

## Six-State High Plains–Ogallala Aquifer Area Regional Study

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*Harvey O. Banks*

### Introduction

This comprehensive resource and economic development study was authorized by Congress October 26, 1976, in Section 193 of Public Law 94-587, with authorization for a \$6 million appropriation. The moneys were appropriated in fiscal years 1977–78 and 1978–79. Responsibility for the study was assigned to the Secretary of Commerce. The Economic Development Administration (EDA) of the U.S. Department of Commerce is conducting the study on behalf of the secretary.

At the insistence of the six states involved—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, and Texas—the High Plains Study Council was formed, consisting of the governors of the six states, three representatives of each state appointed by the governor, and a federal member from EDA. The council is responsible for directing the study, for preparing final recommendations, and for submittal of the final report to the secretary of commerce. In February 1977, the council adopted a plan of study that is the basis for the comprehensive study now in progress.

On September 22, 1978, EDA awarded a contract to Camp Dresser & McKee Inc. (CDM) as prime contractor and leader of the general contractor team for the study, under the author's direction as officer-in-charge and project director. Ms. Jean O. Williams, CDM vice-president, is project manager. Associated with CDM on the general contractor team are Arthur D. Little, Inc. (ADL) of Cambridge, Massachusetts, and Black & Veatch (B & V), Consulting Engineers, of Kansas City, Missouri. ADL

is responsible for the agricultural-economic-social aspects of the study, and B & V for the energy aspects. Each of the six states, as subcontractors to CDM, will conduct certain portions of the study as outlined below. The U.S. Corps of Engineers, under separate contract with EDA, is conducting studies of sources, yields, and costs of potential interbasin transfers.

The study is being coordinated with other relevant studies and programs by federal, state, and local agencies, including among many others those by:

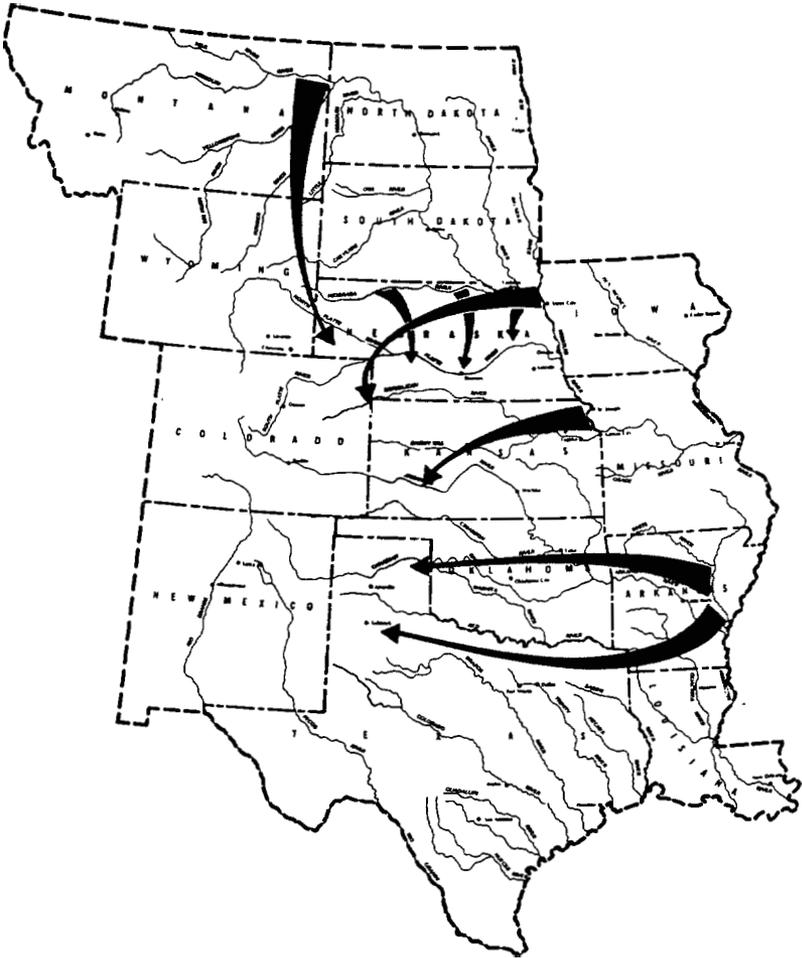
- United States Geological Survey—Ogallala Modelling Study
- United States Bureau of Reclamation—Llano Estacado Study of Playa Lakes
- U.S. Department of the Interior, U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service—Platte River Habitat Study
- U.S. Department of Agriculture
- U.S. Corps of Engineers

A draft final report is to be submitted by the general contractor to the High Plains Study Council on or before March 31, 1982, and a final report on or before June 30, 1982.

### The Study Area

The Ogallala Aquifer and the study area are shown in Figure 1. The study area includes some 180 counties in the six states lying wholly or partly over the Ogallala and encompasses 225,000 square miles. The area is one of the largest and most important agricultural areas in the United States as shown by Charts 1-7 appended to this paper. It includes some 20 percent of the total national irrigated acreage. There are about 90 million acres of irrigable land. The soils are deep and fertile. The climate is conducive to high agricultural production. Over 40 percent of the beef cattle supplying the tables of U.S. citizens are fed on the High Plains. The Ogallala Aquifer is now the principal source of water for irrigation. Recharge to the aquifer is very small.

Figure 1



**INTERBASIN TRANSFER STUDIES**

## The Problem

The region is faced with ultimate exhaustion of the groundwater resources unless additional water can be made available although the timing of final depletion would vary widely since the Ogallala is not uniform in thickness or in hydrologic-hydraulic characteristics. Groundwater levels are declining rapidly in most of the area, with consequent increases in pumping costs. Production of oil and gas, which has been an important aspect of the total economy of much of the area, is also declining. The price of energy for pumping irrigation water has increased rapidly. Much of the area could be forced to revert to dryland farming or be abandoned in the near future. Some farms, particularly in the south High Plains of west Texas have already reverted. Deterioration of the agricultural economy of the High Plains-Ogallala Aquifer Region would have grave consequences for the business and financial communities outside as well as those located within the region.

## The Objectives

In authorizing the study, the Congress and the states recognized the problems associated with the decline and, over the long term, possible exhaustion of the Ogallala Aquifer and the economic effects of declining oil and gas reserves. The study is based on the recognition that the problems are regional in nature with potentially severe adverse national implications and that new institutions might be necessary.

The congressional objectives, as excerpted from Public Law 94-587, Section 193, are:

- to assure adequate water supplies to the area
- to assure an adequate supply of food to the nation
- to promote economic vitality of the High Plains region
- to develop plans to increase water supplies in the area
- to assure continued growth and vitality of the region

In its adopted plan of study, which is the basis for studies

by the general contractor and the states, the High Plains Study Council stated the objectives as follows:

- to determine potential development alternatives for the High Plains Region
- to identify and describe the policies and actions required to carry out promising development strategies
- to evaluate the local, state, and national implications of these alternative development strategies or the absence of these strategies

The objective of the studies by the general contractor, including those by the states, is to develop factual evaluations of the several potential alternative futures or alternative development strategies for the High Plains–Ogallala Aquifer Region. This array of the region's potential and alternatives for achieving that potential will provide the High Plains Study Council, the Congress, the state legislatures, and other decision-makers a meaningful opportunity to make knowledgeable decisions as to the course this region may elect to follow and the role this region is to play in the nation's future.

As noted above, the general contractor will report its evaluations of the potential alternative futures to the High Plains Study Council, which in turn will report to the secretary of commerce with such recommendations for further action as it deems advisable. The secretary will report to the Congress.

### **The Study Organization**

The Technical Advisory Group is composed of representatives of the principal federal agencies with interests in or involved with the study, appointed at the request of EDA. The Consulting Advisory Panel, appointed by the general contractor, comprises twelve nationally and internationally recognized experts in resource management, agriculture, economics, engineering, social analysis, and laws and institutions.

As previously indicated, CDM is responsible, as prime contractor, for management of the entire study, for the water resource,

environmental, legal, and institutional studies, and for the final report. Arthur D. Little, Inc., is handling the agricultural, economic, and social aspects. Black and Veatch is conducting the energy studies. There is continuing interaction among the three firms.

### Alternative Development Strategies

The following alternative development strategies, or alternative futures, have been formulated by the general contractor and approved by the High Plains Study Council for analysis and evaluation in the study.

*Baseline.* Continuation of current local, state, federal policies, and trends. No new state or federal programs.

*Water Resources Alternatives.* Alternatives are listed in order of increasing costs and increasing potential availability:

- Water Demand Management—encourage users to practice conservation through application of proven technology; provide incentives for the farmer to conserve.
- Water Demand Management—apply all advanced water and agricultural management technology on a broad scale, identifying any necessary constraints.
- Local Water Supply Management—augment water supplies at the local level with techniques such as artificial recharge, weather modification, land management, snow pack management, vegetation management, desalting, evaporation management, and others.
- Subregional Intrastate Importation Supply Management—augment local water supplies with interbasin transfers of surface water as available.
- Regional Interstate Importation Supply Management—augment local water supplies with major interbasin transfers of water, possibly providing for expansion of irrigated acreages.

*Nonagricultural Development Alternatives.* Nonagricultural Alternatives—development and use of available resources for purposes other than agricultural production. These alternatives are not mutually exclusive. For a particular subregion, or combination of subregions, a mix of alternatives may be found to be the best solution to meet objectives. The results of analyses and evaluations of the water resource and nonagricultural development alternatives will be compared to the adverse effects of the baseline or "no action" alternative.

It is important to note that this concept of analysis of alternative development strategies for the High Plains-Ogallala Aquifer Region was very clear in the thinking of the Congress, EDA, and the states as this study was formulated and authorized. The thrust of the regional approach embodied in the study is identification of these things:

- What choices for the region are available?
- Who must make those choices?
- What does each alternative mean in terms of possible beneficial and/or adverse economic, environmental, and social impacts?
- Are those impacts local, regional, national, or some combination?
- How, by whom, and at what costs could selected alternatives be implemented?
- To what degree would there be a federal interest and justification for federal investment?

## **State Research**

State agencies and universities for each of the six states are now engaged in the following studies as specified by the High Plains Study Council:

### **A-1 State Agriculture and Farm Level Research**

Project cropping patterns, agricultural output and output value, inputs and input costs, and agricultural employment and income for each alternative development strategy.

## A-2 Energy Industry Impacts

Project energy production, energy requirements for irrigation, employment, royalties, and other income from energy, industry, and water requirements.

## A-3 State Water Resources Evaluation and Impacts Research

A-3.a. Evaluate intrastate water resource situation; project intrastate water supplies and demands under each alternative development strategy.

A-3.b. Project economic adjustments and socioeconomic and environmental impacts at the subregional and state level resulting from changes in land use and changes in supply and uses of water, energy, and other sources under each alternative development strategy.

Results of the state research will be used by the general contractor in the regional and national analyses.

## Research by General Contractor

The regional and subregional research studies by the general contractor will analyze:

- B-1 Interbasin transfers—in cooperation with Corps of Engineers.
- B-2 National and regional changes in commodity prices, shifts in agricultural production, changes in consumer prices and shifts in consumer expenditures.
- B-3 Effects and costs of applying advanced agricultural and water management technologies to achieve more efficient use of water.
- B-4 Environmental impacts.
- B-5 Technologies for augmenting locally available water supplies and costs.

- B-6 Legal and institutional frameworks for implementing alternative development strategies.
- B-7 Crop price projections; analyses of total revenue and costs for wide range of commodity and livestock enterprise situations.
- B-8 Energy prices and technology.
- B-9 Impacts of transition to dryland farming.
- B-10 Regional and subregional potentials for nonagricultural development.
- B-11 Evaluation of alternative development strategies.

Evaluations of the alternative development strategies will be reported to the High Plains Study Council for consideration and recommendations to the secretary of commerce.

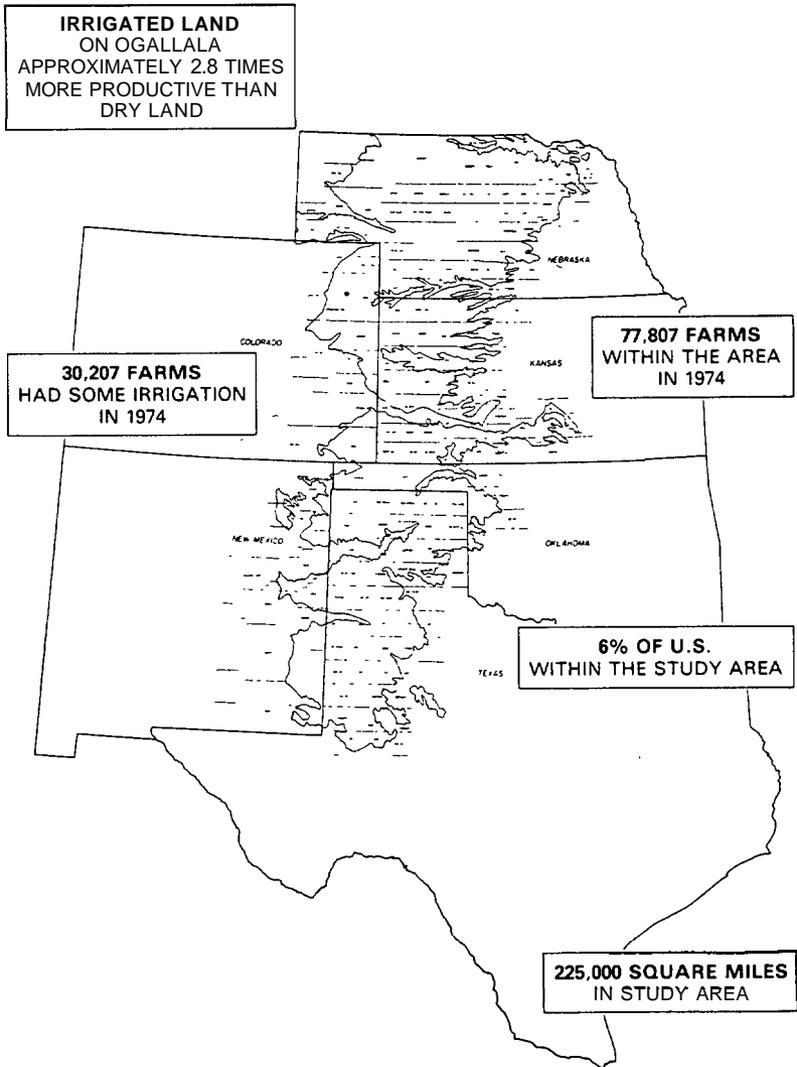
All of these studies, which were directed by the High Plains Study Council plan of study, are presently under way. The research is being fully coordinated with federal, state, and local plans and programs.

### **Interbasin Transfer Studies by U.S. Corps of Engineers**

The Corps is studying potential sources of water that might be imported to the High Plains–Ogallala Aquifer Region, potential yields, costs of diversion, possible routings and costs for conveyance, amounts and costs of necessary terminal storage reservoirs, and environmental impacts. Possible sources and conveyance routings are shown in generalized fashion by Figure 2. The Corps studies are being carried out in close coordination with the studies of interbasin transfers being conducted by the general contractor.

### **Final Products of the Study**

For the states involved, the region, and the nation, this study



**Figure 2**  
The Ogallala Aquifer and Study Area

will evaluate the effects of continuing existing trends and policies ("no action") and the effects of implementing each of the positive alternative development strategies on:

- the economy
- the environment
- the quality of life

The study will also determine:

- the costs of implementing each of the alternative development strategies
- the legal, institutional, financial, and organizational changes necessary to implement each of the positive alternative strategies
- the consequences of the "no action" option compared with the results of implementing positive action alternative development strategies

These study results will provide the High Plains Study Council, secretary of commerce, the Congress, state legislatures, and others an informed basis for reaching decisions as to the future of the High Plains-Ogallala Aquifer Region. Work by the general contractor must be essentially complete early in 1982.

It is planned to issue interim reports on the means, effects, and costs of applying advanced agricultural and water management technologies to achieve a more efficient use of water, and technologies for augmenting locally available water supplies and costs, during the first quarter of 1980. There are some measures that could be implemented early that would allow some degree of alleviation of the overdraft on the Ogallala Aquifer. A major interstate, interbasin project could not be completed and operational in less than twenty years.

Chart 1

# HIGH PLAINS IRRIGATED CROPLAND

Millions of Acres

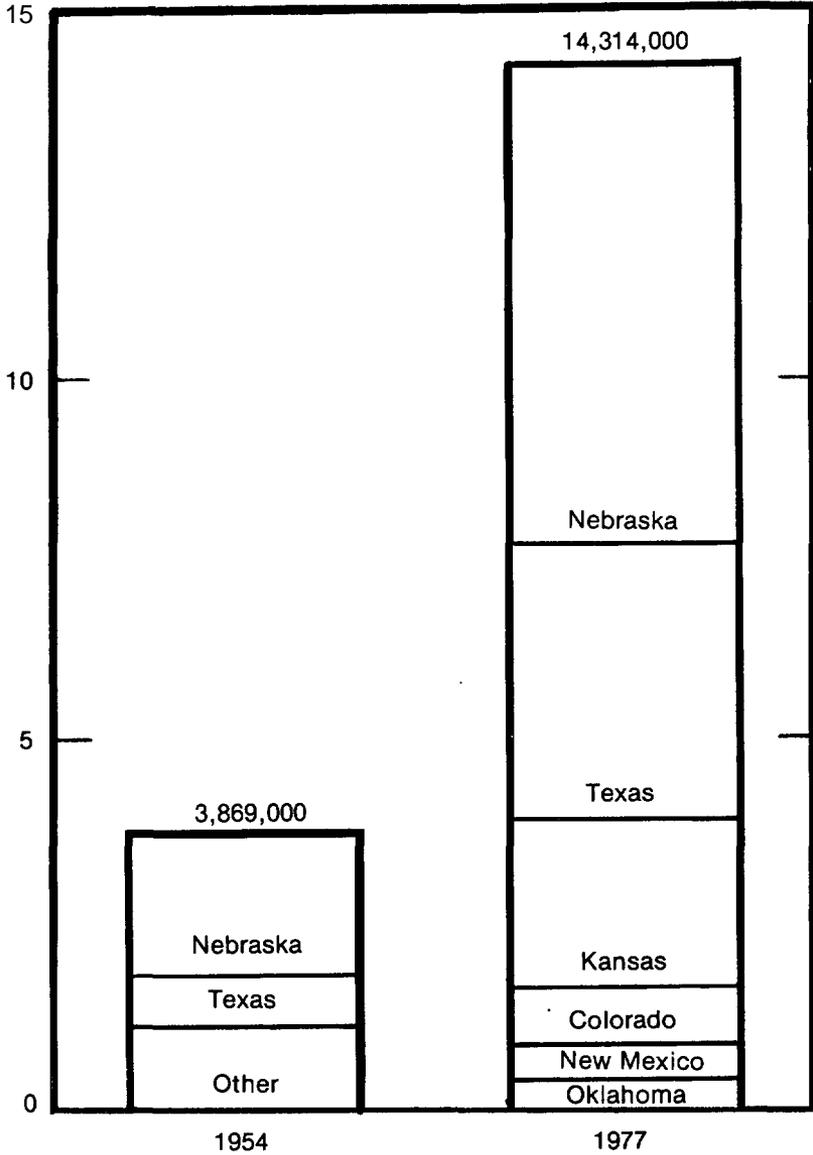


Chart 2  
**MAJOR HIGH PLAINS IRRIGATED CROPS**

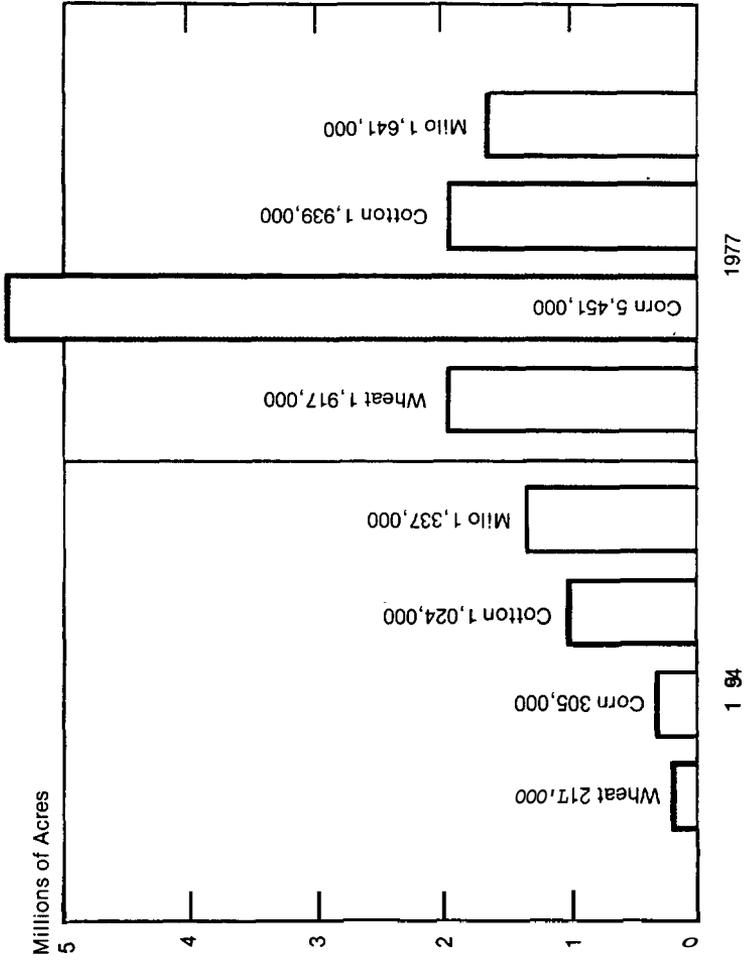


Chart 3  
**TYPICAL HIGH PLAINS CROP YIELDS 1977**

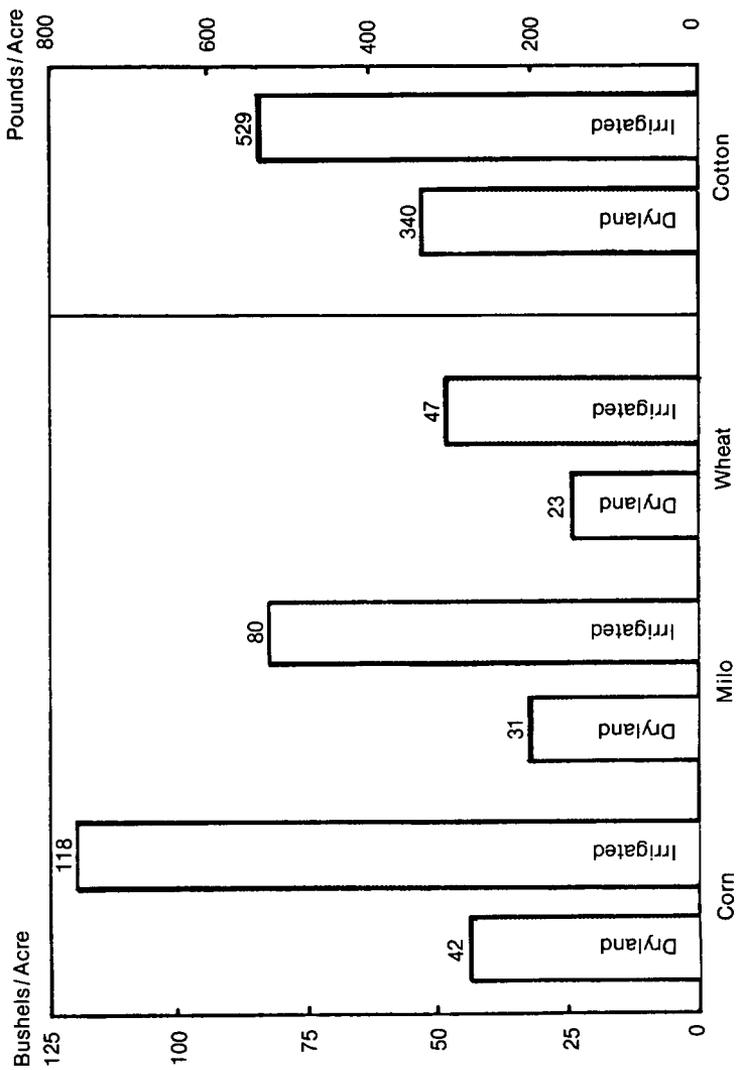


Chart 4  
**VALUE OF EXPORT SHARE OF  
TOTAL FEED GRAINS**

Billions of Dollars

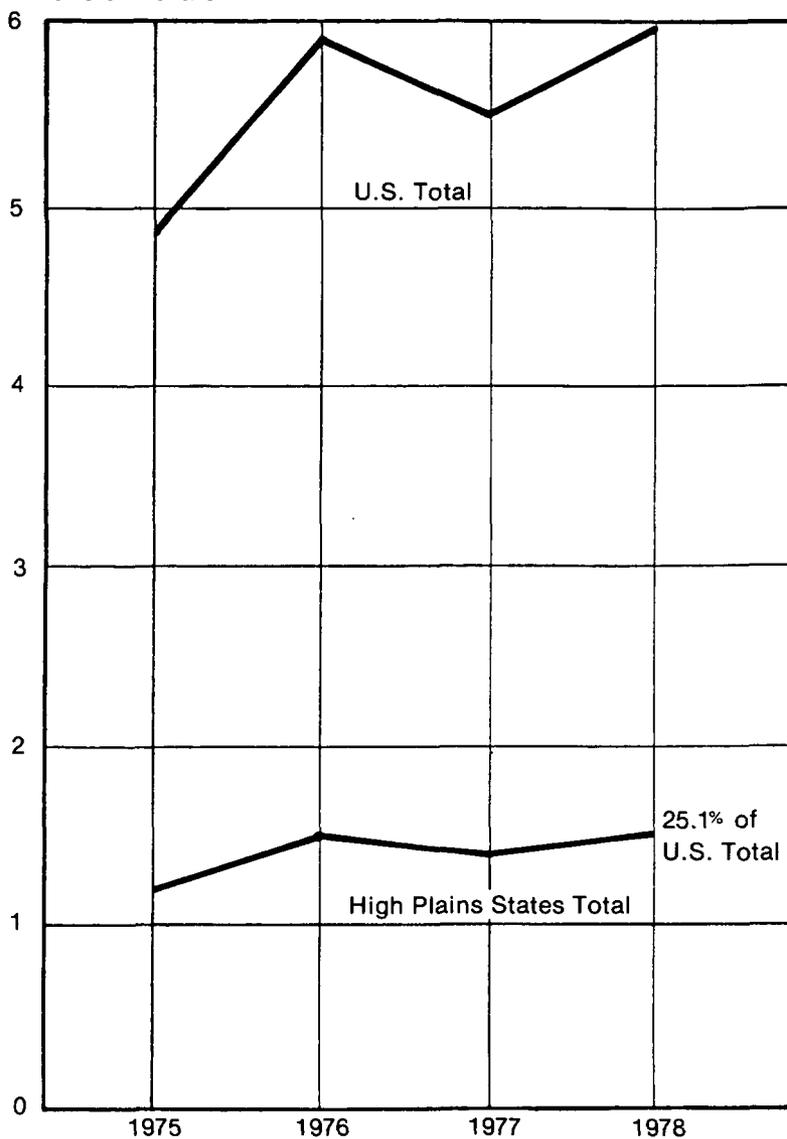


Chart 5  
**VALUE OF EXPORT SHARES OF  
WHEAT AND FLOUR**

Billions of Dollars

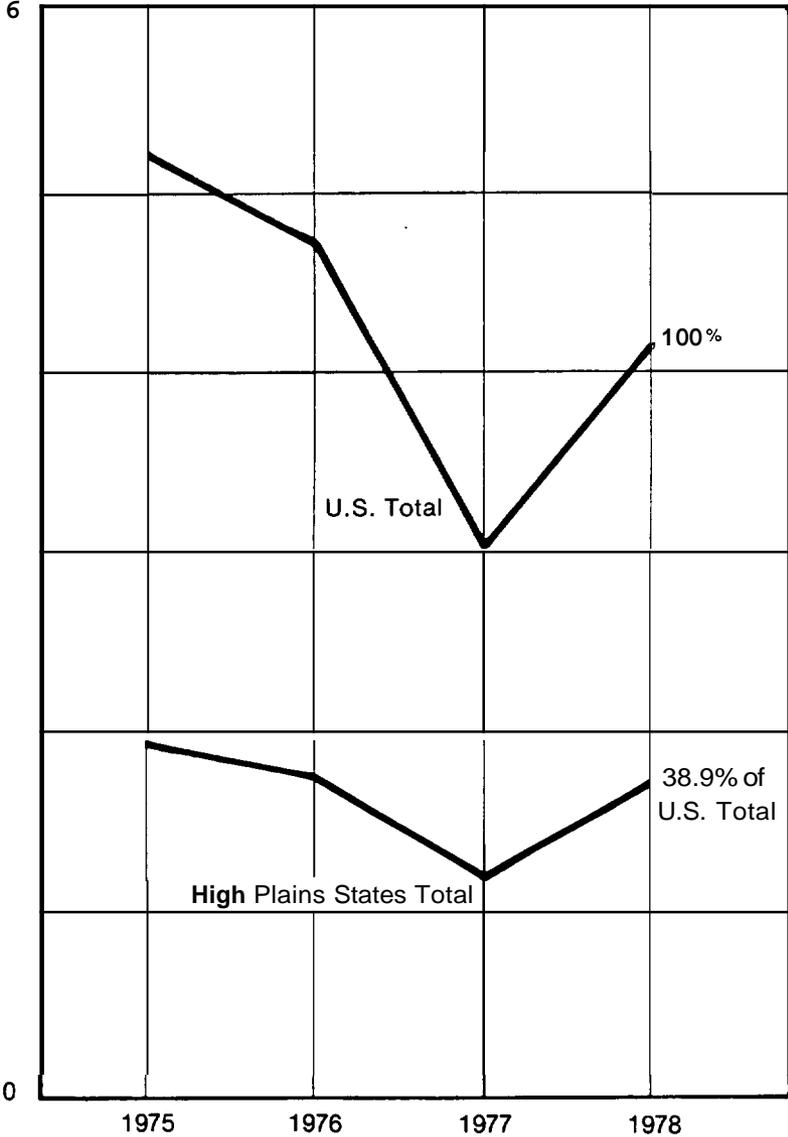


Chart 6  
**VALUE OF EXPORT SHARES OF COTTON,  
INCLUDING LINTERS**

Billions of Dollars

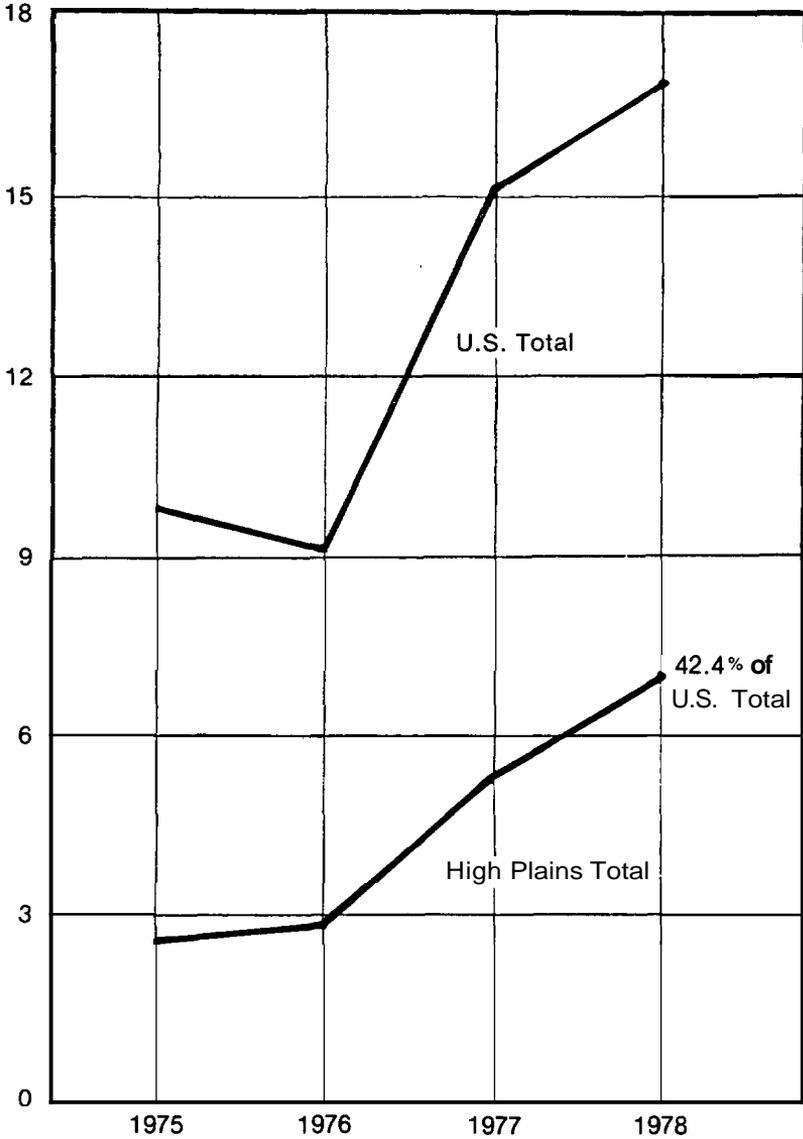


Chart 7

# VALUE OF EXPORT SHARES OF ALL AGRICULTURAL COMMODITIES

Billions of Dollars

