

GRAIN RESERVES: A REVIEW OF SELECTED
LITERATURE

by

MARITES S. CORPUS

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Major Professor

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TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION.....	1
II. WORLD FOOD PRICE VARIABILITY AND FOOD SECURITY.....	7
III. HISTORY OF FOOD RESERVE EFFORTS.....	11
IV. WHAT IS A GRAIN RESERVE?.....	16
Types of a grain reserve.....	16
Multiple goals of a grain reserve.....	16
Size of a grain reserve.....	32
Composition of a grain reserve.....	36
V. COSTS OF HOLDING A GRAIN RESERVE.....	38
VI. WHO SHOULD HOLD AND CONTROL THE RESERVE?.....	41
VII. WHERE SHOULD STOCKS BE HELD?.....	49
✗ VIII. BENEFITS FROM A GRAIN RESERVE.....	51
IX. APPLICATION OF GRAIN RESERVE TO A DEVELOPING COUNTRY.....	58
X. SUMMARY.....	80
LITERATURE CITED.....	82

LIST OF TABLES

TABLE	PAGE
1. World Net Grain Exports and Imports.....	3
2. Stocks of Grain on Hand at the Beginning of the Year, 1960-61 to 1976-77.....	5
3. Percentage Change in National Monthly Average Prices Received by U.S. Farmers for Corn, Soybeans, Wheat, Hogs, and Beef Cattle, 1968-1974.....	8
4. Four Types of Grain Reserves.....	17
5. Types of Reserves According to Size and Functions....	19
6. Types and Functions of a Grain Reserve.....	21
7. Measurability of Costs and Benefits by Types of Grain Reserves.....	23
8. Estimated Grain Requirements, 1978-80.....	34
9. Gains and Losses When Grain is Stored and When Grain is Withdrawn From Storage.....	56
10. Computed Reserve Storage Capacity.....	72
11. Average Utilization of Reserve Capacity.....	73
12. Computed Average Annual Total for Reserves.....	77

LIST OF FIGURES

FIGURE	PAGE
1. Gains and losses from storage operation.....	54
2. Gains and losses from storage operation: grain into storage.....	57
3. Gains and losses from storage operation: grain out of storage.....	57
4. Computed Storage Capacity and Inventory for ASEAN Security Reserves (All Grains with Stabilizing Trade).....	75

CHAPTER I

INTRODUCTION

Until the early 1970's the world food situation was gradually improving. World production of grains rose almost every year from 1960 through 1972, interrupted only by poor crops in the USSR in 1961 and 1963 and the great Indian drought of 1965-1966.¹ Over the period 1950 to 1970, world food output increased by 0.75 percent per capita per year and in the developed countries by about 1.5 percent.² In general, world production growth kept pace with world consumption increases until 1970.³

The first threat of this period started with the corn blight in the United States in 1970 which caused a brief increase in grain and meat prices and a sharp reduction in feed grain stocks.⁴ Another unexpected development was the decline in food and grain production in many areas during the period 1972-1973, attributable to adverse weather over large areas of the world, especially the United States,

¹Dale E. Hathaway, "The World Food Crisis-Periodic or Perpetual?", Increasing Understanding of Public Problems and Policies-1975, (Oak Brook, Ill.: Farm Foundation 1975), p. 67.

²Ibid., p. 69.

³G. Edward Schuh, "US Food Policies: The Perspective of Developed Countries", Increasing Understanding of Public Problems and Policies-1977, (Oak Brook, Ill.: Farm Foundation 1977), p. 50.

⁴Committee For Economic Development, A New U.S. Farm Policy For Changing World Needs, (n.p.: Georgian Press, Inc., October 1974), p. 49.

the Soviet Union, China, the Middle East, Australia, and Africa.¹

Because of the poor wheat crop, the Soviet Union purchased a significant amount of U.S. grain -- more than they had previously imported.² This was followed by increased grain importation by the People's Republic of China and the developing countries in 1973-74 (Table 1). The poor anchovy catch off the coast of Peru, contributed to a fish meal shortage which increased the demand for U.S. soybeans and soybean meal and thus further intensified the impact of the reduction of U.S. feed grain stocks. The decline in Peruvian production of fish meal from 1972 to 1973 was equivalent to 750,000 tons of soybean meal.³

Other developments of a more permanent nature which depleted world grain reserves in 1972-1974 were noted by Lutgen and Peterson:⁴

1) the lost momentum in the Green Revolution which resulted in leveling-off production in Southeast Asia; 2) the re-entry of the People's Republic of China in the international market; 3) the United States devaluation of the dollar, which greatly increased the purchasing power of other countries and expanded exports of U.S. agricultural products; 4) the shift from holding goods as a hedge against rapid

¹Tim Josling, "The World Food Problem: National and International Aspects", in The World Food Problem and U.S. Politics and Policies: 1972-1976, ed. Ross B. Talbot (Ames, Iowa: Iowa State University Press, 1977), p. 6.

²Schuh, p. 51.

³D. Gale Johnson, World Food Problems and Prospects, (Washington, D.C.: American Enterprise Institute for Public Policy Research, June 1975), Foreign Affairs Study 20, p. 646.

⁴Lynn H. Lutgen and Everett E. Peterson, "Food Reserves Policy Choices", Food and Farm Policy: A Fresh Outlook, (Manhattan, Kansas.: Kansas State University, October 1974), p. 15.

Table 1
World Net Grain Exports and Imports

Country	1969/70 to 1971/72 (average)	1971/72	1972/73	1973/74
(million metric tons)				
Developed Countries	31.9	41.9	62.4	58.4
United States	39.8	42.8	73.1	72.5
Canada	14.8	18.3	18.8	13.1
Australia and New Zealand	10.6	10.8	5.8	9.9
South Africa	2.5	3.7	0.4	4.0
EC-9	-16.6	-14.0	-13.4	-13.0
Other West Europe	-4.8	-4.3	-5.3	-8.9
Japan	-14.4	-15.4	-17.0	-19.2
Centrally Planned Countries	-6.8	-13.0	-32.2	-15.9
East Europe	-7.6	-9.2	-8.0	-4.8
USSR	-3.9	-1.3	-19.6	-4.4
People's Rep. of China	-3.1	-2.5	-4.6	-6.7
Developing Countries	19.1	-26.9	-23.2	-30.3
North Africa and Middle East	-9.2	-11.9	-8.1	-14.9
South Asia	-5.7	-5.4	-4.5	-7.0
Southeast Asia	3.2	3.3	1.2	2.5
East Asia	-8.4	-9.2	-10.4	-10.2
Latin America	3.2	-2.0	--	0.7
Central America	-1.9	-2.0	-2.0	-2.1
East Africa	-0.3	0.3	0.6	0.7
Others	-0.2	-0.2	-0.3	-0.3
World Total Exports	107.6	111.2	141.8	151.0

Source: Foreign Agricultural Service and Economic Research Service,
USDA Grain Data Base, November 1974.

inflation; 5) the general increase in the demand for food due to a growing world population; and 6) the rising affluence during the 1960's which significantly increased the demand for livestock products and consequently for feed grains and oilseeds. Programs undertaken by the United States, Canada, and Australia to reduce grain production were another factor.¹

World grain stocks decreased from 188 million metric tons in 1969-1970 to about 102 million metric tons in 1975-1976. The United States holdings also declined from 67.8 million metric tons of grains to 23.2 million metric tons within the same span of time (Table 2).

According to D. Gale Johnson,² shortfalls in production had relatively small impact in reducing grain prices. In his analysis, sharp price increases were results of "still other factors" such as: 1) the simultaneous economic boom in the industrial economies; 2) the continued increase in cattle herds throughout the world; and 3) internal government price policies in some countries which prevented the price system from rationing available supplies and enhancing domestic outputs. Thus, the price increasing factors were concentrated in the international grain markets which had to absorb most of the production shortfalls and the expanding world demand.³

¹Committee for Economic Development, p. 50.

²Johnson, p. 653.

Table 2

Stocks of Grain on Hand at the Beginning
of the Year, 1960-61 to 1976-77.¹

Year	World Total Grain	United States		Percent of Total Stocks Held by the U.S.	
		Total Grain	Wheat		Coarse Grains
million metric tons					
1960/61	164.0				
1961/62	176.7	115.4	38.4	77.0	65.3
1962/63	150.0	101.5	36.0	65.5	67.7
1963/64	153.2	91.0	32.5	58.5	59.4
1964/65	148.0	87.4	24.5	62.9	59.1
1965/66	151.3	71.9	22.2	49.7	47.5
1966/67	115.6	71.9	22.2	49.7	47.5
1967/68	144.6	45.3	11.6	33.7	31.3
1968/69	159.4	58.7	14.7	44.0	36.8
1969/70	188.1	67.8	22.2	45.6	36.0
1970/71	168.2	68.1	24.1	44.0	40.5
1971/72	130.5	50.7	19.9	30.8	38.9
1972/73	147.7	68.6	23.5	45.1	46.4
1973/74	108.1	42.0	11.9	30.1	38.9
1974/75	110.6	27.0	6.7	20.3	24.4
1975/76 ²	101.9	23.2	8.7	14.5	22.8
1976/77 ²	99.4	32.2	10.8	21.4	32.4

¹Total grains include wheat, rye, barley, oats, corn, sorghum. Coarse grains include grains listed except wheat.

²Estimated.

Source: U.S. Department of Agriculture, Foreign Agricultural Service, World Grain Situation, FG8-75, July 15, 1975 and FG16-75, December 22, 1975.

All these circumstances, temporary or permanent in nature threatened world food supplies and brought unusual instability to farm and food prices during the early 1970's. Hence, the interest in establishing reserves for emergencies and to reduce price instability.

The purpose of this report is to deal with price instability and food security issues. Included are: 1) a review of events that led to grain shortages and increased price variability (these events were discussed earlier in the introduction); 2) a historical review of food reserve efforts; 3) a discussion of objectives of grain reserve programs; 4) a survey of various proposals for grain reserves; 5) costs of building grain reserves; 6) a discussion of management and financing alternatives for grain reserves; and 7) a presentation of benefits obtained from grain reserve programs.

CHAPTER II

WORLD FOOD PRICE VARIABILITY AND FOOD SECURITY

Recent international concern about high variability in prices of food and feed grains emerged in 1972. A comparison of the percentage change in monthly prices of corn, soybeans, and wheat in the United States between the periods 1968-1971 and 1972-1974 concretely describes the condition during those years (Table 3). The average percent price change from low to high for wheat during the first period was 13.0 percent. From 1972-74, the average variation was 90.0 percent. Monthly prices for soybeans exhibited the largest variation (111.0 percent) in 1972-1974, while corn showed 70.0 percent variability. Daily price fluctuations for all three commodities were reported to be even greater in this latter period.

Prices for hogs and cattle were also reported to be more variable in the period 1972-1975 than in previous years. Monthly average prices for hogs fluctuated within one year by 55.0 percent during 1972- 1975 compared to 42.0 percent for 1968-1971. Average prices for cattle varied by 31.0 percent in 1972-1975 compared to 17.0 percent during the earlier period. The variability of prices for soybeans, corn, and other grains contributed much to the fluctuations in livestock prices because these commodities are used as animal feeds.¹

¹Hathaway, p. 67.

Table 3

Percentage Change in National Monthly Average Prices
Received by U.S. Farmers for Corn, Soybeans,
Wheat, Hogs, and Beef Cattle, 1968-1974.

Item	Price Change, Low to High Month	
	1968-1971 Average Percent	1972-74 ¹ Average Percent
Corn, per bushel Year Beginning, October 1	27	70
Soybeans, per bushel Year beginning, September 1	18	111
Wheat, per bushel Year beginning, July 1	13	90
Hogs, hundred weight ²	42	55
Beef Cattle, hundred weight ³	17	31

¹For grains, 1972-74 are included. For livestock, average is for 1972-1975.

²Barrows and gilts, markets.

³Choice steers, Omaha.

Note: Change is measured from low price month to high price month within a given year, then averaged over the years included.

Source: B.F. Jones, Grain Reserves in Agricultural and Food Policy,
(West Lafayette, Ind.: Purdue University Agricultural Experiment
Station), no. 124 (May 1976), p.2.

Consumer food prices increased considerably from January 1972 to December 1975. Higher farm commodity prices contributed to this increase.¹ The average growth of consumer prices in OECD² countries was 3.7 percent annually during 1961-1971. However, prices increased by 4.7 percent in 1972 and increased as much as 12.5 percent between March 1973 and March 1974. In developing countries, the effect of increased food prices was more severe because consumer expenditures on food as a percentage of income is much higher.³

The tremendous reduction in world grain reserves was a big contributing factor in the price variability of grain and livestock. When grain reserve levels are low, "grain prices fluctuate widely in response to changes in output."⁴ This causes the price of other food commodities to vary eventually. High prices brought windfall gains to grain producers during the early years of crisis.⁵ On the other hand, high prices caused hardships, especially to the world's poorest consumers. Price variability benefited grain and livestock producers who were good at speculation. However, variability made it

¹B. F. Jones, Grain Reserves in Agricultural and Food Policy, (West Lafayette, Indiana: Purdue University Agricultural Experiment Station), No. 124 (May 1976), p. 1.

²Countries that are members of the Organization for Economic Cooperation and Development are: Canada, United States, Japan, Australia, France, Germany, Italy, United Kingdom, Belgium, Denmark, Ireland, Netherlands, Austria, Finland, Norway, Portugal, Spain, Sweden, and Switzerland.

³USDA, The World Food Situation and Prospects to 1985, (Washington, D.C.: U.S. Government Printing Office for the USDA Economic Research Service, March 1975), No. 98, p. 7.

⁴Jones, p. 1.

⁵USDA, The World Food Situation and Prospects to 1985, p. 40.

more difficult for producers to plan their production for efficient use of resources. Furthermore, poor information about future prices increased the risk for producers. Some actually went bankrupt.¹

These conditions forced a renewed interest in rebuilding grain reserves for the purpose of "providing for the world food security and for grain price and supply stability."² Various proposals to attain stability in grain price and supply were forwarded.³ Since production has always been uncertain due to yield variability, most of the proposals focused on rebuilding food and feed grain reserves. However, proposals also varied in terms of their treatment of management and financial factors. Different views existed as to who should hold stocks, where stocks should be held, how large stocks should be, and who should pay for them.⁴

¹USDA, The World Food Situation and Prospects to 1985, p. 4.

²Ibid., p. 40.

³Lutgen and Peterson, p. 15.

⁴Ibid.

CHAPTER III
HISTORY OF FOOD RESERVE EFFORTS

Present concern for stabilizing prices or the supply of food is not of recent origin. The Bible records that Joseph, as Governor of the Land, stored one fifth of the crop in the years of abundance for release in the lean years.¹ However, there is evidence that Egypt was a granary for hundreds of years before Joseph was born.²

The name "ever-normal granary" appeared in Chinese records of about 1100 B.C. The Chinese recognized the importance of storing grain which benefited not only the people but also earned money for the state. Li K'o, minister of Wei in the 12th century B.C., pointed out that high grain prices in years of poor crops hurt consumers and that low grain prices in years of successful crops hurt farmers.³ The Athenians and Romans also attempted to control both quantities and prices of grain.⁴

¹Genesis 41-47

²Jerry A. Sharples and Rudie W. Slaughter, "Alternative Agricultural and Food Policy Directions for the United States with Emphasis on Stability of Prices and Producer Income", Agricultural and Food Price and Income Policy; Alternative Directions for the United States, ed. Robert G. F. Spitz, Report of a Policy Research Workshop, Washington, D.C., January 15-16, 1976, (Champaign, Ill.: University of Illinois at Urbana-Champaign Agricultural Experiment Station), Special Publication No. 43 (August 1976), p. 75.

³Huan-Chang Chen, "The Economic Principles of Confucious and His School", cited by David J. Eaton, A Systems Analysis of Grain Reserves, (Washington, D.C.: n.p. for the USDA Economics, Statistics, and Cooperative Service, January 1980), No. 1611, pp. 3-4.

⁴Mary G. Lacy, "Flood Control During Forty-Six Centuries", Vol. 16, No. 6, (June 1923), cited by Sharples and Slaughter, p. 75.

During the 17th and 18th centuries, efforts were made by India and England to stabilize grain prices. Similar attempts were made by the Spanish Viceroy in Mexico City by maintaining a controlled market.¹

Food reserves to protect farm prices continued to be a major concern through the years. In the United States, the Commodity Credit Corporation initiated by Henry Wallace,² was created in 1933 to stabilize, support, and protect U.S. farm prices and to help maintain adequate supplies of agricultural commodities. The result of Wallace's works was embedded in Title III of the Agricultural Adjustment Act of 1938. In that title, "provision was made for the systematic storage of surpluses to meet any shortage that develops either on the farm, in the country, or in the case of natural need."³

Food problems which arose during and after World War II resulted in the United States and Great Britain joining forces in 1942 to establish the Combined Food Board. The Board was designed to formulate plans for a number of purposes, among them the "supply, production, transportation, disposal, or distribution in or to any part of the world of foods" and "to work in collaboration with other member-countries of the United Nations toward the utilization of their food resources."⁴

¹Sharples and Slaughter, p. 75.

²U.S. Secretary of Agriculture, in the Roosevelt Administration.

³U.S. Congress, House Committee on Foreign Affairs, International Food Reserves: Background and Current Proposals, 93rd Congress, 2nd Session, 1974 October, p. 3.

⁴Eric Roll, "The Combined Food Board", (Stanford, Calif.: Stanford University Press, 1956), cited by U.S., Congress, International Food Reserves, p. 4.

While the Board did not become directly involved in food production and allocation, its proposal "tempered the broad pattern of food policy for the United States and Great Britain during its lifetime."¹ After four years, the International Emergency Food Council, supported by nineteen member-nations, took over functions of the Board.²

The Food and Agricultural Organization of the United Nations also made a number of proposals to solve the widespread food problem. An executive board, the World Food Council was established to continue a steady review of the world's food situation. One of the achievements of the Council was the creation of the World Food Program. The United States participated in the program through its Public Law 480. PL 480 was a mechanism for distributing U.S. agricultural surplus to developing food deficit nations of the world. It was designed to prevent hunger and malnutrition and to stimulate economic growth.³ Other countries participated through contributions of commodities, cash, and services.⁴ The program proved to be successful to developing nations, not only during emergency situations but also in carrying out their economic and social development projects.

The Food Aid Convention was set up under the International Grains Agreement of 1967 and the 1971 International Wheat Agreement. Its objective was to carry out a food aid program with the help of contributions for the benefit of developing countries. A Food Aid Committee

¹Eric Roll, p. 4.

²U.S. Congress, International Food Reserves, p. 4.

³USDA-Foreign 202, "Twelve Years of Achievement Under Public 480", November 1967, cited by U.S. Congress, International Food Reserves, p. 6.

⁴U.S. Congress, International Food Reserves, p. 6.

established by the convention reviews the amount and terms of contribution made and exchanges information on the operation of the convention.¹

Besides the FAO and the Food Aid Committee, several other official and semi-official international organizations have considered the importance of world food reserves. The proposal of the Secretary General of the Organization of Economic Cooperation and Development (OECD), Thorkil Kristensen in 1967, is a case in point. He suggested that the bad weather in India for two consecutive years indicated the need for a world food reserve. His proposition stated that wheat and possibly rice should be kept at a certain level, "and that in the event such reserves fell below that level in a bad year, they should be restored the following year."² He suggested that such responsibility entailed world cooperation and should not be shouldered solely by a single country. However, his proposal was never given serious consideration.

The history of grain reserve efforts indicate that countries such as the United States realized the importance of stability in food prices and supplies. However, it is evident that the goal of stability was secondary to raising farm income. Lutgen and Peterson³ reported that "federal farm programs over the past 45 years were designed primarily to increase net farm income and that large carryovers were a by-product of this effort." Basically, supplies reaching the market were

¹U.S. Congress, International Food Reserves, p. 7.

²Ibid.

³Lutgen and Peterson, p. 13.

restricted to boost farm product prices. Stocks accumulated "accidentally" due to overproduction. Holding these surpluses was costly, so the government had to find means of disposing them. The increased foreign demand due to war and crop failure transformed these surpluses into "strategic reserves" or as gifts and concessional sales to needy countries.

The "surplus psychology" was held by developed and developing nations alike until 1972.¹ A combination of circumstances in 1972 and 1973 changed this outlook. Suddenly food reserves (especially grains) in the United States and world-wide were depleted, causing concern over "possibly chronic food shortages." Since then, a serious interest in food security emerged and led to the 1974 Rome World Food Conference sponsored by the United Nations. At the conference relevant steps concerning food production, nutrition, food security, and food trade, food aid, and related matters were agreed upon. The World Food Council, different from the Executive Board created by FAO in 1945, was established to coordinate the implementation of these resolutions.²

Other international forums followed subsequently. Economic research increased and provided suggestions and measures for attaining food security.³ Much of this research focused on food and feed grain reserves. This is to be expected, because the variations in prices and supplies of commodities have been correlated to the availability and prices of food and feed grains in the world market.

¹Hathaway, p. 67.

²USDA, The World Food Situation and Prospects to 1985, p. 86.

³See James P. Houck and Mary E. Ryan, Economic Research on International Reserves: The State of Knowledge, (University of Minnesota Agricultural Experiment Station, 1979), No. 532.

CHAPTER IV

WHAT IS A GRAIN RESERVE?

With the development of various proposals regarding grain reserves, numerous perspectives about the type, objectives, size, composition, and management responsibility were forwarded. This chapter reports a range of options and their implications. There is no general agreement concerning definitions of categories of reserves.

Types of a Grain Reserve

David J. Eaton¹ distinguished four varieties of grain reserves, i.e., working stocks, bufferstocks, food aid, and emergency food reserves. Working stocks are marketing reserves in which "grain is stored for gradual use over the remainder of the growing cycle." Buffer stocks store grains from a year of high production for use in another period of low harvest. A food aid reserve is grain set aside "at any time (even during a year of production shortfall) for distribution to domestic or foreign persons defined as the needy." In times of natural disaster or civil order, emergency food reserves are dispatched to help meet food needs of people. Conceptually, these four reserve categories can be distinguished by certainty of demand, the rate of stock turnover, and their function (Table 4).

¹David J. Eaton, A System Analysis of Grain Reserves, (Washington, D.C.: n.p. for the USDA Economics, Statistics, and Cooperative Service, January, 1980) No. 1611, p. 5.

Table 4
Four Types of Grain Reserves

Reserve Type	Demand Certainty	Rate of Reserve Turnover	Social Function
Working Stock	Relatively Certain	Disposed of within one year of growing cycle	Intra-year stabilization
Buffer Stock	Uncertain	Build-up and release rules set time in storage	Inter-year stabilization
Food Aid Reserve	Relatively Certain	Determined by need of target group	Political leverage and/or humanitarian use
Emergency Reserve	Uncertain	Depends upon what is defined as an emergency	Humanitarian use and/or political leverage

Source: David J. Eaton, A Systems Analysis of Grain Reserves, (Washington, D.C.: n.p. for the USDA Economics, Statistics, and Cooperative Service, January, 1980), no. 1611, p.6.

Unlike Eaton, Harry Walters¹ categorized grain reserves into three different levels (Table 5) i.e., 1) an insurance reserve of around 20 to 30 million metric tons; 2) a stabilization reserve of about 60 million metric tons; and 3) a combined food aid- emergency relief-contingency reserve ranging between 30 to 60 million metric tons. Quantities and costs involved in an insurance reserve are moderate and considerable room is allowed for market forces to reflect demand and supply within price bands. Such reserves would not become available until prices or production or consumption shortfalls reached predetermined levels. Stabilization reserves are needed to offset deviations in production or consumption trends. The third kind of reserve would provide some measure of food security to poor developing countries and international stability within a wide price band.

James P. Houck and Mary E. Ryan² reported two types of grain stocks. The first type (market stocks) includes: 1) minimum working stocks (also called pipeline supplies); 2) additional working stocks held by consumers or merchandisers to meet future needs; and 3) speculative stocks held in anticipation of future profit. The second type, (the non-market stocks) are stocks segregated from normal market channels to meet special needs such as price stability, food aid commitments, and unanticipated emergency food needs in times of disaster.

¹Harry Walters, Food Reserves Policy and International Trade Policy, n.p., p. 2.

²James P. Houck and Mary E. Ryan, p. 26.

Table 5

Types of Reserves According to Size and Function

Type	Size (million metric tons)	Function
Insurance Reserve	20 to 30	Halt extreme effects of price or supply stability
Stabilization Reserve	60	Provide a high degree of stability to grain prices and offset a large fraction of grain shortfalls (85 to 95 percent)
Combined Food Aid- Emergency Relief- Contingency Reserve	30 to 60	Provide food security to developing countries and grain stability within wide price bands (50 to 100 percent) worldwide

Source: Harry Walters, Food Reserves Policy and International Trade Policy, n.p., p.2.

There are three types of internationally supervised agricultural stocks according to a tripartite report by fourteen experts from North America, the European Community and Japan.¹ They are stocks for commercial emergencies, buffer stocks, and strategic food reserves (Table 6).

Stocks for commercial emergencies would be held by individual governments. The cost of acquiring and holding them would be allocated among participating governments on the basis of volume of production and consumption or some combination of the two. Stocks would be released from the market when the world price reaches or exceeds a predetermined level. In a situation of surplus, these stocks would be accumulated when prices fall below a predetermined floor.

To minimize year to year fluctuations in the volume and value of international trade in grains, buffer stocks are accumulated. Such stocks are acquired by requiring participating nations to add to stocks when output exceeds the level of a moving average of output over the previous four or five years. Stocks are released when output falls below the average. As an alternative, acquisitions and releases are based on an agreed international market price.

Strategic food reserves are established to alleviate the threat of sudden crop failures in developing countries. Some analysts suggest such stocks be placed in developing countries themselves as far as is economically feasible to assure that supplies will not depend on the availability of international shipping facilities.

¹The Brookings Institution, Toward the Integration of World Agriculture: A Tripartite Report by Fourteen Experts from North America, the European Community and Japan, (Washington, D.C.: The Brookings Institution, 1973), p. 24.