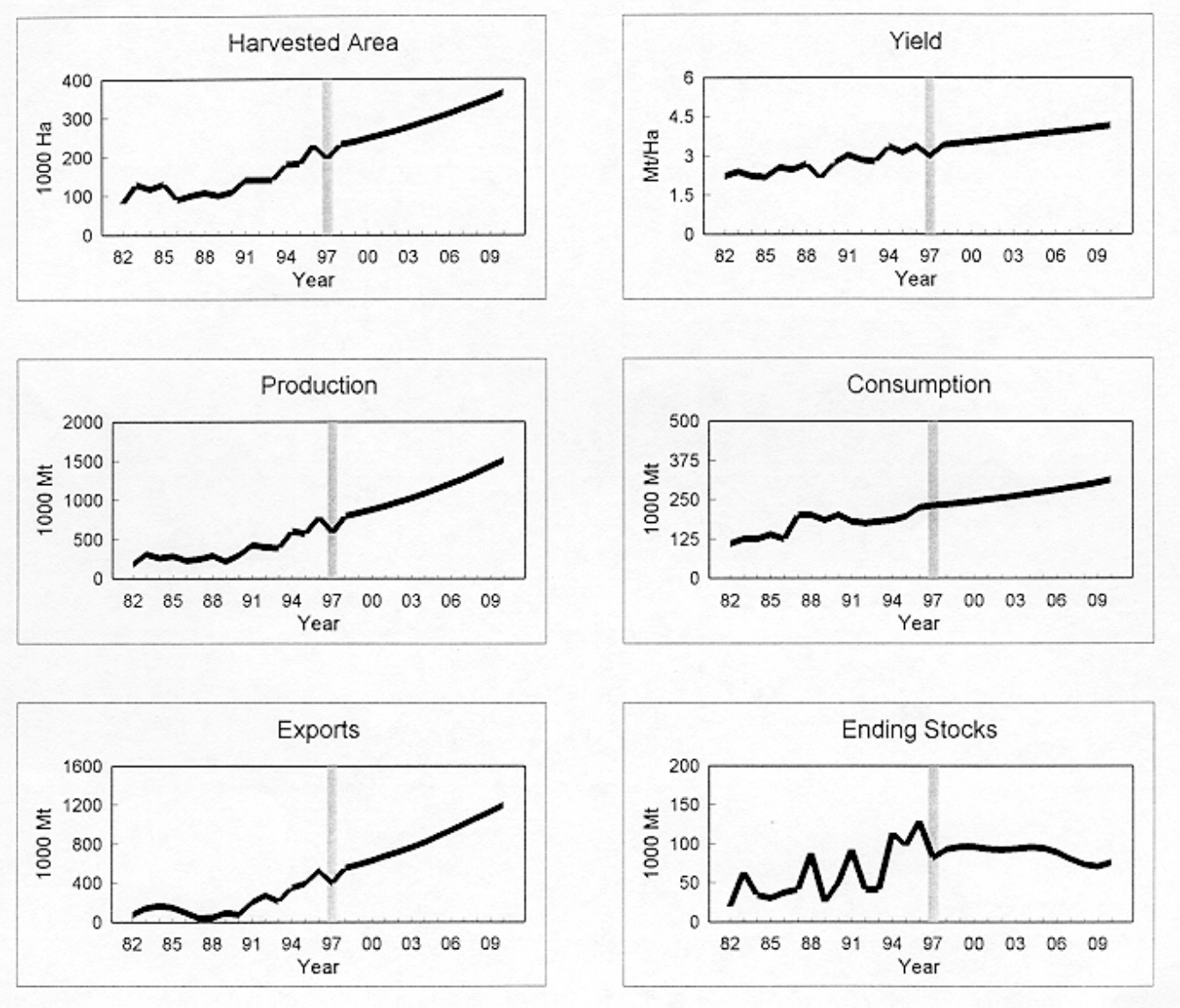

Fig. 30. Arkansas Global Rice Model 1998 projections: Argentina rice.

country's total exports are projected to increase substantially from 399 thousand mt in 1997 to 1.2 mmt by 2010, equivalent to an annual growth of close to 9 percent. Ending stocks will range from 70 to 100 thousand mt during the same period.

Uruguay

Uruguay has a small, relatively open economy. The country's economy is historically agriculture-based. Agriculture remains important especially in the case of beef, wool and rice. Supported with the country's Mercosur membership, trade is advancing rapidly. Trade with Argentina and Brazil accounts for nearly half of Uruguay's total world trade. The US is the third largest trading partner for Uruguay. The Uruguayan government allows the peso to float against the dollar within a seven percent range. The country has no foreign exchange controls and allows free conversion of the peso into dollars for transactions. Most of the economy is "dollarized." Procurement practices are well-defined, transparent and closely followed. The country's present tariff structure is set by the Mercosur (Bierlen et al., 1997).

Uruguay's rice crop suffered also from severe flooding in 1997. While harvested area increased by 5 percent to 163 thousand ha, yields decreased by about 10 percent to 4.15 mt

per ha. Harvested area is projected to increase to 168 thousand ha in 1998 and expand steadily to 210 thousand by 2010 (Table 26 and Figure 31). Uruguay experienced record yields of 4.55 mt per ha in 1995 and 4.63 mt in 1996. Yields are expected to recover in 1998 at 4.52 mt and increase steadily to 5.31 mt by 2010, which is equivalent to an annual growth of nearly 2 percent. Total production is projected to increase to 1.1 mmt in 2010 from 678 thousand in 1997.

Total consumption is projected to increase gradually from 80 thousand mt in 1997 to 106 thousand in 2010 as population grows at a decreasing rate (0.9 percent in 1997 to 0.3 percent by 2002). Per capita consumption is expected to increase steadily to 31.7 kilograms in 2010 from 25.0 in 1997 as incomes grow. The country's GDP growth is projected to decline to 2.6 percent in 1998 from 3.5 percent in 1997 and stabilize at 1.9 percent by 2001. Inflation rate, while declining, remains high at 26.7 percent in 1997 but is expected to decline and stabilize at 16.2 percent by 2001. As a member of Mercosur like Argentina, Uruguay has been able to increase its exports to Brazil due to the favorable external tariff. Brazil has normally imported about 75 percent of Uruguay's rice. Uruguay rice exports to Brazil are usually priced at a premium of $100 per mt above world market price. Uruguay exports high-quality long grain rice to non-

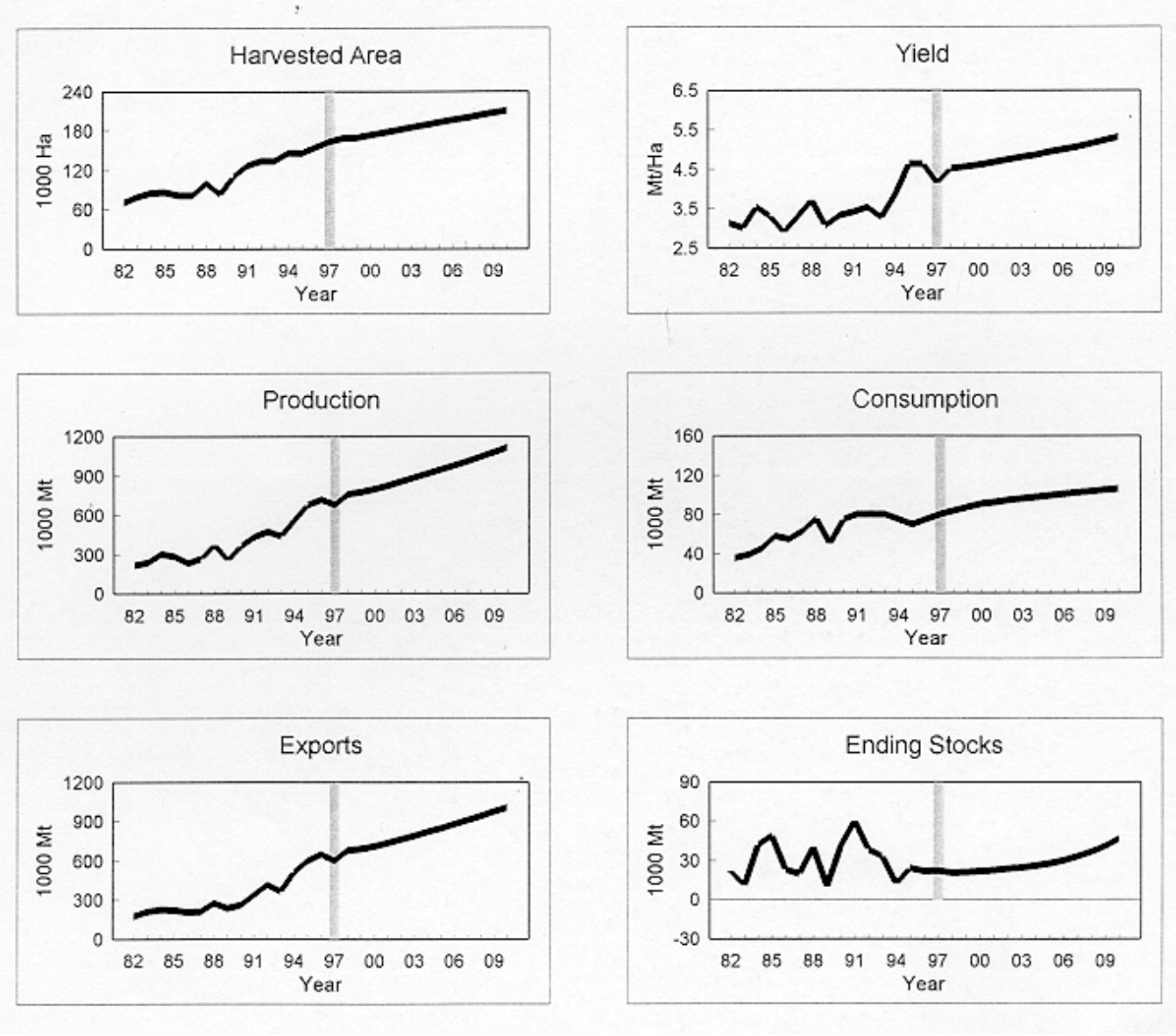

Fig. 31. Arkansas Global Rice Model 1998 projections: Uruguay rice.

Mercosur markets. The large crop during the 1995/96 crop year enabled the country to export rice to Iran, Peru, Mexico and Senegal. The country's exports are projected to increase to 1.0 mmt by 2010 from 597 thousand mt in 1997. Ending stocks range from 21 to 46 thousand mt during the same period.

MAJOR IMPORTING COUNTRIES

Brazil

Brazil is in the fourth year of an economic restructuring program designed to bring inflation down, dismantle state control of the economy, reduce market barriers and encourage greater private sector (including foreign) investment to achieve sustainable long-term growth. The process of trade liberalization initiated in 1990 has produced significant changes in the country's trade regime, resulting in a more open and competitive economy (US Department of State, 1997).

Brazil's economy grew around 3.9 percent in 1997 and is projected to stabilize at 3.6 percent by 2001. Population is expected to grow at a declining rate, i.e., from 1.1 percent in 1997 to 0.8 percent starting in 2005. The country experienced the third highest inflation rate in 1996 at 19.5 percent, which is expected to stabilize at 9.8 percent beginning in 2002. Since the introduction of a new currency, the Real, in July 1994, domestic inflation has dropped from an average monthly increase of 50 percent in the first half of 1994 to less than one-half percent per month in 1997. This situation has been achieved by maintaining high interest rates to attract foreign capital, a strong currency and market-opening measures, which increased competition and exerted downward pressure on prices, particularly for traded goods. Brazil is a founding member of the WTO. While the Brazilian government does not provide direct subsidies to exporters, it offers a number of tax and tariff incentives to encourage export production and encourage the use of local inputs for exported products. Brazil imposed new import financing rules, effective March 1997, that are adversely affecting a range of US exports to Brazil. The rule requires importers to purchase foreign exchange to pay for most imports upon importation or 180 days in advance, rather than when payment is due under the contract (Bierlen, et al., 1997; US Department of State, 1997).

Brazil has three rice production environments: lowland-irrigated, lowland rain-fed and upland rice areas. Ninety percent of the lowland-irrigated area is planted to modern rice varieties; 80 percent is planted in rotation with two years of rice and three years of pasture. There are 12,000 producers of irrigated rice in Brazil. The irrigated rice area is expected to grow at 2.2 percent per year over the forecast period. However, upland rice, which has served as a reclamation crop in new areas that eventually convert to soybeans, has been decreasing over time and is projected to decline by 1.7 percent per year over the same period. Total harvested rice area is projected to decrease by 0.4 percent annually, from 3.3 million ha in 1997 to 3.1 million by 2010, with the increase due to a relatively larger decline in upland area compared to the increase in irrigated area (Table 27 and Figure 32). Production constraints include the prevalence of red rice, rice water weevil and low temperatures during flowering time. The average yield per ha is projected to increase steadily from 1.82 mt in 1997 to 2.48 mt by 2010, an annual growth of 2.4 percent. This high yield growth rate is due in part to the projected shift to higher-yielding irrigated area and a decline in lower-yielding upland rice area. Total rice production declined dramatically in 1997 due to unfavorable weather, i.e., flood damage in Rio Grande do Sul and drought in the northeastern part of the country. Production is projected to recover to 6.5 mmt in 1998 and increase steadily to 7.7 mmt by 2010.

Annual per capita consumption is expected to stabilize around 48 kilograms over the projection period. Total rice consumption is projected to continue increasing steadily from 7.9 mmt in 1997 to 8.9 mmt in 2010. Brazil is expected to remain a rice-importing country, with projected net imports decreasing from 1.7 mmt in 1997 to 1.2 mmt in 2010. Most of Brazil's imports will come from the Mercosur countries Argentina and Uruguay. These countries have a major advantage because of relatively low transportation and production costs. Import tariffs on non-Mercosur rice in 1988 were 13 percent, but there was no tariff on imports from Argentina and Uruguay. Ending stocks are projected to build up to nearly 1 mmt by 2010 from 497 thousand mt in 1997.

European Union

The European Union (EU), the world's largest economy and the largest US trade and investment partner, is comprised of 15 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the UK). It is a unique organization in that the member states have ceded to it increasing authority over their domestic and external policies, although not all countries have agreed to monetary union. Those who have agreed are on course to implement the Euro monetary system by achieving a set of "convergence criteria" for monetary union: maximum deficit of 3 percent of GDP; gross national debt of 60 percent of GDP; inflation and interest rate levels no more than one and a half percentage points above the average of the three lowest rates among the member states; and two years of relative exchange rate stability. The EU intends to establish an Economic and Monetary Union (EMU) with a common monetary and exchange rate policy no later than January 1, 1999.

The growth of the EU's aggregate economy is projected to stabilize at 2.4 percent per year over the projection period. While the EU is important as both a rice importing and ex-

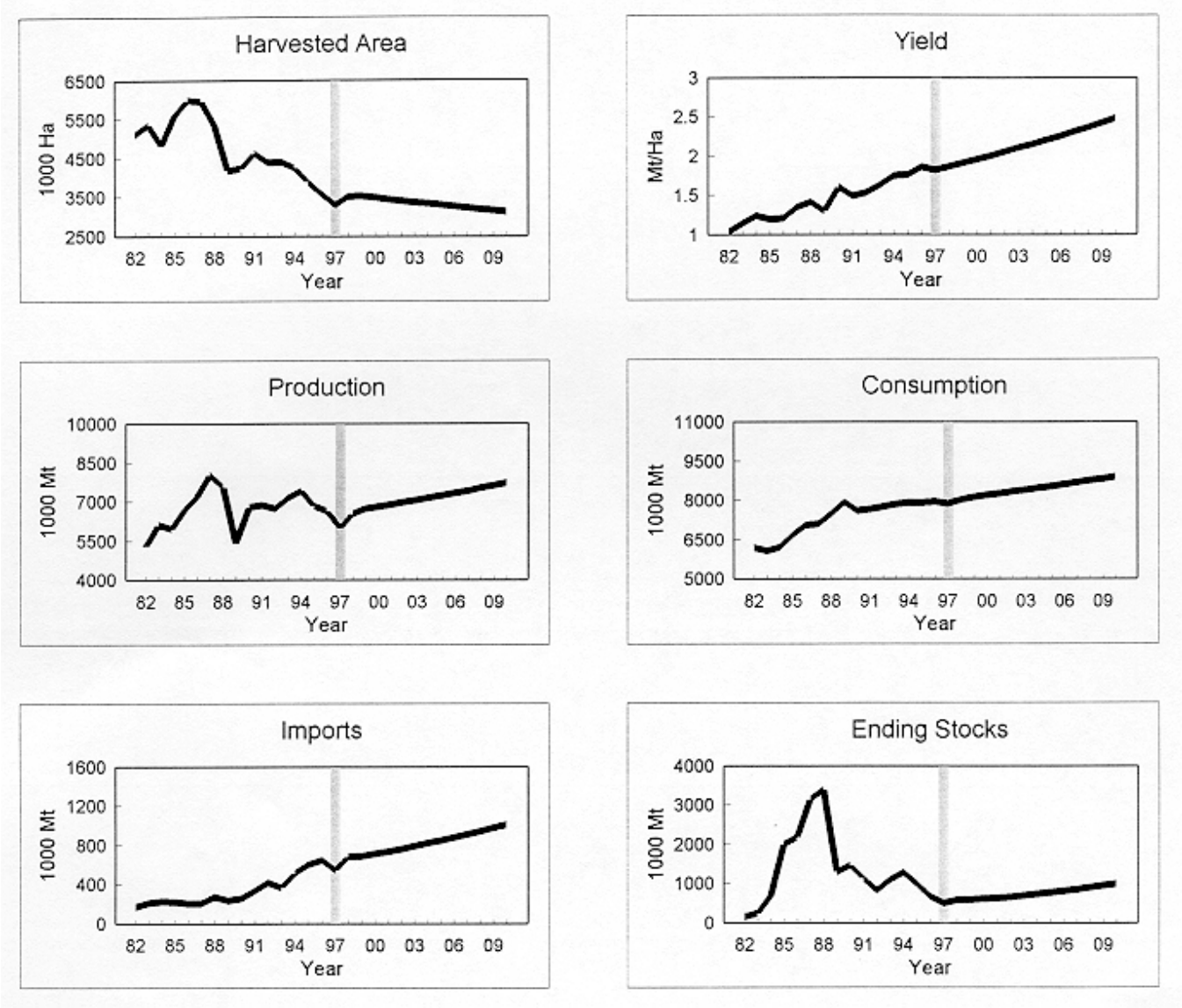

Fig. 32. Arkansas Global Rice Model 1998 projections: Brazil rice.

porting region, it has traditionally been a net importer and is projected to remain so over the forecast period. The total harvested area is projected to decrease gradually from 406 thousand ha in 1997 to 379 thousand by 2010 (Table 28 and Figure 33). Italy and Spain account for nearly 85 percent of EU's total rice area; hence, discussion in this paper focuses on these two countries.

Italy, which is the world's fifth largest economy, has undergone a dramatic transformation into an industrial power in the past 50 years. Italy maintains an open economy and is a member of major multilateral economic organizations such as the Group of Seven (G-7) industrialized countries, the Organization for Economic Cooperation and Development (OECD), The WTO, the IMF and the EU. However, certain characteristics of the Italian economy impede growth and reduce import demand. These include rigid labor markets, underdeveloped financial markets and a continued, heavy state role in the production sector. There has been some progress at addressing these structural issues. (US Department of State, 1997).

Spain's economy is growing very well. Growth is broadly based, with support coming from agricultural exports, capital

goods, investment and private consumption. Much of the country's economic policy has focused on meeting the criteria for consideration to join the monetary union. Under the EU's Common Agricultural Policy (CAP), Spanish farm incomes are protected by direct investments and guaranteed farm prices that are higher than world prices using high external tariffs. However, the Uruguay Round agreement requires that all import duties on agricultural products be reduced by an average of 36 percent during the six-year period beginning in 2000 (US Department of State, 1997).

Italy represents over 60 percent of EU's total rice area but is constrained from expanding its area beyond 240 thousand ha (Table 29 and Figure 34). Spain's rice area, on the other hand, is dependent on rain-fed reservoirs. Year-to-year variability in irrigation water supply has the largest impact on Spain's rice area. Under normal weather, Spain has had enough water for approximately 80 thousand ha of rice. Water supplies in 1998 are excellent, and rice area is expected to be above normal, despite the recent toxic sludge contamination of a 6,000-ha area that includes rice, cotton and horticultural crops. Over the longer term, rice area in Spain is projected to decline to 78 thousand ha by 2005 from 111 thousand in 1997 (Table 30 and Figure 35). The rest of EU's rice area

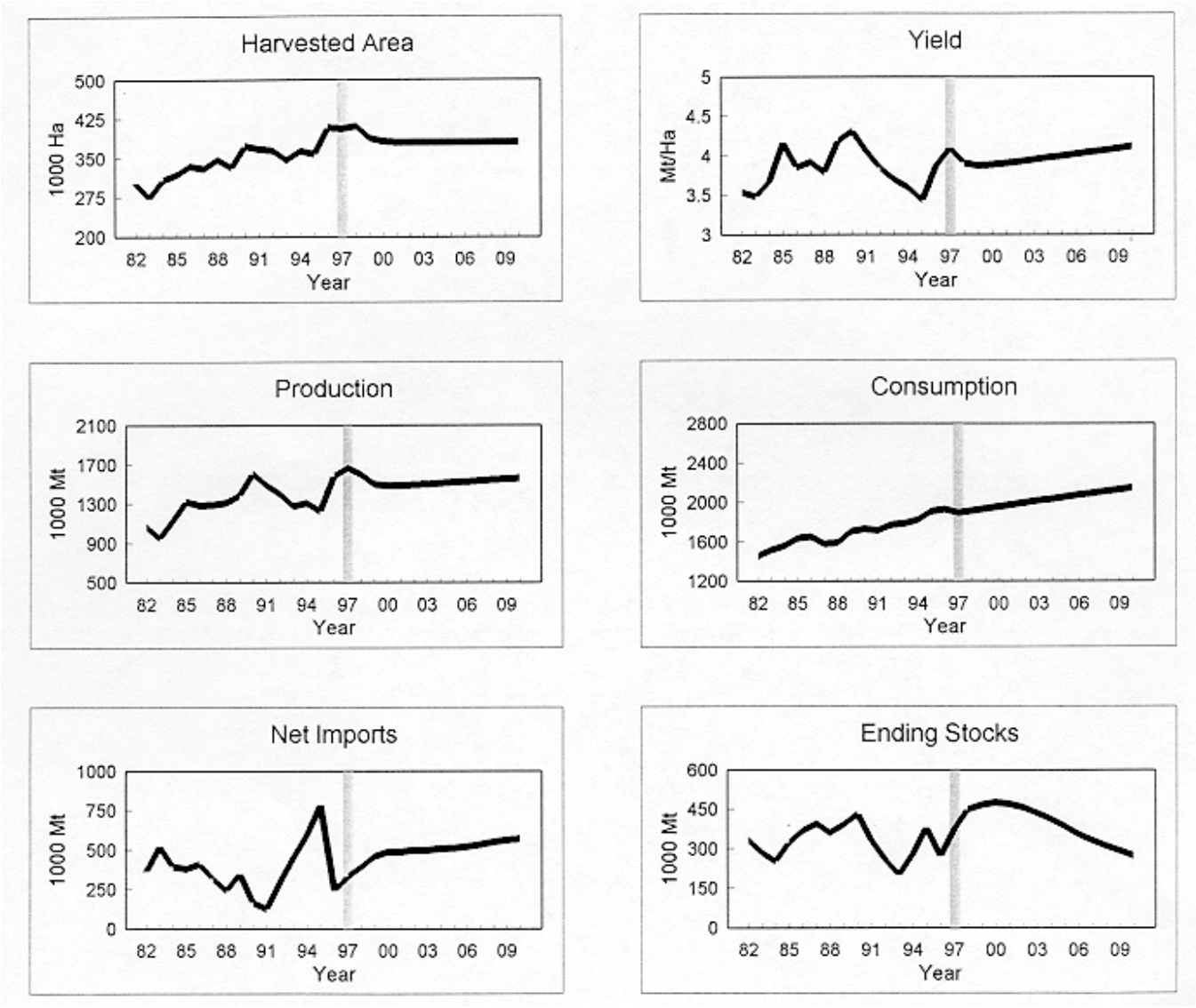

Fig. 33. Arkansas Global Rice Model 1998 projections: European Union rice.

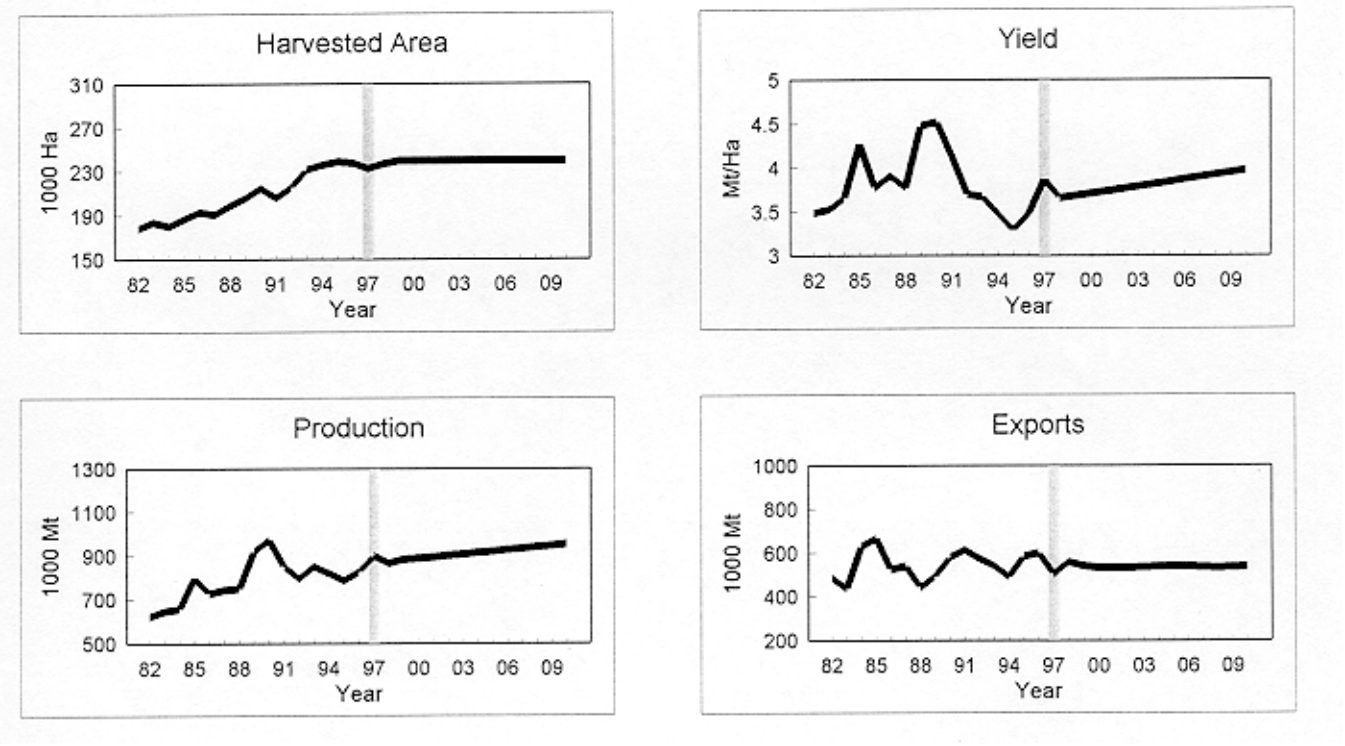

Fig. 34. Arkansas Global Rice Model 1998 projections: Italy rice.

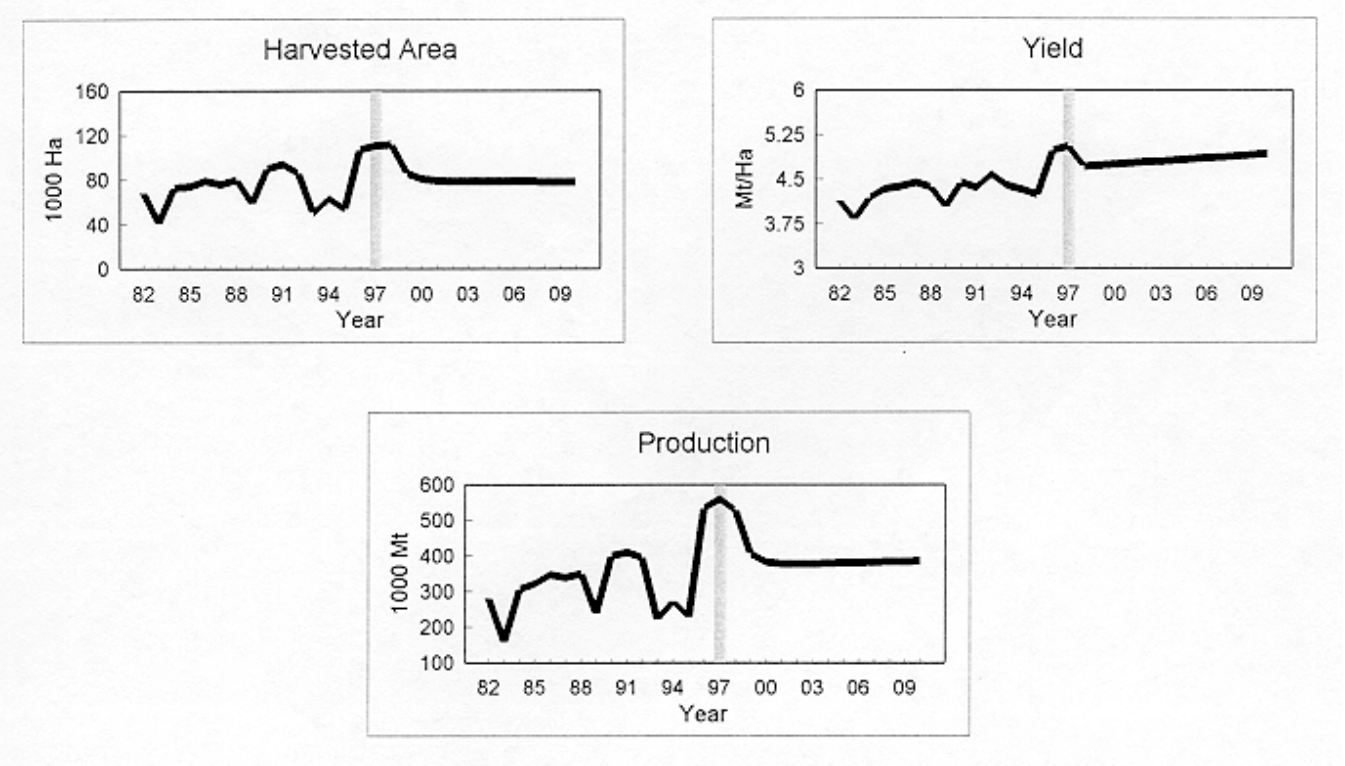

Fig. 35. Arkansas Global Rice Model 1998 projections: Spain rice.

(France and Greece) is expected to stabilize at 61 thousand ha over the forecast period (Table 31 and Figure 36).

The EU average rice yields are projected to be around 4 mt per ha during the projection period. Italy's 1997 average yield, at 3.87 mt, is 11 percent higher than the previous year's level mainly due to adequate water supply. Italy's yield is expected to follow trend levels starting in 1998, increasing by 0.7 percent per year during the rest of the forecast period. Average rice yield of Spain is projected to grow by about 0.4 percent annually during the same period, while average yields in other producing countries in the EU are expected to increase by 0.6 percent per year. Total EU production is projected to range between 1.5 and 1.6 mmt over the forecast period. Italian rice production increases from 901 thousand mt in 1998 to 953 thousand mt by the end of the projection period due solely to yield gains. Spain's production declines to 385 thousand mt in 2010 from 559 thousand in 1997. Production of the rest of EU is projected to increase from 203 thousand mt in 1997 to 222 thousand in 2010.

As the EU population grows slightly (0.30 percent in 1997 and declining to 0.13 by 2006), total rice consumption also is projected to continue growing marginally, i.e., from 1.9 mmt in 1997 to 2.1 mmt by 2010. Per capita consumption increases steadily from 5.36 kilograms in 1997 to 5.93 over the same period. As a result of reduced import levies and export subsidies, EU's net imports are projected to increase from 332 thousand mt in 1997 to 568 thousand mt in 2010. EU imposed a quota of 42,650 mt of rice imports for the first four months of 1997. Italy's exports, which are driven by available supply and real average medium grain export price, are projected to range between 530 to 560 thousand mt from1998 through 2010.

As part of the concessions made to the US as compensation for the accession of Austria, Finland and Sweden to the EU, the EU agreed to implement tariff quotas for imports of 38,000 mt of milled rice and 8,000 mt of brown rice from the US. On July 1, 1995, the EU implemented its Uruguay Round commitment for grains and rice using a reference price system. The US gained an agreement with the EU, with the EU committing to implement a system allowing importers of brown rice the possibility to cumulatively recover duty overages that might occur. This agreement was designed as a one-year trial and implemented on July 1, 1997 (US Department of State, 1997).

The EU has tightened up rice quality standards as part of a sweeping reform of its rice market under the CAP. The regulation determining the standard quality of rice (No. 3073/95) replaces the 1976 requirements. It states that paddy rice must be of a "sound and fair marketable quality, free of odor."

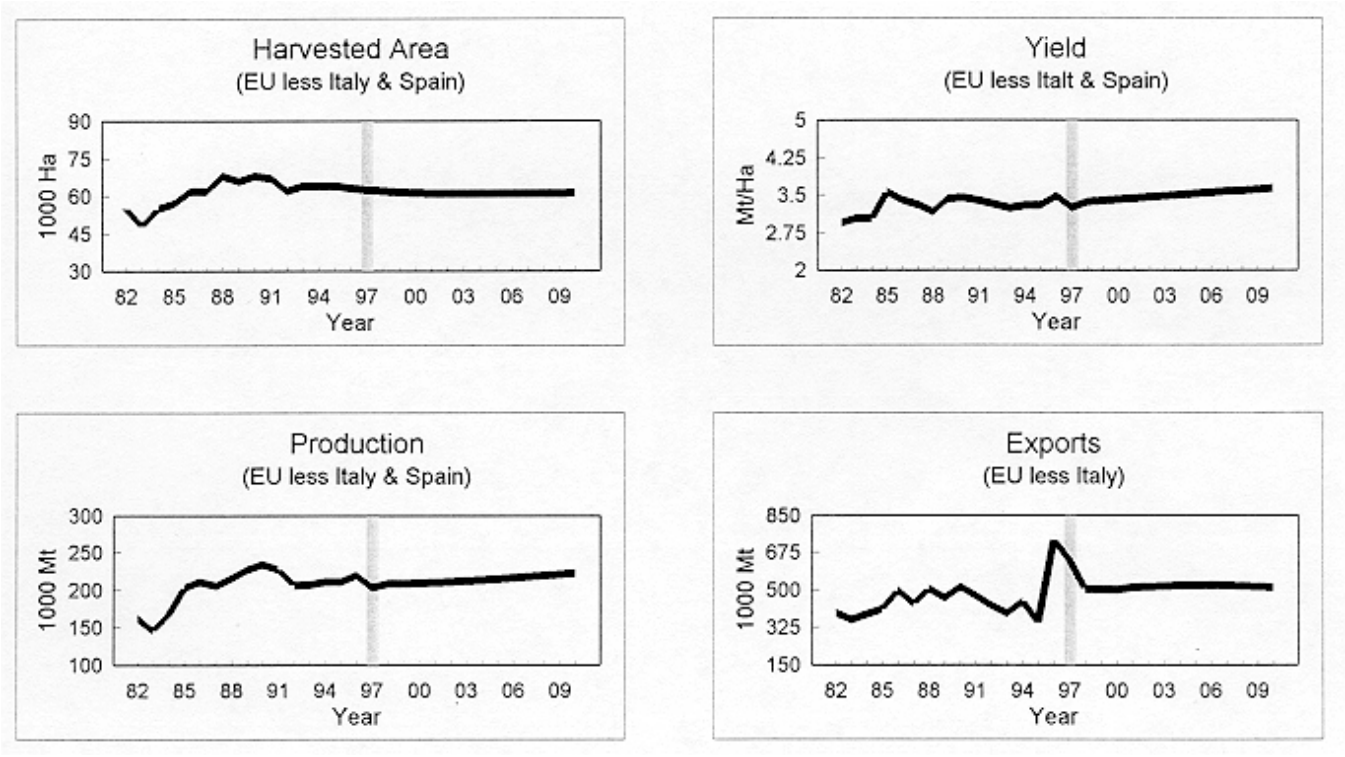

Fig. 36. Arkansas Global Rice Model 1998 projections: other European Union rice.

Moisture content is limited to 14 percent in 1997 and 1998 and 13 percent thereafter.

Indonesia

Indonesia has made significant economic progress over the past three decades. Real GDP grew at an average of over 7 percent during the period 1991-1996, with inflation ranging from 5 to 10 percent. But by mid 1997 a major financial crisis confronted Indonesia. The first major catalyst of the crisis began on July 1, 1997, when Thailand allowed the baht to float against the dollar and other currencies for the first time in 14 years. The baht fell more than 15 percent; traders, economists and *The Wall Street Journal* lead articles predicted dire affects on other Asian-Pacific currencies. The Indonesian rupee was R2,450 to the US$ in July 1997; by December the exchange rate fell to R4,000, and by June 1998 it was R10,400. Inflation in the second half of 1997 increased from 5.5 percent in June 1997 to 8 percent by December, but by May 1998 inflation was at 40 percent, shortly after President Suharto resigned. The second major catalyst was drought conditions caused by El Niño. Planting of the main rice crop was delayed by two months, to December-February, with yields and area harvested both lower. This led to the largest annual rice imports for any country to date.

The government enforces a system of floor and ceiling prices for certain "strategic" food products such as rice. The country launched a set of economic reforms in November 1997 that reduced the number of such products. These reforms were initiated with encouragement from the IMF. Some goods, such as fertilizer and electricity, enjoy direct government subsidies. The number of items subject to import licenses and other non-tariff import barriers such as special licensing requirements are being reduced. While distribution in the domestic market is still restricted, the November 1997 reform allows foreign firms that produce in Indonesia to directly distribute their products domestically; beginning in 2003, such firms may sell their products at the retail level (US Department of State, 1997).

As the third largest rice producing and consuming country in the world, Indonesia's participation in international rice trade in the past has been relatively small but volatile. At times it has been a major importer, at other times a significant exporter. The government has promoted a rice self-sufficiency policy for many years. Area harvested in the country is influenced by farm prices and increasingly by industrial development, with significant conversion of highly productive rice areas in Java to housing and industrial use. The government is trying to expand rice production by developing 1.0 million ha of new rice area, specifically in Central Kalimantan. However, progress is constrained because at least 400 thousand ha of the 1.0 million new agricultural land may not be suitable for rice due to thick peat layers. The estimated cost of the project is Rp5 trillion. The government also plans to introduce new high-yielding varieties, expand irrigation and encourage the use of more efficient type of fertilizers. The country is also developing 350 thousand ha of farmland for rice over 26 provinces distributed across South Celesta, West Java, North Sumatra and West Sumatra–aimed at increasing rice production. Java accounts for over half of Indonesia's rice production (USDA/FAS, 1997).

Indonesia's rice area is a function of government support and input (fertilizer) prices. However, in 1997 Indonesia's rice crop was substantially affected by the El Niño weather phenomenon, reducing area by 2.4 percent, yield by 1 percent and total production by 3.4 percent compared to 1996. The area harvested is projected to recover slightly to 11.3 million ha in 1998 from 10.8 million in 1997 and increase steadily to 11.9 million ha by the year 2010 (Table 32 and Figure 37). Due to a strong national commitment to rice research and the adoption of IRRI varieties, yields are projected to increase from 2.86 mt per ha in 1997 to 3.13 mt by the end of the projection period. Total production is projected to increase to 32.5 mmt in 1998 from 30.9 mmt in 1997 and reaching an annual output of 37.3 mmt by 2010.

Per capita use, which has increased over the past several decades, reached 166.6 kilograms in 1997 and is expected to remain between 164 and 166 kilograms over the forecast period. Per capita consumption is a function of GDP and real retail prices; the positive effect of GDP is counterbalanced by the negative effect of increasing real retail prices. Total consumption is projected to increase to 35.2 mmt in 1998 from 35.9 mmt in 1997. By 2010, consumption is expected to be 41.0 mmt due to population growth (1.51 percent in 1997 but projected to decline to and stabilize at 1.25 percent by 2007).

While Indonesia has a policy of self-sufficiency, production shortfalls are expected to make the country a net rice importer during the projection period. Under the GATT accord, Indonesia would phase out non-tariff barriers and reduce the bound tariff rate to 160 percent by 2004. The El Niño-related crop shortfall caused Indonesia to become the top importer in 1997 with net imports of nearly 5 mmt, six times its 1996 quantity and a world record. As in the past, the country is expected to remain a source of volatility in the world rice trade, mainly due to weather-related factors. Net imports are projected to decrease to 2.6 mmt in 1998 and to 2.3 mmt in 2000 and gradually increase to 3.7 mmt by 2010. Ending stocks should increase steadily from 1.5 mmt in 1997 to 1.8 mmt in 2010 (Table 30).

Iran

Iran's economic difficulties are an offshoot of the country's struggle with a government program of austerity designed to cope with the excesses of the reconstruction boom of the early 1990s, the government's failure to implement promised economic reform measures and a stagnant petroleum sector.

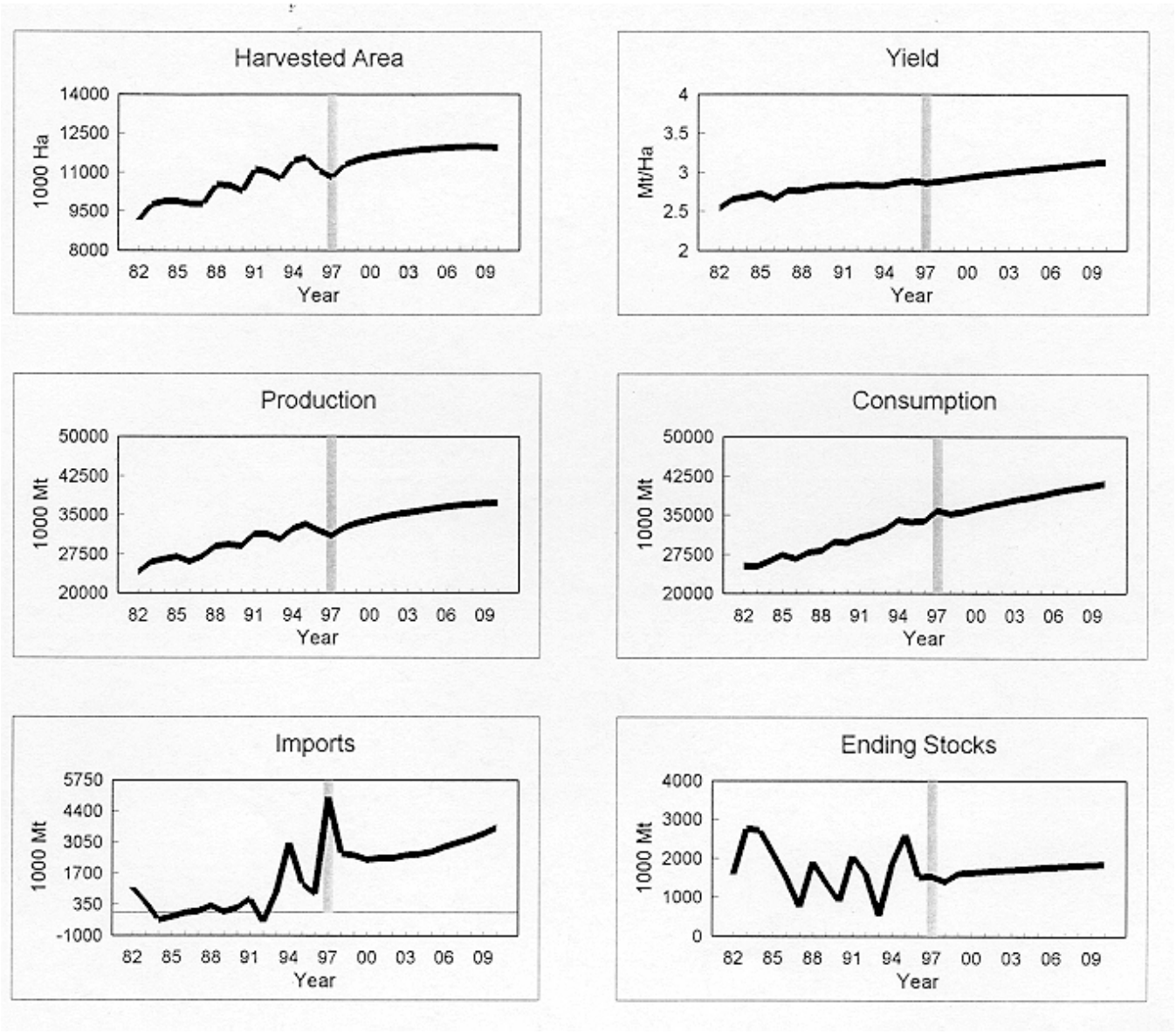

Fig. 37. Arkansas Global Rice Model 1998 projections: Indonesia rice.

While the country did not resort to external debt during the eight-year war with Iraq, Iran borrowed heavily during 1988 through 1992–leading to the current external debt of nearly $30 billion. The principal of the rescheduled debts became due in 1997, and the country's ability to make timely payments remains uncertain. To aggravate the situation, Iran is not a member of the WTO, and US investments in and trade with Iran are prohibited under Executive Order 12959, which took full effect in August 1995 (US Department of State, 1997).

Iran's economy grew by 2.6 percent in 1997 and is expected to stabilize at 3.3 percent by 2001. Iran experienced a high rate of inflation over the past two years (45.6 percent in 1996 and 30.2 percent in 1997), which is expected to decline to 23.1 percent in 1998 before stabilizing at 8.5 percent by 2001.

Harvested rice area in Iran has recently increased due to the government's high domestic price and its support in improving the agricultural market infrastructure (e.g., farm-to-market roads) which benefit rice production. The area harvested is projected to increase from 600 thousand ha in 1997 to 609 thousand in 1998, and increase steadily to 707 thousand ha by 2010 (Table 33 and Figure 38). Yields per ha increase from 2.67 mt in 1997 to 3.02 mt by 2010. Likewise,

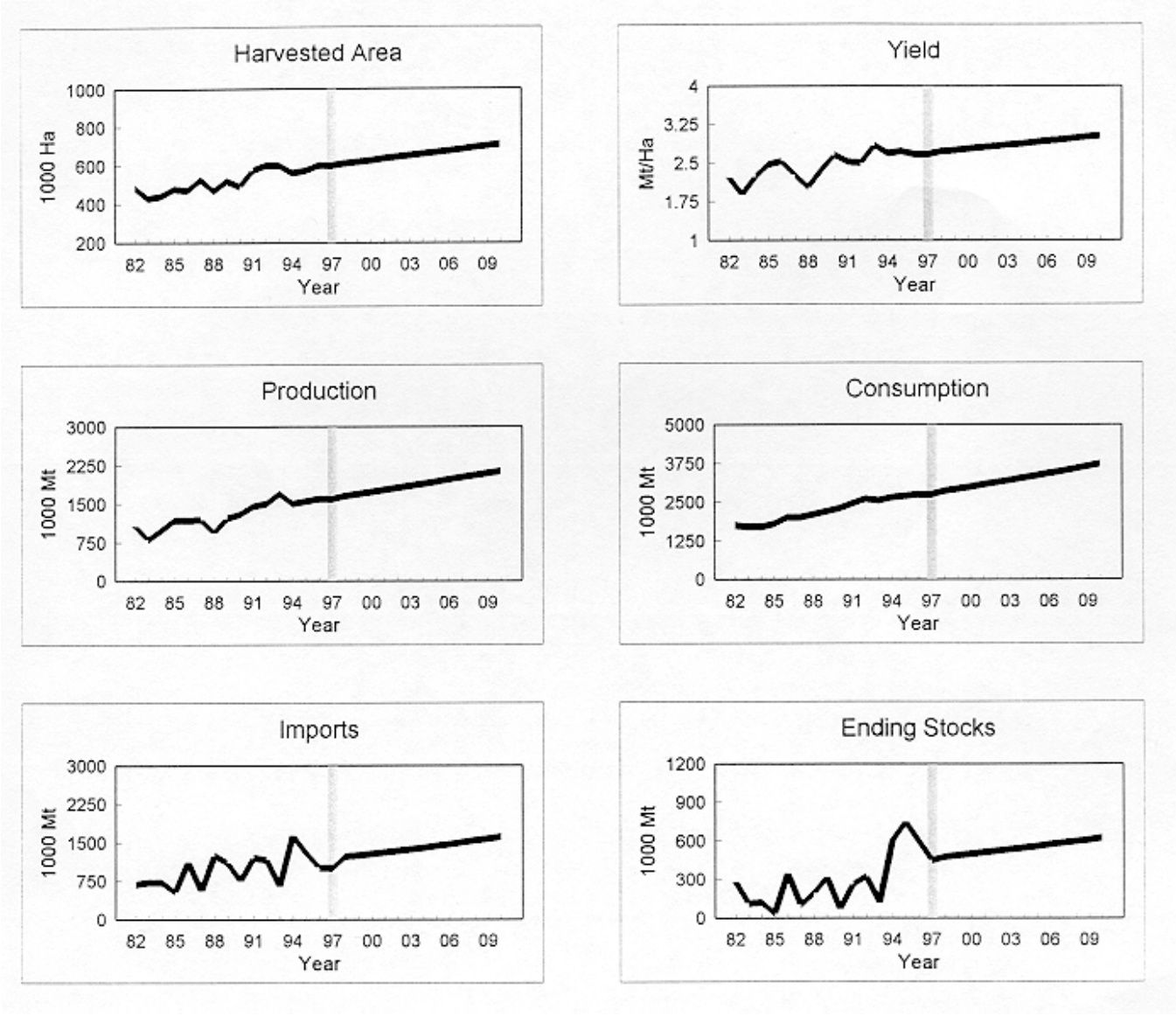

Fig. 38. Arkansas Global Rice Model projections: Iran rice.

total rice production is projected to grow steadily from 1.6 mmt in 1997 to 2.1 mmt by 2010.

Annual per capita consumption is projected to increase gradually from 43.2 kilograms in 1997 to 44.6 kilograms by the end of the forecast period. Growth in total rice consumption is projected to continue, increasing from 2.75 mmt in 1997 to 3.73 mmt in 2010, due primarily to population growth of over 3 percent over the forecast period. Total rice consumption is also a function of real CIF rice prices and real GDP.

Iran's government has a monopoly on rice imports. It is expected to remain a rice-importing country, with imports increasing to 1.2 mmt in 1998 from 1.0 mmt in 1997. Net imports are expected to grow steadily, reaching 1.6 mmt by 2010. Sale of imported rice in Iran is controlled through issuance of ration coupons. Ending stocks are expected to range between 500 and 600 thousand mt over the projection period.

Iraq

A United Nation's near-total trade and air embargo on Iraq, and freezing the country's overseas assets, is still in effect, and the country's economy has continued to deteriorate. For humanitarian reasons, the U.N. Security Council passed Resolution 986 in April 1995, allowing Iraq to export

$1 billion worth of oil every three months and to use the proceeds to purchase food, medicine and other essential items for civilian purposes. The Iraqi government refused to implement the resolution initially but finally agreed to an "oil-for-food deal" in December 1996.

Iraq depends on imports for most of its rice requirements for domestic consumption. Domestic production capacity has improved in recent years, but it remains vulnerable to weather and political conditions. It is becoming increasingly difficult for the government to convince farmers to sell their harvest to the government. Most farmers prefer to hoard their production or sell it on the black market at much higher prices than are paid by the government.

Iraq harvested 140 thousand ha of rice in 1997. Area is expected to increase by 8,000 ha in 1998 and continue increasing gradually to 165 thousand ha by 2010 (Table 34 and Figure 39). Yields per ha are projected to increase steadily from 1.43 mt in 1997 to 1.80 mt in 2010. Total production in 1997 remained flat at 201 thousand mt but is projected to increase steadily thereafter, reaching 297 thousand by 2010.

Total consumption is projected to increase rapidly as population grows at 3 percent per year and incomes rise. As is true for Iran, Iraq's total rice consumption is driven by real CIF rice prices and real GDP. The country's inflation is assumed to be stable at 4.2 percent. Rice consumption increased sub-

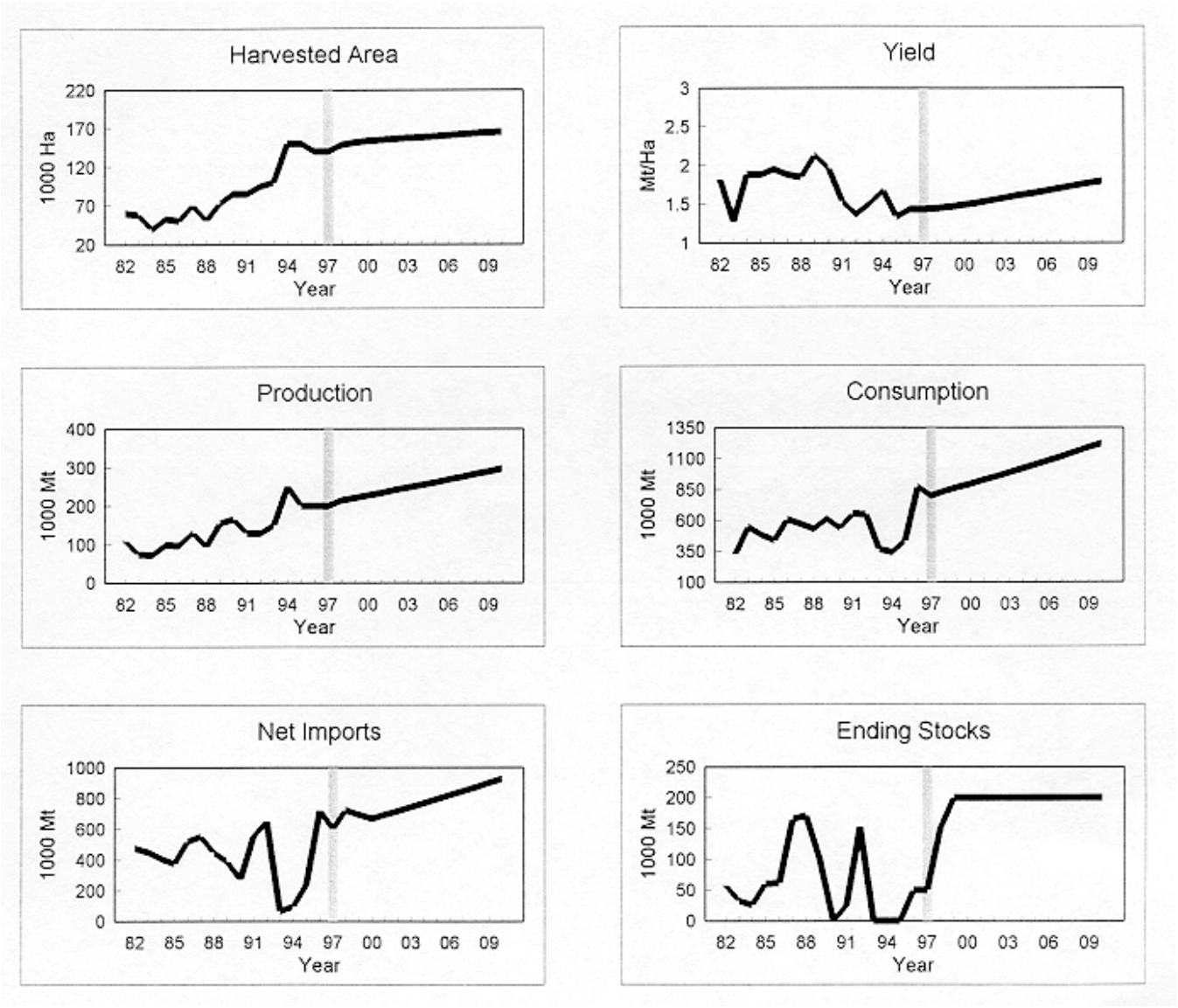

Fig. 39. Arkansas Global Rice Model 1998 projections: Iraq rice.

stantially to 870 thousand mt in 1996 from 450 thousand in 1995 due to the food-related relaxation of the ban for humanitarian reasons. The consumption estimated for 1997 is 800 thousand mt but would increase steadily to 1.2 mmt by 2010. Annual per capita consumption is projected to increase to 37.6 kilograms in 2010 from 36.2 kilograms in 1997.

The government procures and distributes rice. Net imports are projected to range from 700 to 900 thousand mt over the forecast period. Ending stocks are projected to stabilize at 200 thousand mt.

Saudi Arabia

Saudi Arabia prides itself on being a free market economy. However, while the government tends to encourage commercial enterprise, strict interpretation of Islamic mores serves to limit policy options and opportunities.

The Saudi government has traditionally maintained price controls for basic utilities, energy and many agricultural products. Water, electricity and petroleum products are believed to be subsidized, with prices often substantially below the costs of production in order to share the wealth and spur development. The country is in the process of accession to the WTO. The government has reduced subsidies to agriculture, resulting in reduced agricultural production available for export (US Department of State, 1997).

Since Saudi Arabia has virtually no rice production, its rice supplies are dependent upon imports. Providing the best quality rice to consumers at a low price is a major government policy. While growth in per capita consumption is slow, i.e., from 36 kilograms in 1997 to 37.6 kilograms in 2010, the total consumption forecast shows an increase from 724 thousand mt to 1.2 mmt during the same period as population grows rapidly, i.e., by 3.3 percent per year; and incomes grow by 2.3 percent per year (Table 35 and Figure 40). Consumption is determined by income and prices of imported rice.

Saudi Arabia is projected to import all of its rice consumption requirements. While import subsidies have been used in the past, most imports are currently sold through the open market. The government encourages suppliers to compete in providing the lowest possible import prices.

Japan

Japan's economic growth stagnated in 1997 due in part to a consumption tax increase and the end of income tax breaks. So far, the current economic slowdown, which began in mid-1991, has been the longest in the country's postwar history. The surge in asset prices to unsustainable levels and high rates of capital investment and hiring in the late 1980's gave way by 1991 to sharply slower growth, corporate restructuring and balance sheet adjustment by businesses. Japan's economy is undergoing serious structural pressures, due primarily to technology-driven global competition. Japan is a market economy, with prices generally set in accordance with supply and demand. However, due to the high level of fixed and personnel costs combined with a complex distribution system, gross retail margins are very high–resulting in greater downward stickiness in retail prices than would be expected in other large market economies. Japan is the US's third largest export market while the US is the largest market for Japanese exports. However, US exporters still have incomplete access in many sectors of the Japanese market (US Department of State, 1997).

The domestic rice sector in Japan has been insulated from international markets through high support prices and tight restrictions on rice imports. Under the WTO, Japan is required to import according to established minimum access requirements. The Ministry of Agriculture, Forestry and Fisheries (MAFF) Minister announced in March 1998 that the minimum access rice system should be Japan's basic stance under the next WTO agricultural negotiations as opposed to tariffication.[2] At the OECD Agricultural Ministers meeting, the MAFF minister expressed that international rule should enable Japan to export minimum access rice as food aid.

The minimum access requirement for Japan for the 1998 fiscal year is 680 thousand mt. There will be four simultaneous buy and sells (SBS) tendered for 20 to 30 thousand mt each. For Japanese fiscal year (April 1996-March 1997) the government contracted to purchase 544 thousand mt under the Uruguay Round minimum access agreement. The US captured 50.1 percent of the minimum access tenders followed by Thailand and Australia with 24 and 16 percent of the share, respectively (USDA/FAS, 1998).

A new rice diversion policy was introduced in 1997 for Japan's fiscal year 1988; it will increase the rice diversion program and increase compensation for farmers. The first rice diversion program was initiated in 1969. The primary goal of the 1998 policy is to reduce domestic stock levels. The rice diversion program is expanded from the 1997 target of 787 thousand ha to 963 thousand ha in 1998, which is an increase of 176 thousand ha (USDA/FAS, 1998).

The average rice farm is less than 1 ha. The small farm size has contributed to a high percentage (80 percent) of part-time farmers. Most farms are family owned. The farm operations are highly mechanized with tractors and mechanical transplanters.

[2] Under market access provision, Japan may import under minimum access since imports were less than 5% of domestic consumption under the base period 1986-1988. Under minimum access Japan will provide access opportunities for imports equal to 3% of the base period consumption in the first year agreement, increasing to 5% by the end of the implementation period. Under tariffication, non-tariff border measures are converted to their tariff equivalents. The tariff equivalent is equal to the difference between average world market price and average internal price. Countries then use this price difference to establish either a specific or an ad valorem tariff.

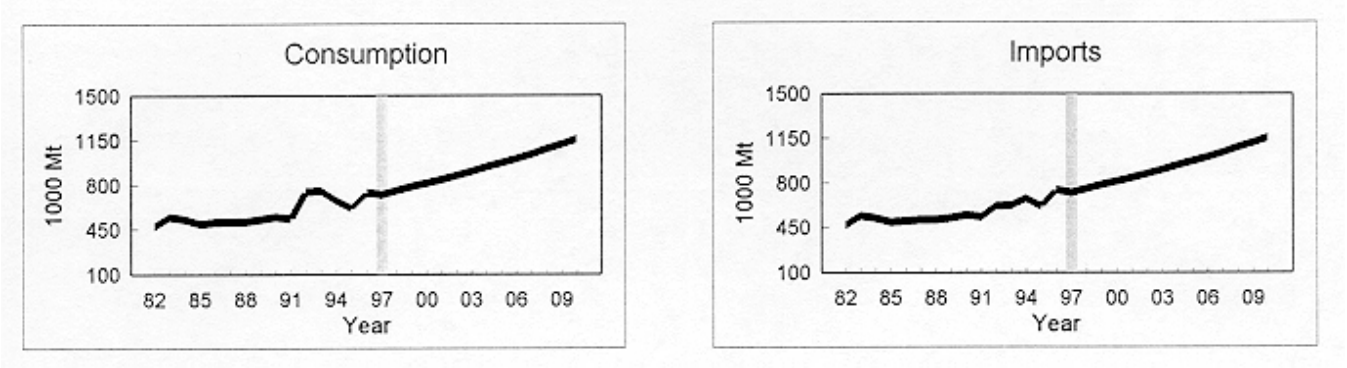

Fig. 40. Arkansas Global Rice Model 1998 projections: Saudi Arabia rice.

In 1997, Japan imported 600 thousand mt of rice and exported 250 thousand mt of rice up until April before announcing a shipment of 500 thousand mt of rice as food aid to Indonesia, apparently aimed at easing the burden of its high stock levels–resulting in net exports of 150 thousand mt. Japan is projected to be a net importer again in 1998 with net imports of 406 thousand mt and expected to increase steadily to 724 thousand mt by 2010.

The Japanese government has used land diversion programs to control rice supplies. Rice acreage is influenced by this government policy and rising costs of production. The area harvested is projected to decline to 1.85 million ha in 1998 from 1.98 million ha in 1997. To accommodate for higher yields, imports and limits on storage costs, the rice land diversion program is expected to be managed such that only about 1.5 million ha of rice will be harvested by 2010 (Table 36 and Figure 41). Japan's rice yields are influenced by high support prices, production costs and new technology. Subsidies to producers of independently distributed rice are being phased out. Yield per ha is projected to increase steadily from 4.67 mt in 1997 to 5.23 mt by 2010. Following the downtrend in area harvested, production is projected to decrease from 9.3 mmt in 1997 to 7.6 mmt by 2010.

Japan's rice consumption is strongly influenced by a negative income elasticity. The country's per capita use of rice declined substantially over the past few decades and is expected to continue declining gradually from 73.3 kilograms in 1997 to 66.7 kilograms by the year 2010. Income and population growth rates are expected to decline. Consequently, total consumption is projected to decline steadily to 8.5 mmt in 2010 from 9.2 mmt in 1997.

Due to bumper rice harvests between 1994 and 1996, current ending stocks are excessively large, reaching nearly 3 mmt in 1997, substantially higher than the target level of 1.5 mmt. MAFF reportedly intends to cut the stockpile by exporting rice for food aid and increasing the riceland diversion requirements. Ending stocks are expected to steadily decline, reaching the target level by 2010.

South Korea

The Korean economy has enjoyed a sustained expansion over the past three decades, averaging roughly a 9 percent real GDP growth per year. However, the GDP growth in 1997 slowed to a 6 percent level, largely due to a cyclic worsening in South Korea's terms of trade, a string of bankruptcies of large business conglomerates and the strains this has placed on the banking system. The Korean economy is notable for the high degree of concentration of capital and industrial output in a small number of conglomerates known locally as "cabalas." The 30 largest cabalas account for about one-third of the total capital of the domestic financial sector and about 35 percent of all manufacturing. These cabalas are highly leveraged; hence, they are susceptible to bankruptcies in periods of economic slowdown (US Department of State, 1997).

Korea's economy is based on private ownership of the means of production and distribution, with basic pricing decisions left to the private sector. Governmental intervention, however, has historically been used to guide the direction of economic development. This includes policy loans and discretionary enforcement of regulatory policies. Korea has lowered its average tariff rate to 7.9 percent. The typical trade barriers in Korea are mostly non-tariff related, i.e., non-transparent regulations that are subject to the discretion of officials. These cover licensing, inspections and standards, among others. Import licensing requirements were removed on all goods effective January 1, 1997, except for roughly 80 items–mostly agricultural products that are included in the "negative list." The Korean government's restriction on the use of credit to finance imports is a significant barrier to US exports to the country. An encouraging development is the country's accession to the WTO Government Procurement Agreement on

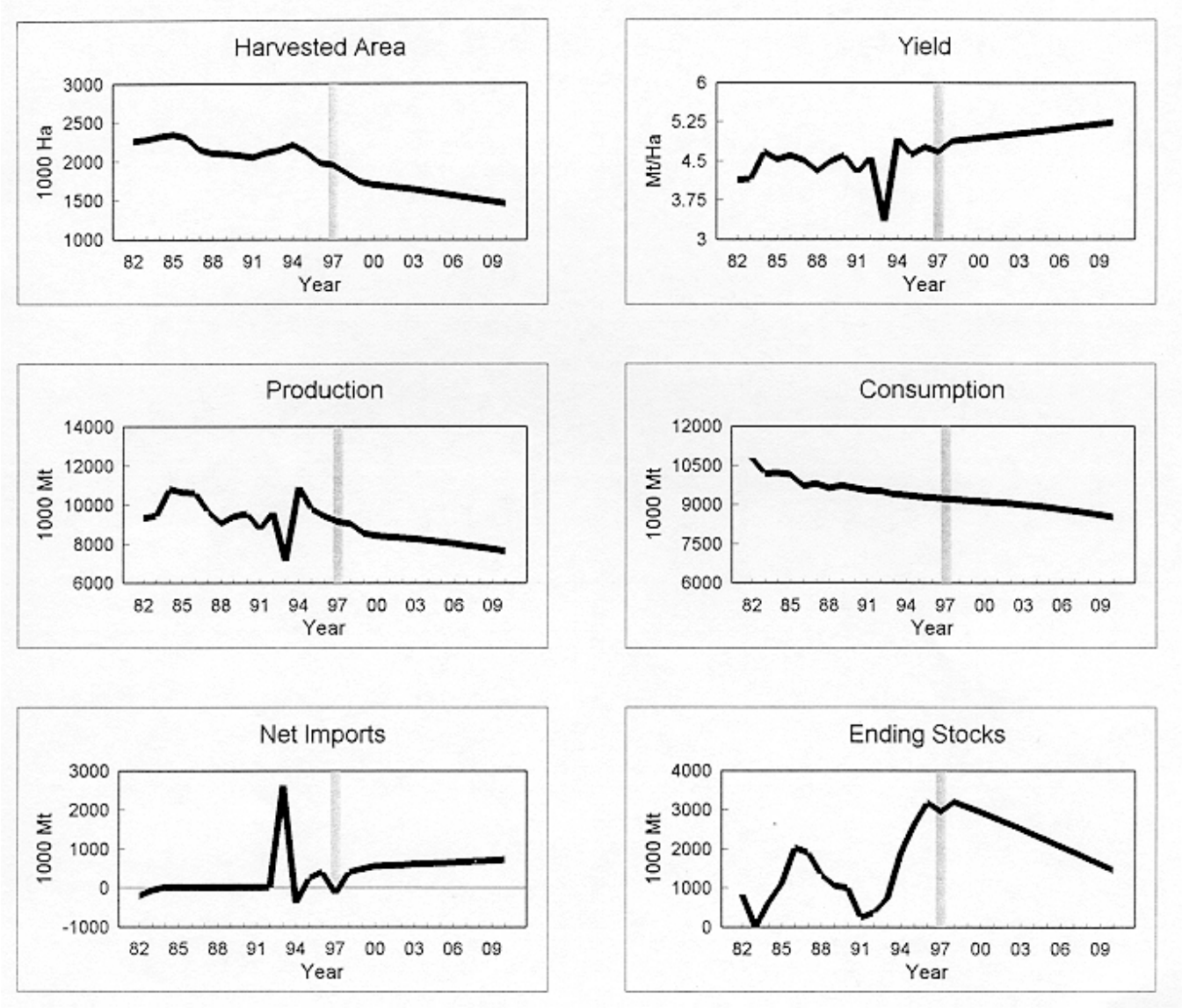

Fig. 41. Arkansas Global Rice Model 1998 projections: Japan rice.

January 1, 1997. While the use of tax exemptions to promote exports is declining, a number of government programs directly support the country's export industries. These include customs duty rebates for raw material imports used in the production of exports, short-term export loans for small- and medium-sized enterprises, rebates on the value-added tax, a special consumption tax for export products and corporate income tax benefits for costs related to the promotion of overseas markets, among others (US Department of State, 1997).

A review of some key demographic changes that occurred in the country over the past couple of years may offer a better understanding of the Korean rice industry. From the period 1970 through 1995, there was rapid rural-to-urban migration in the country, with share of rural population declining from 45 percent of population to 10 percent. Young people moved to cities, leaving an older population and labor force in the farm sector. About 23 percent of the farm workers are over 60 years old, and 45 percent are women. Farmers are highly dependent on farm income due to the limited off-farm income opportunities (USDA/FAS, 1998).

To a large extent, this demographic shift has a dampening effect on the country's agricultural industry in general, and on rice in particular. The country's major objective has been

self-sufficiency in rice and increased rural incomes. The rice industry has been protected and prices have been 3 to 5 times higher than world prices. Support policies have included producer price incentives, restrictions on rice imports and government purchases of rice output. In 1997 the Korean government purchased 1,224 thousand mt, which is limited by Aggregate Measure of Support (AMS) commitment under the WTO. Approximately 96 percent of Korea's AMS is for rice. In 1997 the Korean government AMS commitment was 2,286.5 billion Korean won and will be 1,951.7 billion won in 1998. This will decrease until 2004 when bound rate (the maximum AMS allowed by WTO established under the Uruguay Round) will be 1,490 billion won (USDA/FAS, 1998).

Despite these policies, the harvested rice area in South Korea is projected to decline annually by 1.9 percent, from 1.05 million ha in 1997 to 821 thousand ha by 2010 (Table 37 and Figure 42). One factor causing this decline is the decreasing level of government support prices in real terms. Yields, which are driven by improvements in technology, are projected to increase gradually to 5.36 mt per ha by 2010 from 5.19 mt in 1997. Both 1996 and 1997 have been record yields for japonica rice due to ideal weather conditions throughout the year. The decline in area, however, will cause total production to decline to 4.4 mmt by the end of the forecast period from 5.4 mmt in 1997. The government will try to alleviate the effects of declining area by developing high yield varieties for rice. Currently two new varieties that have favorable potential are SUWON 405 and MILYANG 103, with test yields of 7.11 mt and 6.86 mt per ha, respectively (USDA/FAS, 1998). The object of the Korean government is to develop a super rice hybrid by 2004 with a yield of 10 mt per ha.

One favorable development is that rice farmers appear to respond well to a structural reform program being implemented by the MAFF. Over 7,035 rice farming households have received financial support from the government to specialize in rice production. The average rice farming area per household rose 56 percent to 3.85 ha per household in 1995 from 2.47 ha in 1994. The number of farm households with more than 5 ha rice land also more than tripled, from 395 to 1,426. In order to increase production and pay the government back, most rice farmers raised two crops a year, thus intensifying the land use rate to 138.3 percent from 129.7 percent.

Rice has become an inferior good in South Korea. It is projected that annual per capita use will decline steadily from nearly 109 kilograms in 1997 to 92 kilograms by 2010, a 1.3 percent annual decline. This decline is due to higher incomes (the country's GDP grew by 6.1 percent in real terms in 1997, but will slow down to and stabilize at 5.7 percent by 2001) and higher real retail prices. Consumer prices are expected to increase by 5.1 percent per year during most of the projection period. Despite the growth in population (1.02 percent in 1997 and stabilizing around 0.7 percent by 2007), total consumption is projected to decrease annually by 0.5 percent, from 5 mmt in 1997 to 4.7 mmt in 2010.

In terms of trade, while the most explicit barriers to imports have declined over time, more subtle barriers remain intact. The typical trade barriers facing exporters into the country are the large number of regulations that complicate licensing, inspections, type approval, marking requirements and other standards affecting trade.

Under the WTO, South Korea has agreed to increase rice imports from 1 to 2 percent of domestic consumption for five years beginning in 1995, increasing to 2 to 4 percent of consumption by 2000 through 2004. With its developing country status and a special clause in the Uruguay agreement, the implementation period for tariffication is extended to 10 years, from 1995 through 2005. State trading is allowed to continue, and trade will be controlled by the state during the 10-year grace period. Korea imported 115 thousand mt in 1995, 77 thousand mt in 1996 and 88 thousand mt in 1997. Imports are projected to increase to 115 thousand mt in 1998 and increase steadily to 306 thousand mt by the end of the forecast period. In 1997, the US complained about South Korea's purchase of rice from China through international open bidding. The Seoul government, however, has decided to uphold its stance for rice buying through this method. Ending stocks almost doubled to 1.1 mmt in 1997 compared to the previous year due to yield-induced increase in production. Ending stocks are expected to decline from 1.1 mmt in 1997 to 700 thousand mt level by the end of the projection period.

Taiwan

Taiwan's economy has been characterized by rapid growth and stability over the past four and a half decades, with real GDP growing at an average of 8.5 percent. Taiwan held the third largest foreign exchange reserves in the world at $88 billion. The growing demands for improved infrastructure and social welfare spending have put pressure on Taiwan's budget. Taiwan aims to accede to the WTO and to develop into an Asia-Pacific regional operations center in the near future. In line with this goal, Taiwan has begun to take unilateral steps to liberalize its trade and investment regime. Taiwan has a floating exchange rate system in which the banks set rates independently. The government, however, controls the largest banks authorized to deal in foreign exchange. Taiwan began implementing tariff reductions in July 1997 (U.S. Department of State, 1997).

Taiwan plans to reduce supports for rice (along with other selected crops) over the next five years. On February 20, 1998, the US-Taiwan Comprehensive Market Access Agreement for Taiwan's accession to the WTO was signed.

Taiwan rice policy "Rice Diversion Program" was succeeded by the four-year "Paddy and Upland Utilization Ad-

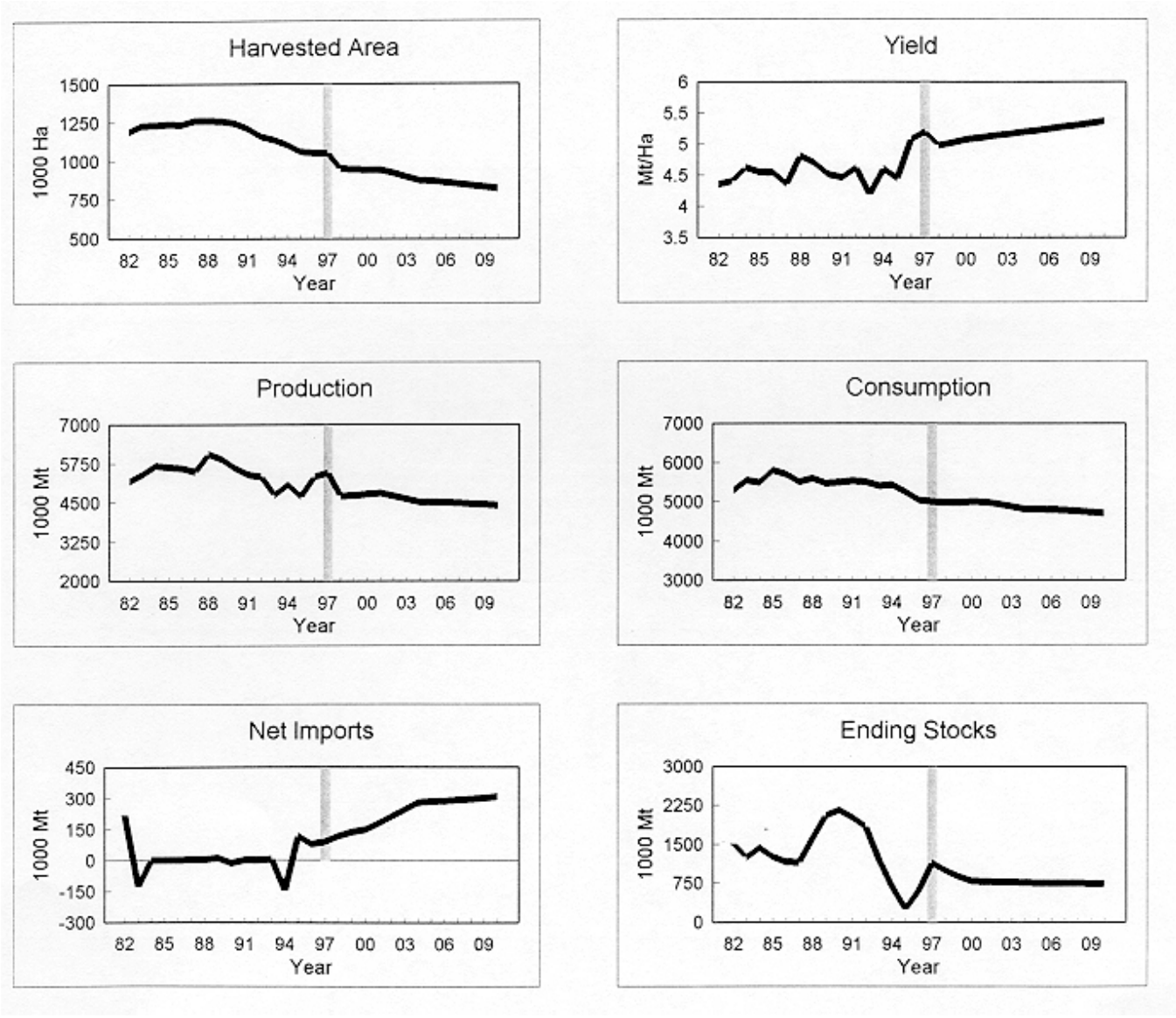

Fig. 42. Arkansas Global Rice Model 1998 projections: South Korea rice.

justment Program" implemented in July 1997. The objective of this policy is to balance supply and demand of rice. The price guarantee programs currently in place will continue for both the first and second rice crop. Rice farmers will also be compensated for rotating rice crop to other crops, or set land aside (USDA/FAS, 1998). Rice area harvested is projected to decline from 364 thousand ha in 1997 to 216 thousand ha by the year 2010. This decrease is mainly due to a policy of reducing the second crop area from production and declining real farm harvest prices. Yields per ha, on the other hand, are projected to increase steadily from 4.04 mt in 1997 to 4.62 mt by 2010 (Table 38 and Figure 43). Average yield is a function of improvements in technology. The expected yield gain, however, is not adequate to compensate for the sharp decline in the area harvested–causing a decline in total production from 1.5 mmt in 1997 to less than 1.0 mmt by the year 2010.

Per capita consumption is predicted to decline from nearly 66 kilograms in 1997 to 47 kilograms by 2010, causing total consumption to decrease from 1.4 mmt to 1.1 mmt during the same period, as per capita incomes increase. Population growth is slightly lower than South Korea's at 0.9 percent in 1997 and declining to 0.74 percent per year starting in 2007.

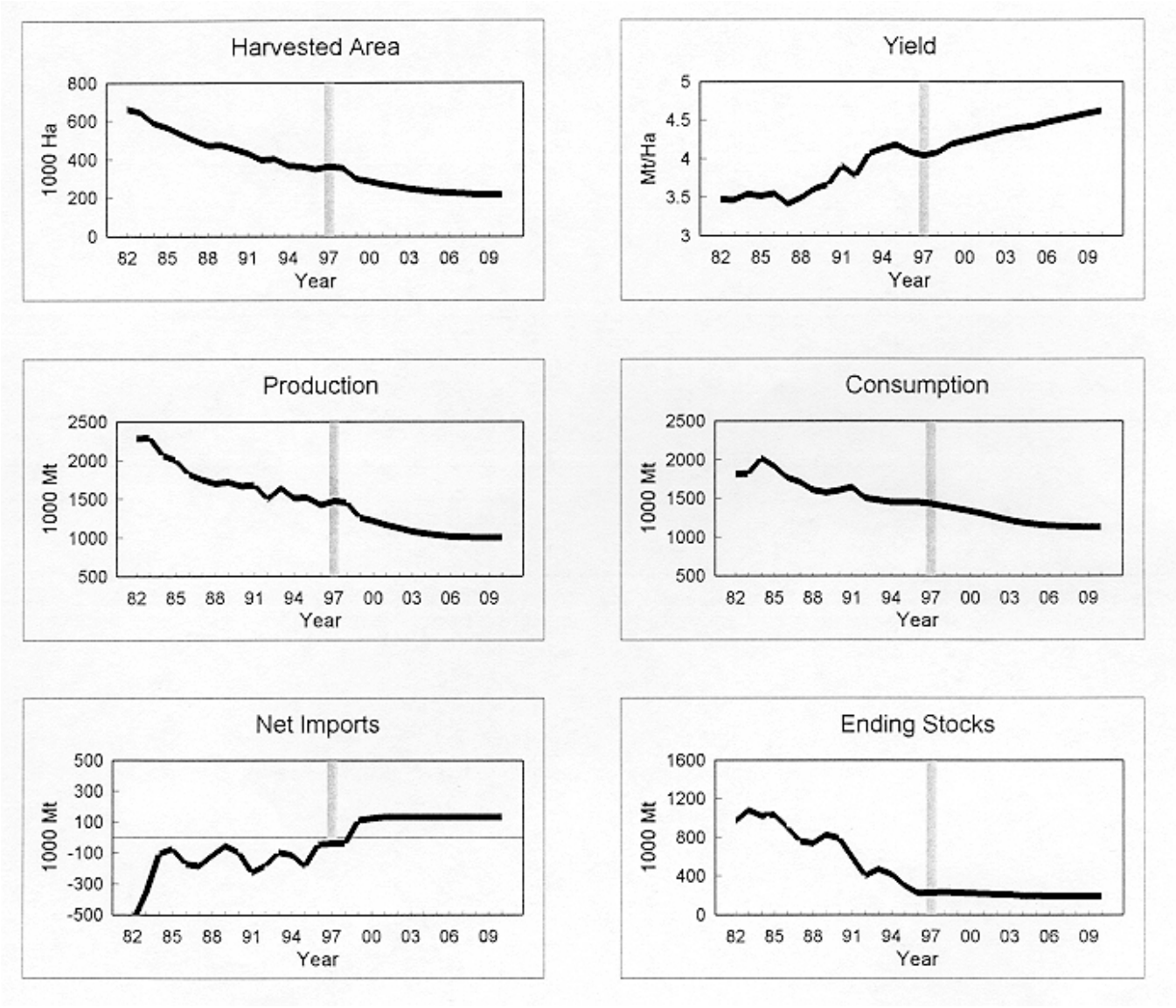

Fig. 43. Arkansas Global Rice Model 1998 projections: Taiwan rice.

There are few subsidy and tax policies for exports. Taiwan's low levels of rice and sugar exports enjoy indirect subsidies through guaranteed purchase prices higher than world prices. The government offers guaranteed prices for a portion of rice and other cereal crops produced by farmers. Fertilizer manufacturing is subsidized by offering lower fuel prices to domestic manufacturers. Taiwan has maintained domestic prices of rice higher than international prices. The government has purchased rice at two to three times higher than world price. Based on an assumption of Taiwan membership in the WTO, the country is expected to be a net importer of rice starting in 1999. Net imports are projected to increase steadily from 110 thousand mt in 1999 to 132 thousand mt by the year 2001 and assumed to stabilize at this level over the rest of the projection period. Ending stocks are expected to be around 200 thousand mt over the projection period.

Rest of the World

While the ROW is an aggregate region, there are a number of pertinent country-specific developments, especially on the demand side, that have substantial potential impact on world prices and hence will be mentioned here. One of these developments is the uncertainties brought about by the food shortage in North Korea. Other countries that, time and again, can

cause uncertainties in the rice market due to unexpected weather-related imports include Bangladesh and the Philippines. In late December 1997, for instance, the Philippines had to purchase large quantities of rice due to drought brought about by El Niño. The strong import demand from the Philippines, as well as from Indonesia, during that period caused international prices to rise slightly despite continued weakness in the Thai currency. Bangladesh is expected to increase rice imports in 1998 due to crop shortfall in 1997.

The ROW is a net rice importer. Area harvested is responsive to low-quality rice (Thai 35%) price and technology. Yields are projected according to historical patterns. Consumption is responsive to the relative world prices of wheat and Thai 35% rice.

Total harvested area in 1997 was 29.3 million ha and is projected to increase slightly to 31.3 million ha by 2010, an annual growth rate of 0.5 percent. Yields are expected to increase steadily from 1.62 mt per ha in 1997 to 1.92 mt by the end of the projection period (Table 39 and Figure 44). As a result of gains in both area and yields, total production is projected to grow by 1.9 percent annually, from 47.4 mmt in 1997 to 60.3 mmt by 2010.

Total consumption is projected to increase to 72 mmt in 2010 from nearly 59.5 mmt in 1997. The ROW imports are projected to range from 11 to 12 mmt over the projection period. Ending stocks range between 4 and 6 mmt during the same period.

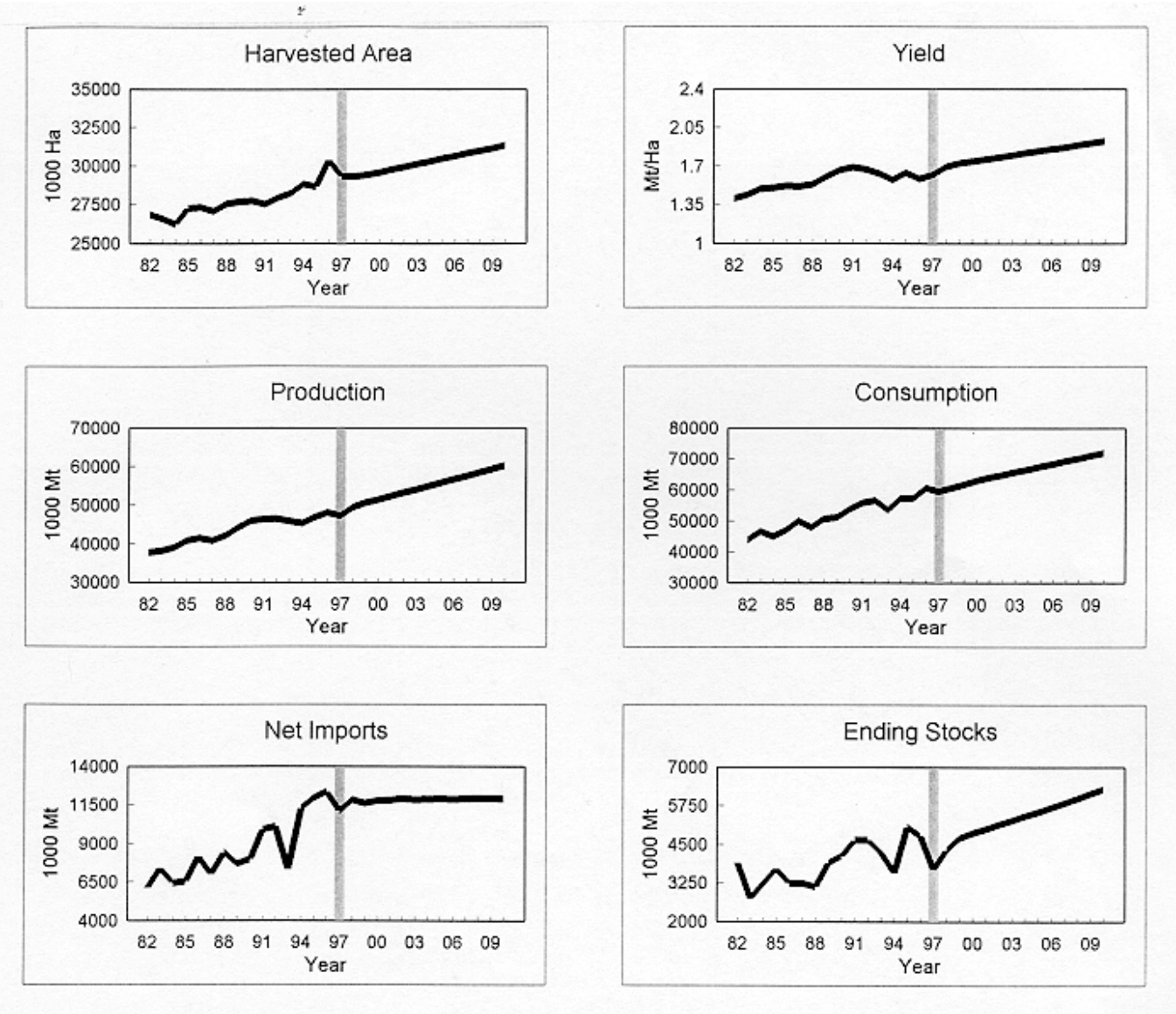

Fig. 44. Arkansas Global Rice Model 1998 projections: rest of the world (ROW) rice.

LITERATURE CITED

Bierlen, Ralph, Eric J. Wailes, Gail L. Cramer. 1997. The Mercosur rice economy. University of Arkansas, Fayetteville. Arkansas Agricultural Experiment Station Bulletin No. 954.

Crook, Frederick W. 1996. China's agricultural policy developments in 1995. China: Situation and Outlook Series 1995. US Dept. of Agriculture, Economic Research Service, WRS-96-2, Washington, DC, June, 1997.

Gao, X.M., Eric J. Wailes and Gail L. Cramer. 1995. Double-hurdle model with bivariate normal errors: An application to U.S. rice demand. J. Agr. and Applied Econ. 27(2):363-376.

Gudmunds, Karl. 1998. PS&D view. US Department of Agriculture, Economic Research Service.

Hansen, James M., Eric J. Wailes and Gail L. Cramer. 1998. The impacts of El Niño on world rice production, consumption and trade. Selected Paper, Southern Agricultural Economics Association, Annual Meeting. Little Rock, Arkansas. Feb. 1-4, 1998.

New York Times. April 6, 1997. Scientists developing "super rice" to feed Asia. p 5.

US Department of Agriculture-Economic Research Service. 1998a. Rice situation and outlook. RCS-0298.

US Department of Agriculture-Economic Research Service. 1998b. World agricultural supply and demand estimates. WASDE-337.

US Department of Agriculture-Foreign Agricultural Service. 1997 and 1998. Country attache reports; grain and feed annual reports, agricultural annual reports and rice reports.

US Department of Agriculture-Economic Research Service. 1996a. Rice situation and outlook. RCS-0298.

US Department of Agriculture-Economic Research Service. 1996b. Rice situation and outlook yearbook. RCS-1996.

US Department of State. 1997. Country reports.

Wailes, Eric J., Gail L. Cramer, Eddie C. Chavez and James M. Hansen. 1997a. Arkansas global rice model: International baseline projections for 1997-2010. Arkansas Agricultural Experiment Station Special Report 177.

Wailes, Eric J., Gail L. Cramer and Eddie C. Chavez. 1996a. International rice baseline projections, 1997-2010. Paper presented at The World Rice Conference. Honolulu, Hawaii. February 20-22, 1996.

Wailes, Eric J., Gail L. Cramer, Eddie C. Chavez and James M. Hansen. 1996b. Analysis and projections of global rice trade. Paper presented at The International Symposium on Biotechnology, Post-Harvest Technology and Supply Projection of Rice. Kwangju, Korea. November 15, 1996.

Wailes, Eric J., Gail L. Cramer, James M. Hansen and Eddie C. Chavez. 1997b. Structure of the Arkansas global rice model. Department of Agricultural Economics, University of Arkansas, Fayetteville, Arkansas.

Young, Kenneth B., Gail L. Cramer and Eric J. Wailes. 1998. An economic assessment of the Myanmar rice sector: Current developments and prospects. Arkansas Agricultural Experiment Station, Research Bulletin 958. Fayetteville, Arkansas.

Table 1. World Rice Supply and Utilization

Variable	Unit / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	148992.2	149391.8	149955	149811	149850	149840	149914	149981	150076	150141	150197	150334	150464	150579	150678
Yield	(mt/ha)	2.55	2.57	2.60	2.62	2.65	2.67	2.70	2.72	2.75	2.77	2.80	2.82	2.85	2.88	2.90
Production	(1000 mt)	379930	383190	389847	393149	396534	400188	404236	407941	412497	416331	420312	424488	428624	433110	437320
Total Consumption	(1000 mt)	378930	379330	386678	391482	395753	399921	404101	408225	412430	416624	420755	424912	429116	433408	437638
Net Exports	(1000 mt)	17275	20336	19517	19384	19525	19732	19956	20149	20367	20600	20892	21225	21523	21869	22204
Net Imports	(1000 mt)	17275	20336	19517	19384	19525	19732	19956	20149	20367	20600	20892	21225	21523	21869	22204
Ending Stocks	(1000 mt)	51120	54980	58149	59817	60598	60865	61000	60717	60783	60491	60048	59623	59131	58833	58515

Note: Data through 1997 are actual and Arkansas Global Rice Model projections are for 1998 and beyond.

Table 2. Total World Rice Trade (Combined Medium and Long Grain)

Country	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EXPORTERS	(1000 mt)	19386	22997	21799	21691	21859	22108	22366	22607	22863	23129	23433	23773	24082	24441	24787
United States	(1000 mt)	2500	2728	2802	2596	2475	2407	2300	2280	2252	2236	2223	2221	2206	2213	2226
Thailand	(1000 mt)	5275	5807	5923	6164	6256	6343	6462	6519	6605	6698	6783	6905	7030	7168	7303
Pakistan	(1000 mt)	1834	1907	1914	1888	1861	1827	1798	1781	1772	1770	1791	1819	1858	1901	1947
Myanmar	(1000 mt)	15	54	216	256	321	373	419	463	506	549	593	639	685	730	777
Vietnam	(1000 mt)	3270	3621	3940	3977	4089	4248	4414	4509	4646	4754	4855	4941	4987	5035	5056
China	(1000 mt)	938	2489	1634	1518	1464	1414	1363	1310	1257	1208	1163	1118	1073	1027	982
India	(1000 mt)	2105	2498	2024	1918	1939	1960	1997	2041	2031	2021	2028	2036	2048	2068	2087
Australia	(1000 mt)	700	701	736	739	770	780	788	798	808	820	832	844	856	868	881
Egypt	(1000 mt)	150	306	124	117	111	106	101	98	95	92	90	87	84	81	78
Italy+Other European Union	(1000 mt)	1331	1139	1059	1043	1035	1043	1046	1052	1055	1059	1059	1054	1050	1048	1048
Japan	(1000 mt)	100	750	200	200	200	200	200	200	200	200	200	200	200	200	200
Argentina	(1000 mt)	523	399	549	589	631	674	719	765	817	874	938	1002	1066	1130	1195
Uruguay	(1000 mt)	645	597	678	687	708	733	760	790	818	847	877	908	940	973	1006
IMPORTERS	(1000 mt)	19386	22997	21799	21691	21859	22108	22366	22607	22863	23129	23433	23773	24082	24441	24787
United States	(1000 mt)	319	318	319	322	334	349	364	379	395	411	426	441	457	473	487
Thailand	(1000 mt)	0	0	243	244	246	247	249	250	250	250	250	250	250	250	250
China	(1000 mt)	326	413	423	457	477	492	504	527	545	557	551	546	543	541	535
Japan	(1000 mt)	500	600	606	682	758	773	789	804	820	837	854	871	888	906	924
Indonesia	(1000 mt)	800	4995	2552	2482	2278	2352	2355	2483	2522	2637	2838	3019	3204	3414	3675
Iraq	(1000 mt)	720	599	721	694	667	691	715	740	765	791	817	843	870	898	926
Iran	(1000 mt)	1000	1000	1231	1242	1271	1300	1331	1362	1394	1427	1461	1496	1532	1569	1607
Saudi Arabia	(1000 mt)	746	724	757	785	814	842	873	904	937	971	1005	1040	1078	1117	1157
European Union	(1000 mt)	1571	1472	1451	1498	1518	1528	1540	1549	1559	1569	1577	1586	1596	1607	1616
South Korea	(1000 mt)	77	88	115	135	147	177	210	244	278	281	285	290	295	300	306
Taiwan	(1000 mt)	-45	-40	-40	110	121	132	132	132	132	132	132	132	132	132	132
Australia	(1000 mt)	35	40	39	41	43	45	47	49	51	53	55	57	59	61	63
Brazil	(1000 mt)	1000	1698	1554	1395	1413	1394	1377	1363	1343	1328	1311	1295	1267	1241	1223
ROW	(1000 mt)	12337	11090	11830	11604	11773	11785	11881	11821	11870	11885	11871	11906	11910	11933	11887

Table 3. World Rice Net Trade

Country	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NET EXPORTERS	(1000 mt)	17275	20336	19517	19384	19525	19732	19956	20149	20367	20600	20892	21225	21523	21869	22204
United States	(1000 mt)	2181	2410	2483	2274	2140	2058	1935	1900	1857	1826	1798	1779	1749	1740	1740
Thailand	(1000 mt)	5275	5807	5680	5920	6010	6096	6213	6269	6355	6448	6534	6656	6780	6918	7054
Pakistan	(1000 mt)	1834	1907	1914	1888	1861	1827	1798	1781	1772	1770	1791	1819	1858	1901	1947
Myanmar	(1000 mt)	15	54	216	256	321	373	419	463	506	549	593	639	685	730	777
Vietnam	(1000 mt)	3270	3621	3940	3977	4089	4248	4414	4509	4646	4754	4855	4941	4987	5035	5056
China	(1000 mt)	612	2076	1211	1061	987	922	859	783	712	651	612	572	530	487	447
India	(1000 mt)	2105	2498	2024	1918	1939	1960	1997	2041	2031	2021	2028	2036	2048	2068	2087
Australia	(1000 mt)	665	661	697	699	727	735	741	749	757	767	777	787	797	807	818
Egypt	(1000 mt)	150	306	124	117	111	106	101	98	95	92	90	87	84	81	78
Argentina	(1000 mt)	523	399	549	589	631	674	719	765	817	874	938	1002	1066	1130	1195
Uruguay	(1000 mt)	645	597	678	687	708	733	760	790	818	847	877	908	940	973	1006
NET IMPORTERS	(1000 mt)	17275	20336	19517	19384	19525	19732	19956	20149	20367	20600	20892	21225	21523	21869	22204
Japan	(1000 mt)	400	-150	406	482	558	573	589	604	620	637	654	671	688	706	724
Indonesia	(1000 mt)	800	4995	2552	2482	2278	2352	2355	2483	2522	2637	2838	3019	3204	3414	3675
Iraq	(1000 mt)	720	599	721	694	667	691	715	740	765	791	817	843	870	898	926
Iran	(1000 mt)	1000	1000	1231	1242	1271	1300	1331	1362	1394	1427	1461	1496	1532	1569	1607
Saudi Arabia	(1000 mt)	746	724	757	785	814	842	873	904	937	971	1005	1040	1078	1117	1157
European Union	(1000 mt)	240	332	391	455	483	486	494	496	504	510	518	533	546	559	568
South Korea	(1000 mt)	77	88	115	135	147	177	210	244	278	281	285	290	295	300	306
Taiwan	(1000 mt)	-45	-40	-40	110	121	132	132	132	132	132	132	132	132	132	132
Brazil	(1000 mt)	1000	1698	1554	1395	1413	1394	1377	1363	1343	1328	1311	1295	1267	1241	1223
Rest of World	(1000 mt)	12337	11090	11830	11604	11773	11785	11881	11821	11870	11885	11871	11906	11910	11933	11887

Table 4. World Long Grain Rice Trade

Country	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EXPORTERS	(1000 mt)	16196	17627	17941	17955	18136	18414	18700	18965	19250	19543	19872	20238	20572	20948	21302
United States	(1000 mt)	1798	2109	2197	1977	1830	1746	1619	1580	1538	1511	1486	1470	1443	1431	1419
Thailand	(1000 mt)	5275	5807	5923	6164	6256	6343	6462	6519	6605	6698	6783	6905	7030	7168	7303
Pakistan	(1000 mt)	1834	1907	1914	1888	1861	1827	1798	1781	1772	1770	1791	1819	1858	1901	1947
Myanmar	(1000 mt)	15	54	216	256	321	373	419	463	506	549	593	639	685	730	777
Vietnam	(1000 mt)	3270	3621	3940	3977	4089	4248	4414	4509	4646	4754	4855	4941	4987	5035	5056
India	(1000 mt)	2105	2498	2024	1918	1939	1960	1997	2041	2031	2021	2028	2036	2048	2068	2087
European Union excl. Italy	(1000 mt)	731	635	500	501	502	510	513	517	517	518	520	519	516	513	511
Argentina	(1000 mt)	523	399	549	589	631	674	719	765	817	874	938	1002	1066	1130	1195
Uruguay	(1000 mt)	645	597	678	687	708	733	760	790	818	847	877	908	940	973	1006
IMPORTERS	(1000 mt)	16196	17627	17941	17955	18136	18414	18700	18965	19250	19543	19872	20238	20572	20948	21302
United States	(1000 mt)	319	318	319	322	334	349	364	379	395	411	426	441	457	473	487
Thailand	(1000 mt)	0	0	182	183	184	185	186	188	187	187	187	187	187	187	187
China	(1000 mt)	326	413	423	457	477	492	504	527	545	557	551	546	543	541	535
Indonesia	(1000 mt)	800	4995	2552	2482	2278	2352	2355	2483	2522	2637	2838	3019	3204	3414	3675
Iraq	(1000 mt)	720	599	721	694	667	691	715	740	765	791	817	843	870	898	926
Iran	(1000 mt)	1000	1000	1231	1242	1271	1300	1331	1362	1394	1427	1461	1496	1532	1569	1607
Saudi Arabia	(1000 mt)	746	724	757	785	814	842	873	904	937	971	1005	1040	1078	1117	1157
European Union	(1000 mt)	1571	1472	1451	1498	1518	1528	1540	1549	1559	1569	1577	1586	1596	1607	1616
Australia	(1000 mt)	35	40	39	41	43	45	47	49	51	53	55	57	59	61	63
Brazil	(1000 mt)	1000	1698	1554	1395	1413	1394	1377	1363	1343	1328	1311	1295	1267	1241	1223
Rest of world	(1000 mt)	9679	6368	8713	8856	9137	9234	9408	9421	9550	9612	9644	9726	9778	9839	9826

Table 5. World Medium Grain Rice Trade

Country	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EXPORTERS	(1000 mt)	3190	5370	3858	3735	3723	3695	3666	3642	3613	3586	3561	3535	3510	3494	3485
United States	(1000 mt)	702	619	604	619	644	662	680	700	714	725	737	751	763	782	807
Australia	(1000 mt)	700	701	736	739	770	780	788	798	808	820	832	844	856	868	881
Egypt	(1000 mt)	150	306	124	117	111	106	101	98	95	92	90	87	84	81	78
Italy	(1000 mt)	600	504	559	542	533	532	533	535	538	541	539	535	534	535	537
Japan	(1000 mt)	100	750	200	200	200	200	200	200	200	200	200	200	200	200	200
China	(1000 mt)	938	2489	1634	1518	1464	1414	1363	1310	1257	1208	1163	1118	1073	1027	982
IMPORTERS	(1000 mt)	3190	5370	3858	3735	3723	3695	3666	3642	3613	3586	3561	3535	3510	3494	3485
Thailand	(1000 mt)	0	0	61	61	61	62	62	63	62	62	62	62	62	62	62
Japan	(1000 mt)	500	600	606	682	758	773	789	804	820	837	854	871	888	906	924
South Korea	(1000 mt)	77	88	115	135	147	177	210	244	278	281	285	290	295	300	306
Taiwan	(1000 mt)	-45	-40	-40	110	121	132	132	132	132	132	132	132	132	132	132
Others (residual)	(1000 mt)	2658	4722	3117	2748	2636	2551	2473	2400	2320	2273	2228	2180	2133	2093	2061

Table 6. World Rice Prices and Price Relationships

Country	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Test	test	test	test	test	test	test	test	test	test	test	test	test	test	test	test	test
Long Grain Rice, High Quality																
Thai 100%B fob	US$/mt	338	306	296	300	300	309	310	317	319	323	330	335	336	337	340
Thai 5% fob	US$/mt	331	295	285	289	289	297	299	305	307	311	318	323	324	324	327
Thai 5% fob (1985$)	US$/mt	227	197	185	182	176	176	171	170	166	164	164	162	158	154	151
US No. 2, fob Houston	US$/mt	450	418	413	409	414	424	428	435	438	443	450	456	459	462	466
US No. 2 - Thai 5%	US$/mt	119	123	128	121	125	127	129	129	131	132	132	133	135	137	139
Long Grain Rice, Low Quality																
Thai 35% fob	US$/mt	259	254	244	248	253	260	261	267	270	275	283	289	290	291	292
US Wheat No. 2, fob Gulf	US$/mt	184	155	150	151	157	159	160	162	164	166	171	174	175	175	175
Wheat/Thai35% Price Ratio	Ratio in %	0.71	0.61	0.61	0.61	0.62	0.61	0.61	0.61	0.61	0.61	0.60	0.60	0.60	0.60	0.60
Thai 35% - US Wheat	US$/mt	75	99	95	97	96	101	101	105	106	108	112	115	116	116	117
Medium Grain Rice																
U.S. No.2 MG Rice fob CA	US$/mt	415	396	409	406	407	411	412	415	417	420	425	428	431	431	433
MG fob CA - LG fob Houston	US$/mt	-35	-22	-4	-3	-7	-13	-15	-19	-21	-22	-25	-28	-29	-30	-33

Table 7. Thailand Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	9175	9272	9198	9114	9041	8972	8933	8889	8870	8832	8787	8766	8746	8716	8683
Yield	(mt/ha)	1.49	1.56	1.57	1.61	1.63	1.64	1.66	1.68	1.69	1.71	1.73	1.75	1.76	1.78	1.80
Production	(1000 mt)	13660	14497	14466	14670	14708	14748	14836	14914	15033	15119	15191	15304	15417	15541	15657
Per-capita Use	(kg)	145.29	144.71	144.19	143.41	141.79	140.07	138.32	137.58	136.87	135.75	134.58	133.37	132.17	130.96	129.73
Total Consumption	(1000 mt)	8550	8602	8655	8689	8669	8639	8604	8630	8656	8653	8644	8631	8616	8600	8583
Exports	(1000 mt)	5275	5807	5923	6164	6256	6343	6462	6519	6605	6698	6783	6905	7030	7168	7303
Imports	(1000 mt)	0.11	0.28	243	244	246	247	249	250	250	250	250	250	250	250	250
Net Exports	(1000 mt)	5275	5807	5680	5920	6010	6096	6213	6269	6355	6448	6534	6656	6780	6918	7054
Ending Stocks	(1000 mt)	646	734	866	928	956	969	988	1002	1024	1042	1055	1073	1093	1116	1137

Table 8. Detailed U.S. Rice Supply and Utilization (In English Units)

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
YIELD (rough basis)																
Actual	(lb/ac)	6121	5911	5980	6130	6154	6193	6250	6290	6334	6376	6432	6488	6545	6604	6663
Program	(lb/ac)	4827	4827	4827	4827	4827	4827	4827	4827	4827	4827	4827	4827	4827	4827	4827
HARVESTED ACREAGE																
Program Area/Contract Area	(1000 ac)	4157.9	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2	4157.2
Total Harvested Area	(1000 ac)	2799.0	3034.0	3191.5	2924.9	2893.3	2877.8	2812.2	2838.2	2828.7	2827.7	2820.2	2826.3	2816.9	2831.9	2831.3
SUPPLY (rough basis)	(mil. cwt)	206.3	216.3	226.4	219.4	215.6	214.3	211.0	212.3	213.3	214.7	216.0	218.2	219.8	222.9	225.7
Production	(mil. cwt)	171.3	179.3	190.9	179.3	178.0	178.2	175.8	178.5	179.2	180.3	181.4	183.4	184.4	187.0	188.7
Beginning Stocks	(mil. cwt)	25.0	27.2	25.8	30.3	27.3	25.3	24.0	22.1	22.0	21.8	21.6	21.3	21.5	21.4	22.2
Imports	(mil. cwt)	10.0	9.7	9.8	9.9	10.2	10.7	11.2	11.6	12.1	12.6	13.0	13.5	14.0	14.5	14.9
DOMESTIC USE (rough basis)	(mil. cwt)	100.7	107.0	110.3	112.6	114.5	116.5	118.4	120.4	122.5	124.6	126.6	128.7	130.8	133.0	134.6
Food	(mil. cwt)	80.0	82.1	84.8	87.2	89.2	91.2	93.0	94.9	96.8	98.7	100.6	102.5	104.5	106.4	108.4
Seed	(mil. cwt)	4.0	4.0	4.2	4.0	3.9	3.7	3.8	3.7	3.7	3.7	3.7	3.6	3.6	3.6	3.0
Brewing	(mil. cwt)	15.4	15.4	15.3	15.4	15.5	15.6	15.7	15.8	16.0	16.2	16.4	16.6	16.8	17.0	17.1
Residual	(mil. cwt)	1.3	5.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
EXPORTS	(mil. cwt)	78.4	83.5	85.8	79.5	75.8	73.7	70.4	69.8	69.0	68.5	68.1	68.0	67.6	67.8	68.2
TOTAL USE	(mil. cwt)	179.1	190.5	196.1	192.1	190.3	190.2	188.8	190.2	191.5	193.1	194.7	196.7	198.4	200.8	202.7
ENDING STOCKS	(mil. cwt)	27.2	25.8	30.3	27.3	25.3	24.0	22.1	22.0	21.8	21.6	21.3	21.5	21.4	22.2	23.0
PRICES																
Loan Rate	(US$/cwt)	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Season Ave. Farm Price	(US$/cwt)	9.96	9.88	9.54	9.51	9.59	9.41	9.62	9.70	9.82	9.95	10.11	10.20	10.29	10.31	10.36
Long Grain Farm Price	(US$/cwt)	10.32	10.40	9.69	9.73	9.84	9.49	9.80	9.86	10.02	10.15	10.33	10.41	10.51	10.50	10.54
Medium Grain Farm Price	(US$/cwt)	9.25	8.79	9.15	9.07	9.11	9.24	9.30	9.40	9.47	9.58	9.71	9.82	9.91	9.97	10.04
LG-MG Margin	(US$/cwt)	1.06	1.61	0.54	0.67	0.73	0.25	0.50	0.45	0.55	0.57	0.61	0.59	0.60	0.53	0.50
Export Price, FOB Houston (U.S. No. 2)	(US$/cwt)	20.43	18.96	18.73	18.57	18.78	19.23	19.40	19.72	19.85	20.08	20.43	20.68	20.83	20.94	21.15
Medium Grain Price, FOB CA (U.S. No. 2)	(US$/cwt)	18.79	17.94	18.54	18.43	18.44	18.66	18.70	18.85	18.92	19.07	19.28	19.43	19.53	19.57	19.64
Deficiency/CLD[1]/Contract Pay Rate	(US$/cwt)	2.77	2.71	2.85	2.75	2.53	2.04	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98
World Price (US$/cwt)	(US$/cwt)	7.51	7.83	6.21	6.31	6.31	6.55	6.59	6.77	6.82	6.94	7.14	7.27	7.31	7.32	7.39
EXPP-SAFP[2] Margin	(US$/cwt)	6.26	5.23	5.48	5.37	5.47	6.17	6.03	6.25	6.21	6.27	6.39	6.51	6.53	6.62	6.76
INCOME FACTORS																
Production Market Value	(mil. US$)	1706	1773	1821	1704	1707	1677	1692	1731	1760	1793	1834	1871	1898	1928	1955
Deficiency/Contract Payments	(mil. US$)	472	465	500	483	443	358	348	348	348	348	348	348	348	348	348
Marketing Loan/Certificates	(mil. US$)	0	0	53	36	36	0	0	0	0	0	0	0	0	0	0
Total Income	(mil. US$)	2178	2238	2374	2223	2186	2035	2040	2079	2108	2141	2182	2219	2246	2276	2303
Returns Above Variable Cost	(US$/ac)	227.79	204.09	208.50	208.15	210.00	184.24	195.33	197.62	202.23	206.92	215.31	219.31	230.62	237.32	246.53

[1]CLD = certificate of loan deficiency.
[2]EXPP = export price, FOB Houston (U.S. No. 2); SAFP = season average farm price.

Table 9. U.S. Long Grain Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
YIELD (rough basis)	(lb/ac)	5777	5413	5526	5614	5638	5679	5717	5761	5804	5848	5903	5961	6020	6085	6152
HARVESTED ACREAGE	(1000 ac)	1964.0	2261.0	2480.4	2105.7	2078.4	2065.2	1987.0	2008.3	1993.4	1991.5	1981.1	1980.0	1965.7	1967.1	1955.7
SUPPLY (rough basis)	(mil. cwt)	132.5	146.1	160.1	150.1	144.3	142.1	137.5	137.8	138.1	139.2	140.3	142.0	143.2	145.3	146.9
Production	(mil. cwt)	113.7	122.1	137.1	118.2	117.2	117.3	113.6	115.7	115.7	116.5	117.0	118.0	118.3	119.7	120.3
Beginning Stocks	(mil. cwt)	10.4	14.3	13.3	22.0	16.9	14.1	12.8	10.5	10.3	10.1	10.3	10.4	10.9	11.1	11.7
Imports	(mil. cwt)	8.7	9.7	9.8	9.9	10.2	10.7	11.2	11.6	12.1	12.6	13.0	13.5	14.0	14.5	14.9
DOMESTIC USE + Residual	(mil. cwt)	61.7	68.3	70.8	72.6	74.2	75.8	77.5	79.1	80.9	82.6	84.3	86.1	87.9	89.8	91.2
EXPORTS	(mil. cwt)	56.5	64.6	67.3	60.5	56.0	53.4	49.6	48.4	47.1	46.3	45.5	45.0	44.2	43.8	43.5
TOTAL USE + Residual	(mil. cwt)	118.2	132.9	138.1	133.2	130.2	129.3	127.0	127.5	128.0	128.9	129.8	131.1	132.1	133.6	134.7
ENDING STOCKS	(mil. cwt)	14.3	13.3	22.0	16.9	14.1	12.8	10.5	10.3	10.1	10.3	10.4	10.9	11.1	11.7	12.2
PRICES																
Season Average Farm Price	(US$/cwt)	10.32	10.40	9.69	9.73	9.84	9.49	9.80	9.86	10.02	10.15	10.33	10.41	10.51	10.50	10.54
Export Price, FOB Houston (U.S. No. 2)	(US$/cwt)	20.43	18.96	18.73	18.57	18.78	19.23	19.40	19.72	19.85	20.08	20.43	20.68	20.83	20.94	21.15
PRODUCTION MARKET VALUE	(mil. US$)	1173.7	1269.1	1328.8	1150.5	1152.5	1113.2	1113.4	1140.3	1158.8	1181.8	1207.6	1228.8	1243.2	1256.8	1268.5

Table 10. U.S. Medium Grain Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
YIELD (rough basis)	(lb/ac)	6929	7410	7564	7456	7470	7501	7532	7571	7600	7634	7681	7721	7759	7783	7806
HARVESTED ACREAGE	(1000 ac)	835.0	773.0	711.1	819.2	814.8	812.7	825.2	829.8	835.2	836.2	839.1	846.3	851.2	864.7	875.7
SUPPLY (rough basis)	(mil. cwt)	73.2	69.5	65.7	68.8	70.7	71.7	72.9	73.9	74.7	75.0	75.2	75.7	76.1	77.1	78.3
Production	(mil. cwt)	58.0	57.3	53.8	61.1	60.9	61.0	62.2	62.8	63.5	63.8	64.5	65.3	66.0	67.3	68.4
Beginning Stocks	(mil. cwt)	14.4	12.2	12.0	7.7	9.9	10.7	10.7	11.1	11.2	11.1	10.8	10.3	10.1	9.8	10.0
Imports	(mil. cwt)	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DOMESTIC USE + Residual		39.0	38.6	39.5	40.0	40.3	40.7	41.0	41.3	41.7	42.0	42.3	42.6	42.9	43.2	43.3
EXPORTS	(mil. cwt)	21.9	19.0	18.5	19.0	19.7	20.3	20.8	21.4	21.9	22.2	22.6	23.0	23.4	24.0	24.7
TOTAL USE + Residual	(mil. cwt)	60.9	57.6	58.0	58.9	60.0	60.9	61.8	62.7	63.5	64.2	64.9	65.6	66.3	67.2	68.0
ENDING STOCKS	(mil. cwt)	12.2	12.0	7.7	9.9	10.7	10.7	11.1	11.2	11.1	10.8	10.3	10.1	9.8	10.0	10.3
PRICES																
Season Average Farm Price	(US$/cwt)	9.25	8.79	9.15	9.07	9.11	9.24	9.30	9.40	9.47	9.58	9.71	9.82	9.91	9.97	10.04
Medium Grain Price, FOB CA (U.S. No.2)	(US$/cwt)	18.79	17.94	18.54	18.43	18.44	18.66	18.70	18.85	18.92	19.07	19.28	19.43	19.53	19.57	19.64
PRODUCTION MARKET VALUE	(mil. US$)	537.0	503.6	492.2	553.8	554.4	563.4	578.1	590.6	601.1	611.4	626.0	641.8	654.5	671.1	686.4

Table 11. U.S. Rice Supply and Utilization (in Metric Units)

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	1132	1227	1291	1183	1170	1164	1138	1148	1144	1144	1141	1143	1140	1146	1145
Yield	(mt/ha)	4.83	4.77	4.83	4.95	4.97	5.00	5.05	5.08	5.11	5.15	5.19	5.24	5.28	5.33	5.38
Production	(1000 mt)	5466	5857	6233	5855	5815	5821	5740	5831	5852	5889	5924	5989	6021	6107	6162
Imports	(1000 mt)	319	318	319	322	334	349	364	379	395	411	426	441	457	473	487
Food Use	(1000 mt)	2551	2680	2770	2846	2912	2978	3037	3099	3162	3224	3286	3349	3412	3477	3541
Seed Use	(1000 mt)	128	145	137	131	126	122	123	121	121	120	119	118	118	117	98
Brewer Use	(1000 mt)	491	503	501	503	506	509	512	517	523	529	535	541	547	554	560
Total Consumption	(1000 mt)	3211	3508	3604	3677	3739	3805	3868	3934	4001	4069	4136	4204	4273	4344	4395
Per Capita Use	(kg)	12.10	13.11	13.34	13.50	13.61	13.73	13.85	13.97	14.10	14.22	14.34	14.46	14.58	14.70	14.76
Exports	(1000 mt)	2500	2728	2802	2596	2475	2407	2300	2280	2252	2236	2223	2221	2206	2213	2226
Residual	(1000 mt)	41	180	196	196	196	196	196	196	196	196	196	196	196	196	196
Total Use	(1000 mt)	5711	6236	6406	6273	6214	6212	6167	6213	6254	6305	6360	6425	6480	6557	6621
Ending Stocks	(1000 mt)	878	817	964	868	804	761	698	695	688	682	672	678	676	700	727

Table 12. Arkansas Rice Supply by Type

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Long Grain Area	(1000 ac)	910.0	1148.4	1324.6	1022.0	1020.2	1015.4	985.5	995.5	991.1	992.0	991.5	994.4	992.3	996.7	995.7
Long Grain Yield	(pounds/ac)	6050	5630	5776	5832	5851	5887	5925	5963	6003	6044	6096	6151	6209	6272	6339
Long Grain Production	(mil. cwt)	55.1	64.7	76.5	59.6	59.7	59.8	58.4	59.4	59.5	60.0	60.4	61.2	61.6	62.5	63.1
Medium Grain Area	(1000 ac)	260.0	220.5	201.5	248.1	247.1	244.9	246.4	245.0	245.9	245.2	243.9	245.3	246.0	250.3	253.9
Medium Grain Yield	(pounds/ac)	6500	5806	6087	6157	6178	6199	6221	6243	6265	6287	6339	6394	6454	6519	6588
Medium Grain Production	(mil. cwt)	16.9	12.8	12.3	15.3	15.3	15.2	15.3	15.3	15.4	15.4	15.5	15.7	15.9	16.3	16.7
Total Area	(1000 ac)	1170.0	1368.8	1526.1	1270.1	1267.3	1260.3	1231.9	1240.5	1237.0	1237.2	1235.5	1239.7	1238.3	1246.9	1249.6
Average Yield	(pounds/ac)	6149	5658	5817	5895	5914	5948	5984	6019	6055	6092	6144	6199	6258	6322	6390
Total Production	(mil. cwt)	71.9	77.5	88.8	74.9	74.9	75.0	73.7	74.7	74.9	75.4	75.9	76.8	77.5	78.8	79.9

Table 13. Louisiana Rice Supply by Type

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Long Grain Area	(1000 ac)	463.0	500.3	557.6	477.8	478.7	473.1	459.8	458.5	452.9	448.7	444.2	440.4	435.0	431.8	426.9
Long Grain Yield	(pounds/ac)	4900	4663	4787	4857	4885	4926	4970	5015	5062	5111	5159	5208	5257	5308	5360
Long Grain Production	(mil. cwt)	22.7	23.5	26.7	23.2	23.4	23.3	22.9	23.0	22.9	22.9	22.9	22.9	22.9	22.9	22.9
Medium Grain Area	(1000 ac)	70.0	45.6	30.5	56.6	61.6	64.4	69.2	72.3	76.6	79.8	83.8	88.4	92.6	99.4	105.9
Medium Grain Yield	(pounds/ac)	4700	4569	4606	4693	4716	4741	4769	4795	4822	4849	4879	4912	4948	4987	5030
Medium Grain Production	(mil. cwt)	3.3	2.1	1.4	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.6	5.0	5.3
Total Area	(1000 ac)	533.0	545.9	588.1	534.4	540.4	537.6	529.0	530.9	529.4	528.6	528.1	528.8	527.6	531.2	532.8
Average Yield	(pounds/ac)	4874	4655	4778	4840	4865	4904	4943	4985	5027	5071	5114	5158	5203	5248	5294
Total Production	(mil. cwt)	26.0	25.5	28.1	25.9	26.3	26.4	26.2	26.5	26.6	26.8	27.0	27.3	27.5	27.9	28.2

Table 14. Texas Rice Supply (Aggregate; Mostly Long Grain)

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area	(1000 ac)	298.0	259.2	253.6	251.7	249.4	248.1	236.0	240.1	238.2	238.2	234.9	234.2	231.2	231.0	229.5
Average Yield	(pounds/ac)	6196	5540	5627	5970	6004	6044	6084	6120	6154	6182	6254	6327	6400	6509	6617
Total Production	(mil. cwt)	18.5	14.3	14.3	15.0	15.0	15.0	14.4	14.7	14.7	14.7	14.7	14.8	14.8	15.0	15.2

Table 15. Missouri Rice Supply (Long Grain)

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area	(1000 ac)	90.0	108.7	124.1	104.8	99.9	99.3	93.8	95.6	94.7	94.7	94.2	94.3	93.4	93.6	92.9
Average Yield	(pounds/ac)	5550	5306	5336	5406	5431	5459	5487	5515	5544	5572	5605	5637	5671	5707	5745
Total Production	(mil. cwt)	5.0	5.8	6.6	5.7	5.4	5.4	5.1	5.3	5.2	5.3	5.3	5.3	5.3	5.3	5.3

Table 16. Mississippi Rice Supply (Mostly Long Grain)

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area	(1000 ac)	208.0	238.3	220.5	249.5	230.1	229.2	211.9	218.7	216.7	217.8	216.1	216.7	213.7	214.1	210.6
Average Yield	(pounds/ac)	6000	5772	5887	5898	5953	6009	6064	6119	6175	6230	6302	6369	6431	6488	6541
Total Production	(mil. cwt)	12.5	13.7	13.0	14.7	13.7	13.8	12.8	13.4	13.4	13.6	13.6	13.8	13.7	13.9	13.8

Table 17. California Rice Supply (Aggregate; Mostly Medium and Short Grain)

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area	(1000 ac)	500.0	507.0	479.1	514.5	506.1	503.3	509.7	512.5	512.8	511.2	511.3	512.7	512.6	515.0	516.0
Average Yield	(pounds/ac)	7500	8324	8374	8386	8436	8487	8541	8597	8655	8716	8781	8840	8892	8938	8975
Total Production	(mil. cwt)	37.1	42.5	40.1	43.1	42.7	42.7	43.5	44.1	44.4	44.6	44.9	45.3	45.6	46.0	46.3

Table 18. China Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	31406	32030	31783	31577	31367	31142	30941	30752	30576	30406	30246	30095	29952	29814	29680
Yield	(mt/ha)	4.35	4.37	4.38	4.42	4.44	4.48	4.52	4.55	4.58	4.62	4.66	4.70	4.74	4.79	4.83
Production	(1000 mt)	136570	139998	139169	139467	139297	139492	139909	139932	140136	140392	140919	141504	142117	142750	143401
Per Capita Use	(kg)	109.20	111.19	110.83	110.65	109.90	109.47	109.15	108.76	108.45	108.12	107.74	107.41	107.13	106.87	106.58
Total Consumption	(1000 mt)	132134	135818	136593	137531	137704	138209	138815	139293	139827	140296	140707	141162	141676	142218	142724
Exports	(1000 mt)	938	2489	1634	1518	1464	1414	1363	1310	1257	1208	1163	1118	1073	1027	982
Imports	(1000 mt)	326	413	423	457	477	492	504	527	545	557	551	546	543	541	535
Net Exports	(1000 mt)	612	2076	1211	1061	987	922	859	783	712	651	612	572	530	487	447
Ending Stocks	(1000 mt)	25556	27660	29024	29899	30505	30866	31101	30957	30553	29998	29597	29367	29278	29323	29553

Table 19. India Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area Harvested	(1000 ha)	42700	42428	42870	43003	43086	43150	43272	43344	43408	43454	43488	43564	43638	43718	43812
East	(1000 ha)	18494	18499	18504	18512	18520	18528	18536	18545	18554	18563	18572	18585	18597	18610	18623
North	(1000 ha)	8506	8572	8764	8764	8750	8734	8782	8780	8767	8731	8679	8660	8635	8610	8591
South	(1000 ha)	7624	7564	7593	7590	7590	7591	7585	7584	7585	7589	7594	7596	7599	7602	7604
West	(1000 ha)	7688	7793	8010	8137	8226	8297	8369	8435	8503	8572	8643	8722	8806	8895	8993
Average Yield	(mt/ha)	1.90	1.94	1.96	1.99	2.02	2.05	2.08	2.12	2.16	2.19	2.22	2.25	2.28	2.32	2.35
East	(mt/ha)	1.59	1.63	1.64	1.67	1.70	1.73	1.76	1.79	1.85	1.88	1.91	1.94	1.97	2.00	2.03
North	(mt/ha)	2.39	2.40	2.45	2.48	2.52	2.56	2.62	2.67	2.71	2.75	2.79	2.83	2.87	2.91	2.96
South	(mt/ha)	2.80	2.84	2.85	2.89	2.92	2.96	2.99	3.03	3.09	3.13	3.16	3.20	3.23	3.30	3.34
West	(mt/ha)	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.48	1.50	1.52	1.54	1.57	1.59
Total Production	(1000 mt)	81200	82481	84044	85515	87010	88426	90154	91699	93941	95378	96724	98172	99613	101365	102946
East	(1000 mt)	29475	30130	30324	30891	31460	32029	32600	33171	34364	34938	35512	36094	36677	37261	37846
North	(1000 mt)	20305	20609	21443	21749	22066	22375	23012	23454	23770	24022	24227	24520	24794	25066	25450
South	(1000 mt)	21345	21460	21647	21912	22184	22458	22710	22980	23446	23729	24019	24298	24580	25102	25382
West	(1000 mt)	9974	10282	10631	10963	11300	11564	11831	12094	12361	12688	12966	13260	13563	13936	14268
Average Per capita use	(kg)	82.31	82.67	82.95	83.20	83.43	83.68	83.95	84.26	84.60	84.94	85.27	85.56	85.83	86.10	86.38
East	(kg)	165.33	164.41	165.39	166.14	166.76	167.34	167.91	168.50	169.12	169.72	170.29	170.80	171.19	171.51	171.76
North	(kg)	16.66	16.66	16.67	16.74	16.86	17.08	17.37	17.74	18.20	18.63	19.09	19.59	20.15	20.80	21.54
South	(kg)	109.02	108.70	108.91	109.15	109.41	109.65	109.93	110.21	110.51	110.83	111.12	111.23	111.33	111.42	111.52
West	(kg)	37.46	37.35	37.24	37.15	37.09	37.04	37.01	37.00	37.01	37.02	37.05	37.09	37.13	37.19	37.26
Total Consumption	(1000 mt)	79250	80156	81789	83376	84950	86533	88145	89792	91485	93169	94856	96514	98183	99885	101624
East	(1000 mt)	41790	42274	43246	44154	45028	45891	46752	47619	48498	49371	50234	51094	51934	52763	53585
North	(1000 mt)	3703	3765	3831	3910	4002	4117	4251	4407	4589	4764	4952	5153	5374	5626	5908
South	(1000 mt)	23954	24298	24755	25217	25682	26140	26606	27076	27549	28025	28496	28924	29359	29799	30246
West	(1000 mt)	9681	9819	9956	10095	10238	10385	10536	10691	10849	11010	11174	11343	11517	11697	11884
Exports	(1000 mt)	2105	2498	2024	1918	1939	1960	1997	2041	2031	2021	2028	2036	2048	2068	2087
Ending Stocks	(1000 mt)	10845	10672	10903	11124	11245	11177	11190	11056	11481	11668	11508	11131	10513	9924	9159

Table 20. Pakistan Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	2252	2316	2324	2323	2319	2313	2306	2307	2313	2321	2335	2352	2372	2394	2416
Yield	(mt/ha)	1.91	1.89	1.94	1.96	1.98	2.00	2.02	2.04	2.06	2.08	2.11	2.13	2.16	2.19	2.21
Production	(1000 mt)	4307	4367	4500	4548	4587	4624	4658	4709	4770	4837	4920	5009	5118	5232	5349
Per Cap Use	(kg)	19.74	19.30	19.49	19.48	19.46	19.45	19.43	19.42	19.40	19.39	19.37	19.36	19.34	19.33	19.31
Total Consumption	(1000 mt)	2550	2549	2630	2685	2740	2795	2850	2905	2960	3013	3067	3120	3174	3230	3286
Net Exports	(1000 mt)	1834	1907	1914	1888	1861	1827	1798	1781	1772	1770	1791	1819	1858	1901	1947
Ending Stocks	(1000 mt)	438	349	306	281	268	269	279	302	340	395	456	526	612	713	829

Table 21. Myanmar Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	5600	5493	5714	5721	5760	5795	5847	5888	5939	5985	6036	6091	6145	6196	6248
Yield	(mt/ha)	1.61	1.62	1.73	1.74	1.77	1.79	1.82	1.84	1.86	1.89	1.91	1.94	1.96	1.99	2.01
Production	(1000 mt)	9000	8920	9876	9954	10189	10384	10613	10828	11064	11294	11538	11795	12053	12313	12578
Per-capita Use	(kg)	200.01	197.10	195.96	195.49	195.33	195.42	195.17	194.80	194.32	193.87	192.98	192.35	192.00	191.91	192.06
Total Consumption	(1000 mt)	9210	9267	9406	9580	9772	9982	10178	10372	10563	10759	10934	11127	11339	11571	11823
Net Exports	(1000 mt)	15	54	216	256	321	373	419	463	506	549	593	639	685	730	777
Ending Stocks	(1000 mt)	660	260	514	633	729	758	775	768	763	749	759	788	818	829	806

Table 22. Vietnam Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area Harvested	(1000 ha)	7050	7105	7164	7191	7213	7226	7243	7254	7265	7270	7277	7286	7292	7294	7295
Mekong Delta	(1000 ha)	3229	3254	3291	3307	3325	3336	3348	3357	3365	3369	3375	3383	3389	3394	3398
Rest of Vietnam	(1000 ha)	3821	3850	3873	3884	3888	3890	3895	3897	3900	3901	3902	3903	3903	3901	3898
Yield Average	(mt/ha)	2.55	2.54	2.61	2.63	2.67	2.71	2.75	2.79	2.83	2.87	2.90	2.94	2.97	3.00	3.04
Production	(1000 mt)	18000	18011	18711	18939	19236	19566	19905	20227	20545	20840	21128	21406	21654	21912	22149
Per Capita Use	(kg)	199.03	191.43	193.54	193.23	192.93	192.54	192.26	192.00	191.82	191.69	191.58	191.55	191.60	191.71	191.87
Total Consumption	(1000 mt)	14730	14390	14771	14963	15147	15318	15492	15718	15900	16085	16272	16465	16667	16877	17093
Net Exports	(1000 mt)	3270	3621	3940	3977	4089	4248	4414	4509	4646	4754	4855	4941	4987	5035	5056
Ending Stocks	(1000 mt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 23. Australia Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	166	148	168	168	168	168	169	169	170	171	172	173	173	174	174
Yield	(mt/ha)	5.98	6.21	6.06	6.10	6.15	6.21	6.26	6.31	6.37	6.42	6.48	6.54	6.60	6.67	6.75
Production	(1000 mt)	992	918	1015	1023	1033	1043	1055	1068	1082	1097	1112	1128	1145	1161	1178
Per Capita Use	(kg)	15.34	15.71	15.83	15.96	16.09	16.22	16.35	16.48	16.61	16.74	16.88	17.01	17.15	17.28	17.42
Total Consumption	(1000 mt)	280	290	295	300	305	310	315	320	325	330	335	340	345	351	356
Imports	(1000 mt)	35	40	39	41	43	45	47	49	51	53	55	57	59	61	63
Exports	(1000 mt)	700	701	736	739	770	780	788	798	808	820	832	844	856	868	881
Net Exports	(1000 mt)	665	661	697	699	727	735	741	749	757	767	777	787	797	807	818
Ending Stocks	(1000 mt)	103	70	93	118	119	117	116	115	115	115	115	116	119	122	126

Table 24. Egypt Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	591	630	600	575	550	525	500	500	500	500	500	500	500	500	500
Yield	(mt/ha)	5.06	4.69	5.02	5.08	5.15	5.23	5.30	5.37	5.45	5.51	5.57	5.63	5.69	5.75	5.81
Production	(1000 mt)	2989	2957	3012	2921	2834	2745	2650	2687	2723	2755	2786	2817	2846	2875	2903
Per Capita Use	(kg)	41.18	42.08	41.79	41.12	40.12	39.06	38.04	37.02	36.60	36.20	35.82	35.49	35.26	35.13	35.13
Total Consumption	(1000 mt)	2600	2707	2737	2742	2723	2697	2673	2645	2659	2673	2688	2705	2730	2764	2807
Net Exports	(1000 mt)	150	306	124	117	111	106	101	98	95	92	90	87	84	81	78
Ending Stocks	(1000 mt)	672	617	768	829	829	771	647	591	559	549	558	583	615	645	662

Table 25. Argentina Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	230	195	232	239	247	256	266	276	287	299	310	323	336	350	364
Yield	(mt/ha)	3.39	3.00	3.43	3.48	3.54	3.60	3.66	3.72	3.78	3.84	3.91	3.97	4.03	4.09	4.15
Production	(1000 mt)	780	583	794	832	876	921	973	1028	1087	1148	1213	1282	1355	1431	1512
Per capita use	(kg)	6.49	6.59	6.62	6.69	6.76	6.84	6.92	7.01	7.10	7.20	7.31	7.42	7.54	7.67	7.81
Total Consumption	(1000 mt)	225	231	235	240	245	250	256	262	268	274	281	288	296	304	313
Exports	(1000 mt)	523	399	549	589	631	674	719	765	817	874	938	1002	1066	1130	1195
Ending Stocks	(1000 mt)	129	82	93	96	96	94	92	93	95	94	88	80	72	70	75

Table 26. Uruguay Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	155	163	168	170	173	177	181	185	189	192	196	200	204	207	210
Yield	(mt/ha)	4.63	4.15	4.52	4.57	4.62	4.67	4.74	4.80	4.86	4.93	5.00	5.07	5.15	5.23	5.31
Production	(1000 mt)	718	678	760	774	800	826	856	887	917	948	980	1013	1047	1082	1117
Per capita use	(kg)	23.66	25.02	26.06	26.99	28.04	28.55	28.99	29.42	29.81	30.20	30.55	30.86	31.16	31.45	31.72
Total Consumption	(1000 mt)	75	80	84	87	91	93	95	96	98	99	101	102	103	105	106
Exports	(1000 mt)	645	597	678	687	708	733	760	790	818	847	877	908	940	973	1006
Ending Stocks	(1000 mt)	22	22	21	21	22	23	24	25	26	28	30	33	36	41	46

Table 27. Brazil Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Area Harvested	(1000 ha)	3570	3299	3513	3529	3487	3443	3406	3369	3333	3293	3255	3217	3187	3154	3119
Irrigated	(1000 ha)	905	900	1002	1020	1037	1052	1068	1084	1101	1117	1132	1148	1164	1179	1194
Upland	(1000 ha)	2665	2399	2511	2509	2450	2391	2338	2285	2233	2176	2123	2068	2023	1975	1925
Average Yield	(mt/ha)	1.86	1.82	1.86	1.91	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.31	2.36	2.42	2.48
Irrigated	(mt/ha)	3.55	3.51	3.56	3.62	3.67	3.72	3.77	3.83	3.88	3.92	3.97	4.02	4.06	4.11	4.15
Upland	(mt/ha)	1.28	1.19	1.19	1.21	1.23	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.41	1.44
Total Production	(1000 mt)	6628	6005	6547	6735	6815	6890	6980	7069	7162	7245	7335	7422	7530	7631	7727
Irrigated	(1000 mt)	3214	3157	3564	3691	3807	3915	4033	4148	4266	4381	4496	4614	4731	4845	4956
Upland	(1000 mt)	3414	2847	2983	3044	3008	2975	2948	2921	2896	2864	2838	2807	2799	2786	2771
Per capita use	(kg)	48.87	47.83	48.23	48.35	48.34	48.31	48.27	48.24	48.23	48.23	48.24	48.27	48.29	48.33	48.37
Total Consumption	(1000 mt)	7950	7869	8021	8121	8197	8264	8331	8398	8466	8535	8604	8676	8750	8826	8903
Net Imports	(1000 mt)	1000	1698	1554	1395	1413	1394	1377	1363	1343	1328	1311	1295	1267	1241	1223
Ending Stocks	(1000 mt)	664	497	577	586	616	636	661	696	734	773	814	855	903	949	995

Table 28. European Union Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	408	406	410	387	382	380	380	380	379	379	379	379	379	379	379
Yield	(mt/ha)	3.87	4.10	3.90	3.87	3.88	3.90	3.92	3.95	3.97	3.99	4.02	4.04	4.07	4.09	4.11
Production	(1000 mt)	1580	1663	1600	1497	1480	1483	1490	1498	1507	1516	1524	1533	1542	1551	1560
Per Capita Use	(kg)	5.47	5.36	5.40	5.45	5.49	5.53	5.58	5.62	5.67	5.71	5.75	5.80	5.84	5.88	5.93
Total Consumption	(1000 mt)	1927	1894	1915	1936	1956	1976	1996	2016	2035	2054	2072	2091	2109	2128	2146
Imports	(1000 mt)	1571	1472	1451	1498	1518	1528	1540	1549	1559	1569	1577	1586	1596	1607	1616
Exports	(1000 mt)	1331	1139	1059	1043	1035	1043	1046	1052	1055	1059	1059	1054	1050	1048	1048
Net Imports	(1000 mt)	240	332	391	455	483	486	494	496	504	510	518	533	546	559	568
Ending Stocks	(1000 mt)	271	373	449	467	474	466	453	432	408	379	349	325	304	286	268

Table 29. Italy Rice Supply

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	238	233	237	240	240	240	240	240	240	240	240	240	240	240	240
Yield	(mt/ha)	3.48	3.87	3.65	3.68	3.71	3.73	3.76	3.78	3.81	3.84	3.86	3.89	3.92	3.94	3.97
Production	(1000 mt)	828	901	866	883	889	896	902	908	915	921	927	934	940	946	953
Exports (Japonica)	(1000 mt)	600	504	559	542	533	532	533	535	538	541	539	535	534	535	537

Table 30. Spain Rice Supply

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	107	111	112	86	80	79	79	79	79	78	78	78	78	78	78
Yield	(mt/ha)	4.98	5.05	4.72	4.74	4.75	4.77	4.79	4.81	4.82	4.84	4.86	4.87	4.89	4.91	4.93
Production	(1000 mt)	533	559	526	406	382	377	377	378	379	380	381	382	383	384	385

Table 31. Other EU Rice Supply

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested (EU-Ita-Sp)	(1000 ha)	63	62	62	61	61	61	61	61	61	61	61	61	61	61	61
Yield (EU-Ita-Sp)	(mt/ha)	3.48	3.25	3.37	3.39	3.41	3.43	3.46	3.48	3.50	3.52	3.55	3.57	3.59	3.61	3.63
Production (EU-Ita-Sp)	(1000 mt)	219	203	208	208	209	210	211	212	213	215	216	218	219	221	222
Exports (EU-Ita), Indica	(1000 mt)	731	635	500	501	502	510	513	517	517	518	520	519	516	513	511

Table 32. Indonesia Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	11072	10806	11285	11468	11589	11680	11753	11814	11867	11911	11945	11968	11978	11971	11942
Yield	(mt/ha)	2.89	2.86	2.88	2.91	2.93	2.96	2.98	3.00	3.02	3.04	3.06	3.08	3.09	3.11	3.13
Production	(1000 mt)	32015	30917	32549	33361	33993	34528	35006	35442	35844	36211	36542	36831	37069	37246	37346
Per-capita Use	(kg)	164.13	171.26	165.49	165.08	165.46	165.88	165.76	165.98	165.71	165.62	165.76	165.68	165.38	164.92	164.33
Total Consumption	(1000 mt)	33905	35911	35219	35648	36245	36852	37339	37899	38346	38827	39356	39829	40254	40643	41005
Net Imports	(1000 mt)	800	4995	2552	2482	2278	2352	2355	2483	2522	2637	2838	3019	3204	3414	3675
Ending Stocks	(1000 mt)	1525	1526	1409	1604	1631	1658	1680	1705	1726	1747	1771	1792	1811	1829	1845

Table 33. Iran Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	600	600	609	618	626	634	643	651	659	667	675	683	691	699	707
Yield	(mt/ha)	2.67	2.67	2.72	2.74	2.77	2.79	2.82	2.84	2.87	2.90	2.92	2.95	2.97	3.00	3.02
Production	(1000 mt)	1600	1600	1655	1694	1733	1773	1812	1851	1891	1931	1971	2012	2053	2094	2136
Per Capita Use	(kg)	44.07	43.15	43.90	44.00	44.09	44.16	44.23	44.30	44.36	44.42	44.47	44.51	44.55	44.59	44.62
Total Consumption	(1000 mt)	2750	2749	2858	2926	2993	3062	3131	3202	3274	3346	3420	3496	3572	3650	3730
Net Imports	(1000 mt)	1000	1000	1231	1242	1271	1300	1331	1362	1394	1427	1461	1496	1532	1569	1607
Ending Stocks	(1000 mt)	596	447	476	488	499	510	522	534	546	558	570	583	595	608	622

Table 34. Iraq Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	140	140	148	151	153	155	156	157	158	159	161	162	163	164	165
Yield	(mt/ha)	1.43	1.43	1.45	1.46	1.49	1.52	1.55	1.58	1.61	1.64	1.67	1.70	1.73	1.77	1.80
Production	(1000 mt)	200	201	214	221	228	234	241	248	255	261	268	276	283	290	297
Per Capita Use	(kg)	40.65	36.21	36.62	36.80	36.99	37.13	37.26	37.36	37.45	37.52	37.56	37.59	37.61	37.61	37.59
Total Consumption	(1000 mt)	870	800	835	865	895	925	957	988	1020	1053	1085	1119	1153	1188	1223
Net Imports	(1000 mt)	720	599	721	694	667	691	715	740	765	791	817	843	870	898	926
Ending Stocks	(1000 mt)	50	50	150	200	200	200	200	200	200	200	200	200	200	200	200

Table 35. Saudi Arabia Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Per Capita Use	(kg)	37.83	35.99	36.41	36.53	36.68	36.74	36.86	36.94	37.06	37.15	37.21	37.29	37.40	37.51	37.60
Total Consumption	(1000 mt)	736	724	757	785	814	842	873	904	937	971	1005	1040	1078	1117	1157
Net Imports	(1000 mt)	746	724	757	785	814	842	873	904	937	971	1005	1040	1078	1117	1157

Table 36. Japan Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	1977	1983	1850	1741	1705	1684	1663	1641	1618	1593	1568	1541	1515	1488	1461
Yield	(mt/ha)	4.76	4.67	4.88	4.91	4.94	4.97	4.99	5.02	5.05	5.08	5.11	5.14	5.17	5.20	5.23
Production	(1000 mt)	9413	9265	9022	8542	8414	8362	8306	8244	8175	8099	8016	7925	7832	7738	7642
Per capita use	(kg)	73.73	73.25	72.86	72.45	71.97	71.54	71.10	70.63	70.13	69.60	69.05	68.47	67.87	67.26	66.65
Total Consumption	(1000 mt)	9250	9209	9180	9150	9109	9075	9037	8992	8941	8883	8819	8747	8673	8598	8522
Exports	(1000 mt)	100	750	200	200	200	200	200	200	200	200	200	200	200	200	200
Imports	(1000 mt)	500	600	606	682	758	773	789	804	820	837	854	871	888	906	924
Net Imports	(1000 mt)	400	-150	406	482	558	573	589	604	620	637	654	671	688	706	724
Ending Stocks	(1000 mt)	3043	2949	3197	3071	2934	2794	2652	2508	2363	2215	2066	1915	1763	1609	1452

Table 37. South Korea Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	1050	1050	948	944	941	943	921	898	873	869	861	852	842	832	821
Yield	(mt/ha)	5.07	5.19	4.97	5.01	5.07	5.10	5.13	5.15	5.18	5.21	5.24	5.27	5.30	5.33	5.36
Production	(1000 mt)	5320	5449	4716	4729	4772	4805	4719	4625	4522	4527	4512	4489	4463	4434	4402
Per capita use	(kg)	110.76	108.84	107.24	106.30	105.79	104.34	102.36	100.27	98.07	97.25	96.31	95.27	94.17	93.03	91.85
Total Consumption	(1000 mt)	5037	5000	4977	4982	5007	4986	4936	4878	4811	4809	4798	4781	4761	4737	4711
Imports	(1000 mt)	77	88	115	135	147	177	210	244	278	281	285	290	295	300	306
Exports	(1000 mt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Imports	(1000 mt)	77	88	115	135	147	177	210	244	278	281	285	290	295	300	306
Ending Stocks	(1000 mt)	605	1141	995	877	789	785	777	768	758	757	756	753	750	746	742

Table 38. Taiwan Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	348	364	355	300	286	271	259	247	239	233	227	223	220	218	216
Yield	(mt/ha)	4.08	4.04	4.08	4.18	4.23	4.28	4.32	4.36	4.40	4.42	4.47	4.51	4.55	4.58	4.62
Production	(1000 mt)	1420	1470	1449	1254	1208	1161	1121	1078	1050	1029	1015	1005	1000	997	998
Per capita use	(kg)	67.47	65.95	64.01	62.08	60.05	57.93	55.73	53.45	51.69	50.34	49.29	48.49	47.88	47.41	47.05
Total Consumption	(1000 mt)	1450	1430	1400	1369	1335	1299	1259	1217	1187	1165	1149	1139	1133	1130	1130
Net Imports	(1000 mt)	-45	-40	-40	110	121	132	132	132	132	132	132	132	132	132	132
Ending Stocks	(1000 mt)	223	223	233	228	223	216	210	203	198	194	192	190	189	188	188

Table 39. Rest of World (ROW) Rice Supply and Utilization

Variable	Units / Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Area Harvested	(1000 ha)	30376	29310	29324	29412	29586	29762	29939	30112	30289	30463	30638	30816	30992	31165	31338
Yield	(mt/ha)	1.58	1.62	1.69	1.72	1.74	1.76	1.78	1.80	1.81	1.83	1.85	1.87	1.89	1.90	1.92
Production	(1000 mt)	48057	47356	49512	50617	51506	52357	53212	54075	54942	55816	56695	57577	58465	59361	60262
Total Consumption	(1000 mt)	60674	59528	60721	61833	63117	64007	64952	65764	66671	67560	68425	69336	70229	71143	72001
Net Imports	(1000 mt)	12337	11090	11830	11604	11773	11785	11881	11821	11870	11885	11871	11906	11910	11933	11887
Ending Stocks	(1000 mt)	4773	3691	4311	4699	4862	4996	5136	5268	5409	5550	5691	5838	5985	6136	6284

Appendix Table 1. Population

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(Percentage Change from Previous Year)														
United States	0.85	0.88	0.89	0.86	0.86	0.87	0.81	0.81	0.80	0.79	0.81	0.81	0.80	0.80	0.80
Thailand	1.04	1.01	0.98	0.94	0.91	0.88	0.86	0.84	0.82	0.79	0.77	0.74	0.74	0.74	0.74
Pakistan	2.22	2.20	2.18	2.16	2.14	2.10	2.05	2.00	1.95	1.90	1.85	1.82	1.82	1.82	1.82
Myanmar	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Vietnam	1.64	1.57	1.53	1.46	1.39	1.33	1.28	1.60	1.25	1.24	1.22	1.20	1.20	1.20	1.20
China	0.99	0.95	0.90	0.85	0.81	0.76	0.73	0.70	0.67	0.65	0.64	0.63	0.63	0.63	0.63
India	1.73	1.69	1.64	1.16	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.35	1.33	1.31	1.31
Australia	0.99	0.97	0.94	0.91	0.88	0.85	0.83	0.80	0.78	0.75	0.73	0.72	0.72	0.72	0.72
Egypt	1.91	1.88	1.84	1.81	1.77	1.75	1.73	1.70	1.67	1.64	1.62	1.59	1.59	1.59	1.59
Argentina	1.11	1.10	1.09	1.08	1.07	1.05	1.04	1.03	1.02	1.00	0.99	0.99	0.99	0.99	0.99
Uruguay	0.63	0.95	0.31	0.62	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Japan	0.20	0.21	0.22	0.23	0.23	0.22	0.20	0.17	0.14	0.10	0.07	0.03	0.03	0.03	0.03
Indonesia	1.53	1.51	1.49	1.47	1.44	1.42	1.39	1.37	1.34	1.31	1.28	1.25	1.25	1.25	1.25
Iraq	3.38	3.27	3.17	3.07	2.98	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Iran	2.16	2.10	2.18	2.14	2.12	2.11	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Saudi Arabia	3.50	3.38	3.36	3.34	3.33	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
European Union	0.31	0.30	0.28	0.27	0.25	0.23	0.21	0.19	0.17	0.15	0.13	0.13	0.13	0.13	0.13
South Korea	1.02	1.02	1.01	1.00	0.98	0.96	0.92	0.88	0.84	0.80	0.76	0.73	0.73	0.73	0.73
Taiwan	0.89	0.88	0.86	0.85	0.83	0.82	0.81	0.80	0.79	0.78	0.76	0.74	0.74	0.74	0.74
Brazil	1.20	1.14	1.08	1.01	0.94	0.90	0.88	0.86	0.84	0.81	0.79	0.79	0.79	0.79	0.79

Appendix Table 2. Real Gross Domestic Product (GDP)

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(Percentage Change from Previous Year)														
United States	2.40	3.60	2.40	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Thailand	6.70	1.20	0.00	3.30	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60
Pakistan	5.40	4.10	5.30	5.90	6.20	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Myanmar	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
Vietnam	10.20	10.10	9.70	9.40	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50
China (GNP)	9.70	9.30	8.00	9.00	9.00	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70
India	5.20	5.10	5.30	5.40	5.30	5.70	5.60	5.80	6.00	5.80	6.00	5.80	5.80	6.00	6.00
Australia	3.60	3.00	3.40	3.40	4.30	3.70	3.50	3.50	3.40	3.40	3.40	3.40	3.40	3.40	3.40
Egypt	5.10	5.00	5.10	5.20	5.50	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Argentina	3.00	4.70	4.90	4.10	4.00	3.40	5.60	5.60	4.90	4.70	4.60	4.60	4.60	4.60	4.60
Uruguay	0.50	3.50	2.60	3.00	3.00	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90
Japan	3.70	1.00	1.10	1.50	1.90	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Indonesia	7.80	6.10	3.00	4.50	6.10	7.00	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Iran	2.10	2.60	2.80	2.60	3.10	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
Saudi Arabia	6.90	0.40	-0.90	2.30	2.50	2.40	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
European Union	1.40	2.40	2.70	2.80	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
South Korea	7.10	6.10	3.30	4.80	6.30	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70
Taiwan	6.00	6.10	6.50	6.30	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40
Brazil	2.80	3.90	0.50	4.00	4.10	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60

Appendix Table 3. Gross Domestic Product (GDP) Deflator

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(Percentage Change from Previous Year)														
United States	2.10	2.20	2.40	2.50	2.50	2.50	2.50	2.40	2.60	2.60	2.60	2.60	2.60	2.60	2.60
Thailand	5.40	7.40	11.90	8.90	6.40	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90
Pakistan	9.60	11.00	10.60	9.80	8.50	8.20	7.90	7.90	7.80	7.70	7.60	7.60	7.60	7.60	7.60
Myanmar	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66
Vietnam	17.80	15.40	13.70	10.70	10.00	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50
China	7.90	-0.10	1.50	3.20	3.20	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
India	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
Australia	2.40	2.20	3.20	3.00	3.30	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Egypt	6.00	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
Argentina	2.50	3.10	3.00	4.70	5.40	8.30	8.30	8.30	8.30	8.30	8.30	8.30	8.30	8.30	8.30
Uruguay	30.10	24.40	24.90	22.50	15.20	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10	17.10
Japan	0.00	1.50	1.10	0.80	0.70	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Indonesia	8.40	7.70	11.80	8.60	8.50	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40
Iran	35.90	25.30	20.60	17.50	10.50	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Saudi Arabia	6.90	0.40	-0.90	2.30	2.50	2.40	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
European Union	5.30	2.70	1.80	2.10	2.20	2.20	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
South Korea	3.40	4.30	7.10	6.80	4.90	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Taiwan	2.50	2.70	2.80	2.70	2.90	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Brazil	18.60	6.20	8.20	6.80	6.90	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10

Appendix Table 4. Consumer Price Index (CPI)

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(Percentage Change from Previous Year)														
United States	2.90	2.50	2.90	3.30	3.30	3.20	3.10	2.80	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Thailand	5.90	5.40	5.30	5.20	5.10	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Pakistan	10.20	10.10	9.50	9.60	9.40	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20
Myanmar	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Vietnam	10.60	10.00	9.50	9.40	8.10	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
China	9.30	11.00	12.40	12.10	11.70	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80
India	8.10	7.50	7.30	7.30	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.20
Australia	3.10	2.80	3.60	3.90	3.10	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Egypt	12.00	8.60	7.80	6.40	5.10	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Argentina	0.20	2.50	3.10	4.00	4.60	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Uruguay	30.10	27.60	24.30	15.50	17.40	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20
Japan	0.10	0.70	1.60	2.00	2.10	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
Indonesia	8.20	8.60	8.50	8.40	8.20	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10
Iraq	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20	4.20
Iran	45.60	30.20	21.30	13.40	9.10	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
Saudi Arabia	1.20	1.70	1.80	1.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
European Union	2.50	2.60	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
South Korea	5.10	5.20	5.40	5.40	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10
Taiwan	3.00	3.40	3.40	3.30	3.50	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
Brazil	19.50	14.00	11.20	10.10	9.60	9.60	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

Appendix Table 5. Exchange Rate*

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	(Percentage Change from Previous Year)														
Thailand	1.50	15.00	25.00	4.50	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pakistan	1.40	12.90	9.20	8.20	7.60	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Myanmar	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59	-1.59
Vietnam	4.10	4.50	4.70	4.60	4.70	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
China	-0.40	-1.00	0.00	0.00	1.00	2.10	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
India	7.10	4.60	4.30	4.20	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
Australia	-5.30	4.50	-1.50	-4.00	-1.30	4.50	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30
Egypt	0.00	0.50	0.50	1.00	1.30	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Argentina	-0.10	0.00	0.00	0.00	0.00	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Uruguay	0.00	20.00	17.71	15.93	12.98	12.16	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Japan	15.60	9.50	9.80	2.40	-0.70	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10
Indonesia	4.20	20.40	38.00	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Iraq	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iran	0.20	9.50	9.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Saudi Arabia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
European Union	4.40	12.60	0.40	-2.10	-2.10	-1.00	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50
South Korea	4.30	10.80	26.20	3.50	2.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
Taiwan	0.89	0.88	0.86	0.85	0.83	0.82	0.81	0.80	0.79	0.78	0.76	0.74	0.74	0.74	0.74
Brazil	9.70	7.50	8.80	5.40	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

*Relative to the US dollar.

Conversion Table

U.S. to Metric			Metric to U.S.		
to convert from	to	multiply U.S. unit by	to convert from	to	multiply metric unit by
length			length		
miles	kilometers	1.61	kilometers	miles	.62
yards	meters	.91	meters	yards	1.09
feet	meters	.31	meters	feet	3.28
inches	centimeters	2.54	centimeters	inches	.39
area and volume			area and volume		
sq yards	sq meters	.84	sq meters	sq yards	1.20
sq feet	sq meters	.09	sq meters	sq feet	10.76
sq inches	sq centimeters	6.45	sq centimeters	sq inches	.16
cu inches	cu centimeters	16.39	cu centimeters	cu inches	.06
acres	hectares	.41	hectares	acres	2.47
liquid measure			liquid measure		
cu inches	liters	.02	liters	cu inches	61.02
cu feet	liters	28.34	liters	cu feet	.04
gallons	liters	3.79	liters	gallons	.26
quarts	liters	.95	liters	quarts	1.06
fluid ounces	milliliters	29.57	milliliters	fluid ounces	.03
weight and mass			weight and mass		
pounds	kilograms	.45	kilograms	pounds	2.21
ounces	grams	28.35	grams	ounces	.04
temperature			temperature		
F	C	5/9(F-32)	C	F	9/5(C+32)


UofA
UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE