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THE 160 - ACRE LIMITATION ON IRRIGATED CROPLAND——ONE CAUSE OF INCREASED PRODUCTION COSTS

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Introduction

Historically, the United States government has pursued policies which increase the productive capacity of the agricultural sector in order to assure an adequate food supply for consumers, to improve the economic well-being of the rural population, and to settle and secure new territories [Seckler and Young, 1978]. As a result of the Homestead Act of 1862 which offered 160 acres of land free to those who would live on it for five years, many people settled in the western areas, and it was found that crop production in the arid and semi-arid west was largely dependant upon irrigation water. The Reclamation Act of 1902 was established to carry through the above policies by providing inexpensive irrigation water. Also in the act, the government imposed a limitation of 160 acres of irrigated land, supplemented that limitation with a residency requirement and anti-speculation rules.

The level of conflict over the 160 - acre limitation has intensified in the last few years and the controversy is essentially a controversy over the distribution of the subsidized value of federal water. Opponents of the limitation demand the entrepreneurial freedom to acquire as much land and water as their efforts and ingenuity permit within the limits and rules of free enterprise system, and argue that larger farms are essential for economic viability and low-cost food production. Proponents of rigorous en-

forcement of the limitation advocate a more wide-spread distribution of the opportunities provided by the reclamation program. [Seckler and Young, 1978]. However, the opponents and proponents agree with one point, which is that there are important gains in the efficiency of agricultural production as farms increase in size (at least up to a limit of very large size farms). Seckler and Young [1978] say that proponents of the acreage limitation used this idea in support of their argument that without some kind of protection to the small family farmer, these farmers will be destroyed in the competitive struggle with large farmers, and opponents of the limitation used this idea to support their argument that if farms are artificially restricted to small sizes, the efficiency of the food production will decline and food prices will rise accordingly.

The purpose of this study [Kwang, 1979] is to determine the effect that strict enforcement of the 1902 Reclamation Act would have on returns to size, and cost economies and diseconomies of farm size in the ALTUS - LUGERT Irrigation District of Oklahoma.

Procedure

This study includes a total of 20 cropping systems——5 individual crops (wheat, soybeans, grain-sorghum, cotton, and alfalfa) and 15 of their combinations as shown in Table 1. The costs and returns of these twenty cropping systems are studied on six irrigated farm sizes (160, 320, 480, 640, 960, and 1280 acres). Four typical dryland crops (wheat, grain-sorghum, cotton, and alfalfa) are used in combinations of typical crop patterns on five dryland farm sizes (160, 320, 480, 800, and 1120 acres). A budgeting procedure was used to analyze the economies of size of these crop combinations on the different farm sizes.

In the budgeting procedure, data from Agricultural Extension Agents

Table 1. TWENTY CROPPING SYSTEMS USED TO STUDY THE COSTS AND RETURNS ON IRRIGATED AND DRY LAND FARMS OF DIFFERENT SIZES IN THE ALTUS-LUGERT IRRIGATION DISTRICT.

Cropping System
Single-Crop Rotation
Grain Sorghum
Cotton
Soybeans
Wheat
Alfalfa
Two-Crop Rotation
Wheat - Grain Sorghum
Grain Sorghum - Soybeans
Wheat - Soybeans
Cotton - Grain Sorghum
Cotton - Soybeans
Wheat - Alfalfa
Cotton - Alfalfa
Cotton - Wheat
Three-Crop Rotation
Wheat - Afalfa - Grain Sorghum
Wheat - Cotton - Grain Sorghum
Alfalfa - Wheat - Cotton
Cotton - Soybeans - Alfalfa
Wheat - Soybeans - Grain Sorghum
Wheat - Cotton - Soybeans
Grain Sorghum - Soybeans - Cotton

and the Oklahoma State University budgets were used to estimate input-output relationships and prices. Based upon these data, the total cost functions were estimated for each cropping system from which costs per acre were derived. These cost functions do not include a rent or cost for land in the calculation of total costs. The inclusion of one specific cost for land would make the results of the analysis difficult to use in many locations because of the extreme variation in land prices.

Description Of The Study Region And Data

The ALTUS - LUGERT Irrigation District consists of 47,602 irrigate acres located in Jackson and Greer counties of Oklahoma, as shown in Figure 1.

Land in the study area is owned by 440 different individuals. Of this number, there are 303 which are classified as residents; thus, there are 137 nonresident owners, or approximately 31 percent of the total, as shown in Table 2. Of the total number of owners, only 114 operate their land; thus 74.1 percent of the owners lease their land to other operators, as shown in Table 3. Of the 128 lessees in the District, many lease more than 160 acres of project land [Provence, 1977].

The five irrigated crop budgets and four dryland crop budgets developed by the Oklahoma State University Extension Personnel were used for developing new budgets of the twenty cropping systems for each farm size. These new budgets were developed to reflect the farming situations in the ALTUS - LUGERT Irrigation District.

Empirical Results

Average Total Cost

In general, total costs per acre decline as moreacres are operated because while variable costs of inputs per acre are constant fixed mach-

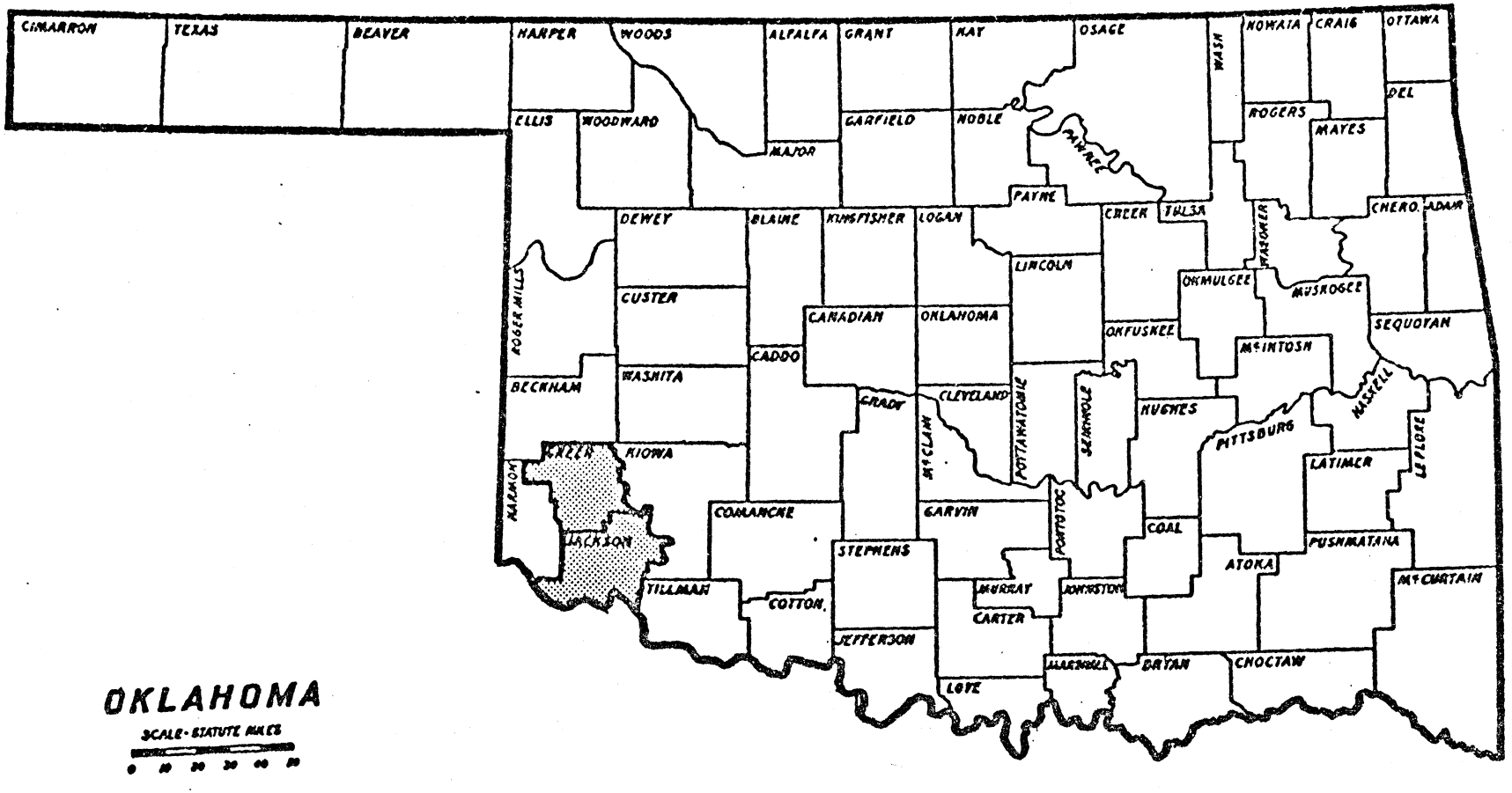

Figure 1. Map of Oklahoma With Shaded Area Indicating the Counties Included in This Study

Table 2. NUMBER AND PERCENT OF RESIDENT AND NONRESIDENT LAND OWNERS IN THE ALTUS-LUGERT IRRIGATION DISTRICT, 1977.

Classification	Number	Percent
Resident Owners	303	69
Nonresident Owners	137	31
All Owners	440	100

Table 3. NUMBER AND PERCENT OF OWNER - OPERATORS AND OWNERS LEASING OUT LAND IN THE ALTUS-LUGERT IRRIGATION DISTRICT, 1977.

Classification	Number	Percent
Owner - Operators	114	25.9
Owners Leasing Out Land	326	74.1
All Owners	440	100

inery costs per acre decline as acreage increases. The source of reduction in machinery can be distinguished in two ways:

1. from utilizing more fully the capacity of a set of machines and
2. from economies of size gained by increasing machine size.

Even though variable input costs per acre are constant as more acres are operated, the decline in machinery cost will cause total cost per unit of product to decrease because yields per acre are assumed constant.

Figure 2 contains curves for total cost per acre for each of the five single-crop rotations. The overall trend of the curves is concave from the top; as farm size increases total cost per acre decreases. The sharpest cost reductions occur between 160 acres and 320 acres.

Figure 3 shows curves for total cost per acre for each farm size, given a two-crop rotation system. In the two-crop rotation system, the overall trend of curves is again concave from the top; that is, as farm size increases total cost per acre decreases. Again the sharpest cost reductions occur between 160 acres and 320 acres.

Figure 4 shows the seven different curves representing total costs per acre for a three-crop rotation system. The curves for the three-crop rotation system are concave from the top showing that as farm size increases, total cost per acre decreases. Again the sharpest cost reductions occur between 160 acres and 320 acres.

Economies of Size

Economies of size arise from decreasing costs per unit of production. Reduced costs per unit of production, or economies of size, may result either from producing a greater volume of output for a given cost of inputs, or from purchasing large quantities of production input goods and services

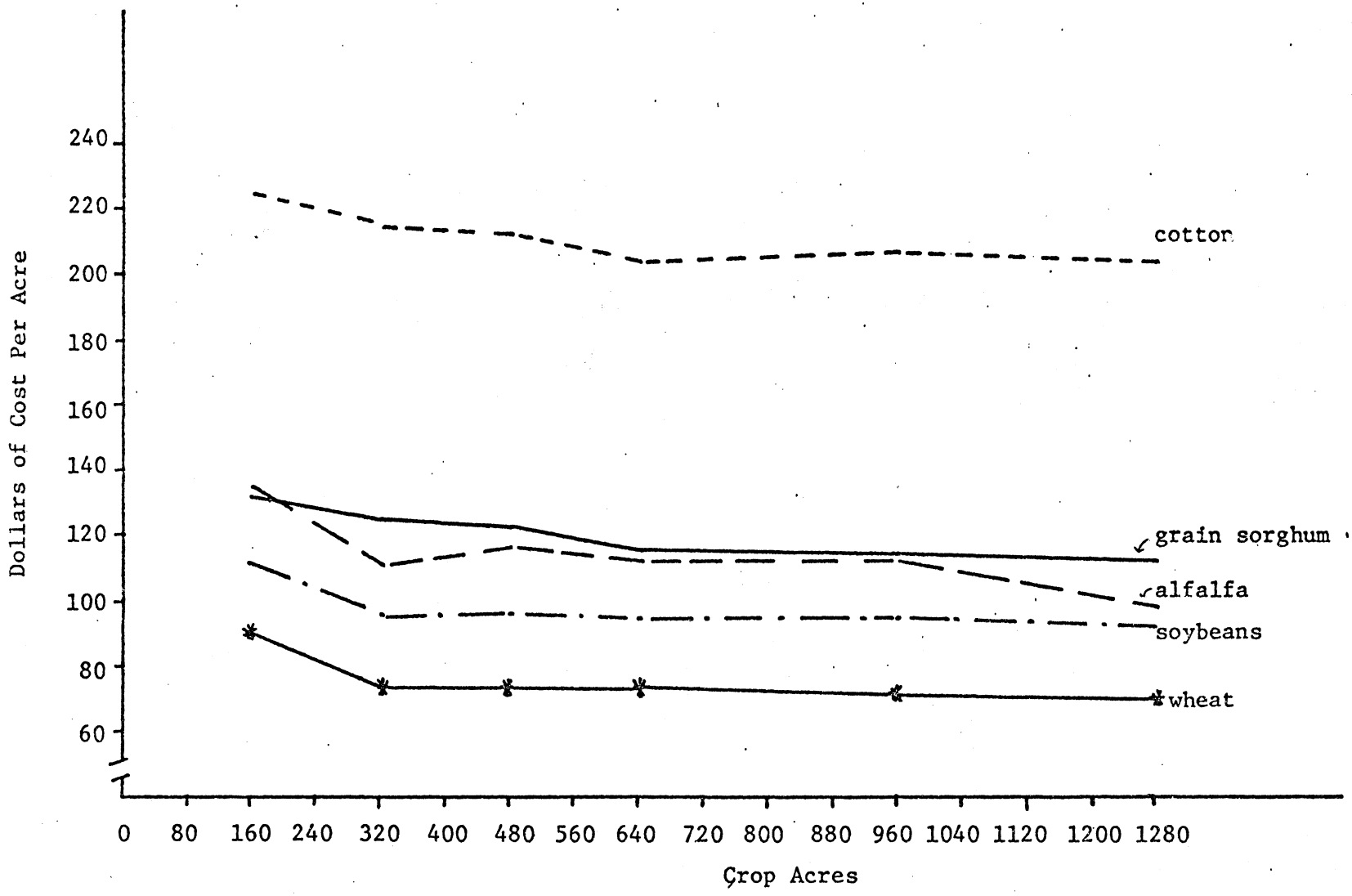

Figure 2. Average Total Cost Per Acre for Six Selected Farm Size of One-Crop Rotation Based on a Minimum Machinery Requirement and Irrigated Cropping Systems

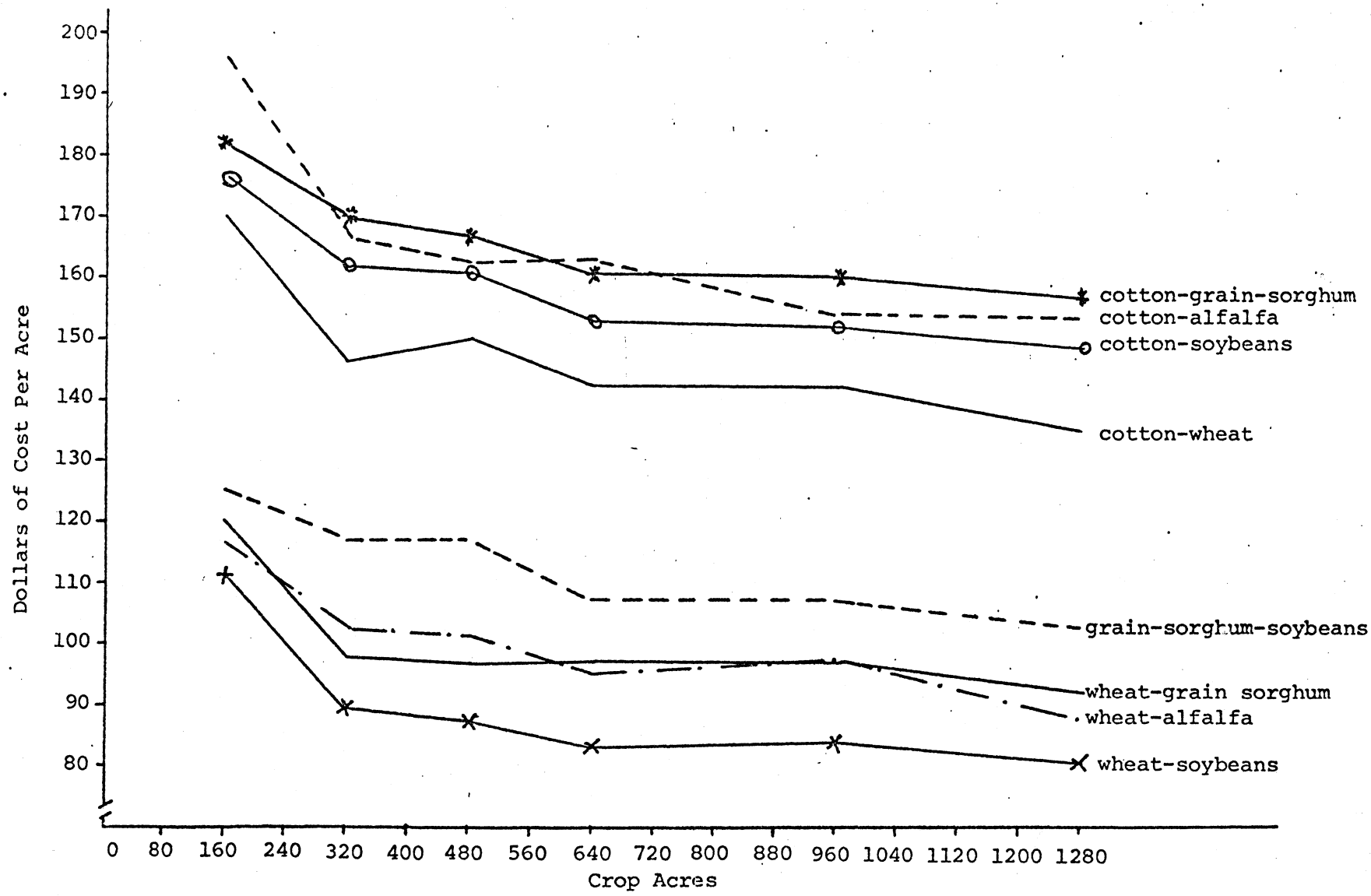

Figure 3. Average Total Cost Per Acre for Six Selected Farm Sizes of Two-Crop Rotations Based on a Minimum Machinery Requirement and Irrigated Cropping Systems

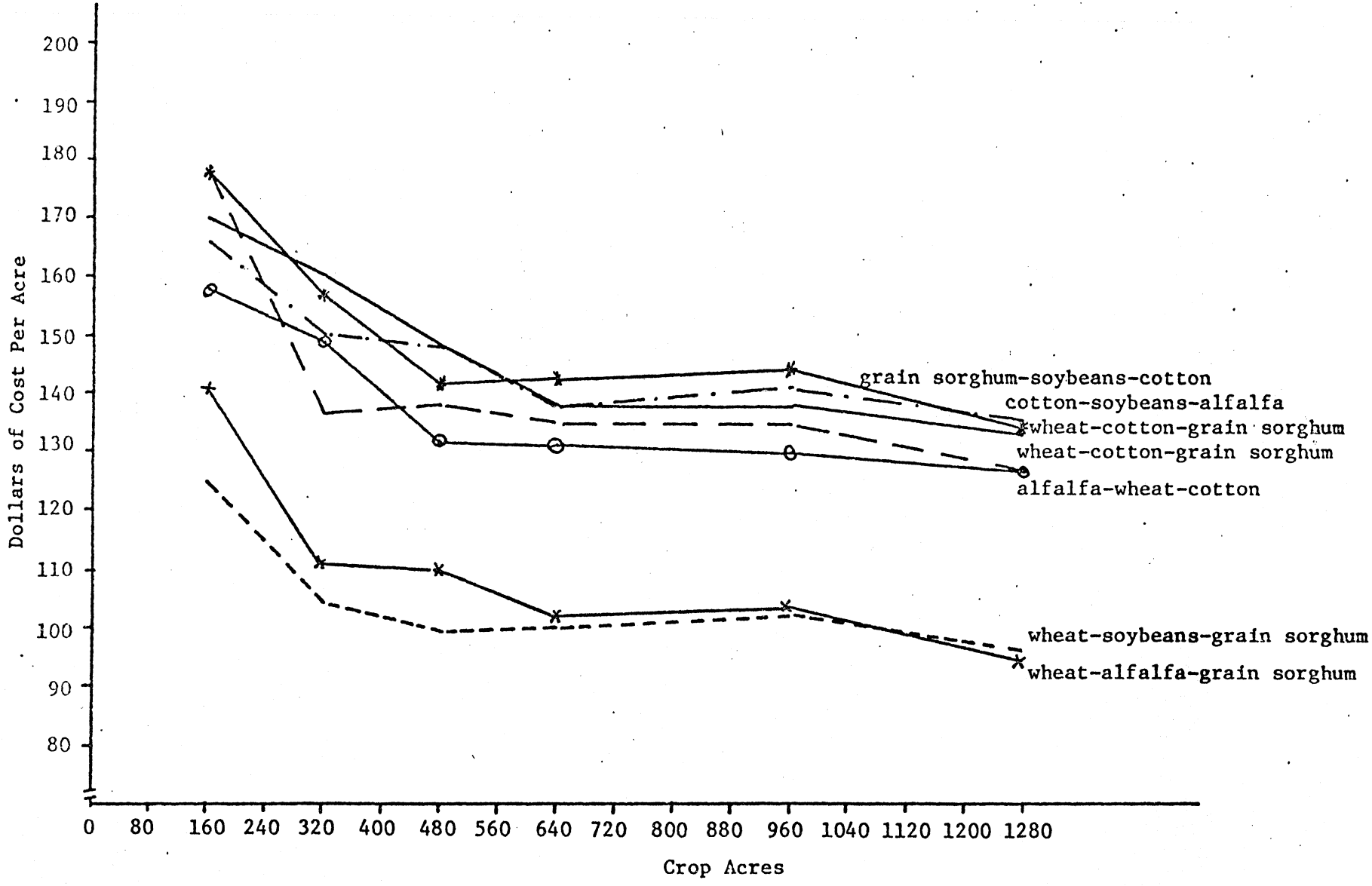

Figure 4. Average Total Cost Per Acre for Six Selected Farm Sizes of Three-Crop Rotations Based on a Minimum Machinery Requirement and Irrigated Cropping Systems

for lower prices, or from a combination of both. In the long run all inputs are variable and a farmer is able to reduce the cost per unit of production by shifting to a machinery combination which has a larger power unit and has a more effective field capacity on expanded farm sizes.

Total revenue and total cost data, when expressed as ratios of total cost to total revenue, suggest the existence and the importance of economies of size.

Figures 5, 6, and 7 show long-run cost curves. These curves show costs per dollar return as gross revenue increases. Costs per dollar return continuously decline over the range of these long-run cost curves for cropping systems. Most of the cost reduction occurs before the dollar return reaches $100,000 with the cost decreasing at a decreasing rate as the total return increases. Even though these long-run planning curves show continuous cost reductions throughout their entire length, lumpiness appears on some of the curves. These cases of lumpiness suggest that cost increases are greater than efficiency gained by shifting to larger or more efficient equipment at those particular larger farm sizes.

Among the crops, cotton shows the highest level of cost per dollar return, while alfalfa has the lowest cost per dollar return.

Summary And Conclusions

This study is concerned with the present nature and extent of economies of size. It is hypothesized that these economies will not be achieved if the 160 acres of irrigated land limitation would be enforced as the 1902 Bureau of Reclamation Law may be interpreted. Total costs per acre are estimated for five irrigated crops and 15 of their combinations, and four dryland crops along with 8 of their combinations. Average total cost curves

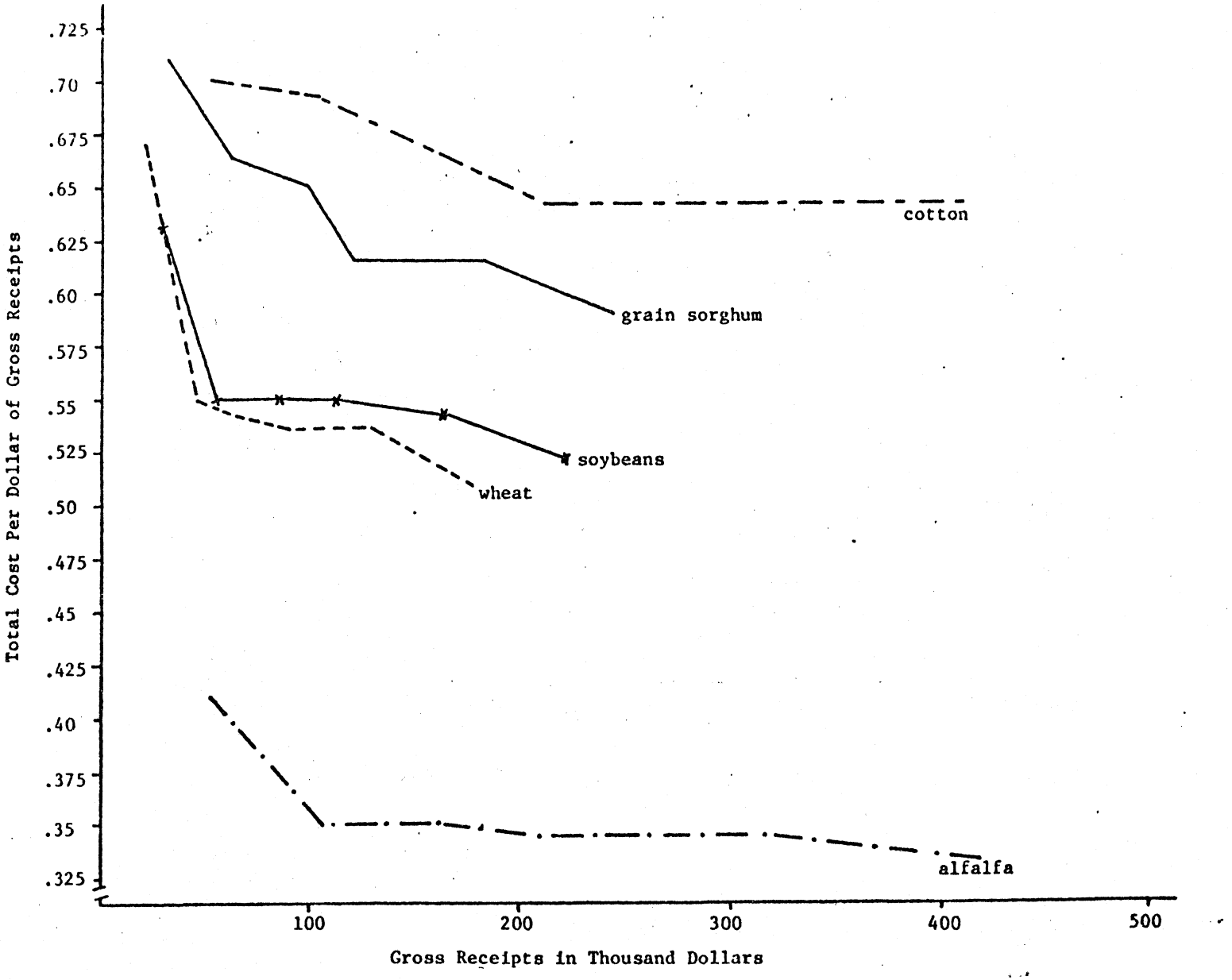

Figure 5. The Ratio of Total Cost to Gross Receipts Per Acre for Selected Farm Sizes of One-Crop Rotations Based on a Minimum Machinery Requirement and Irrigated Cropping Systems

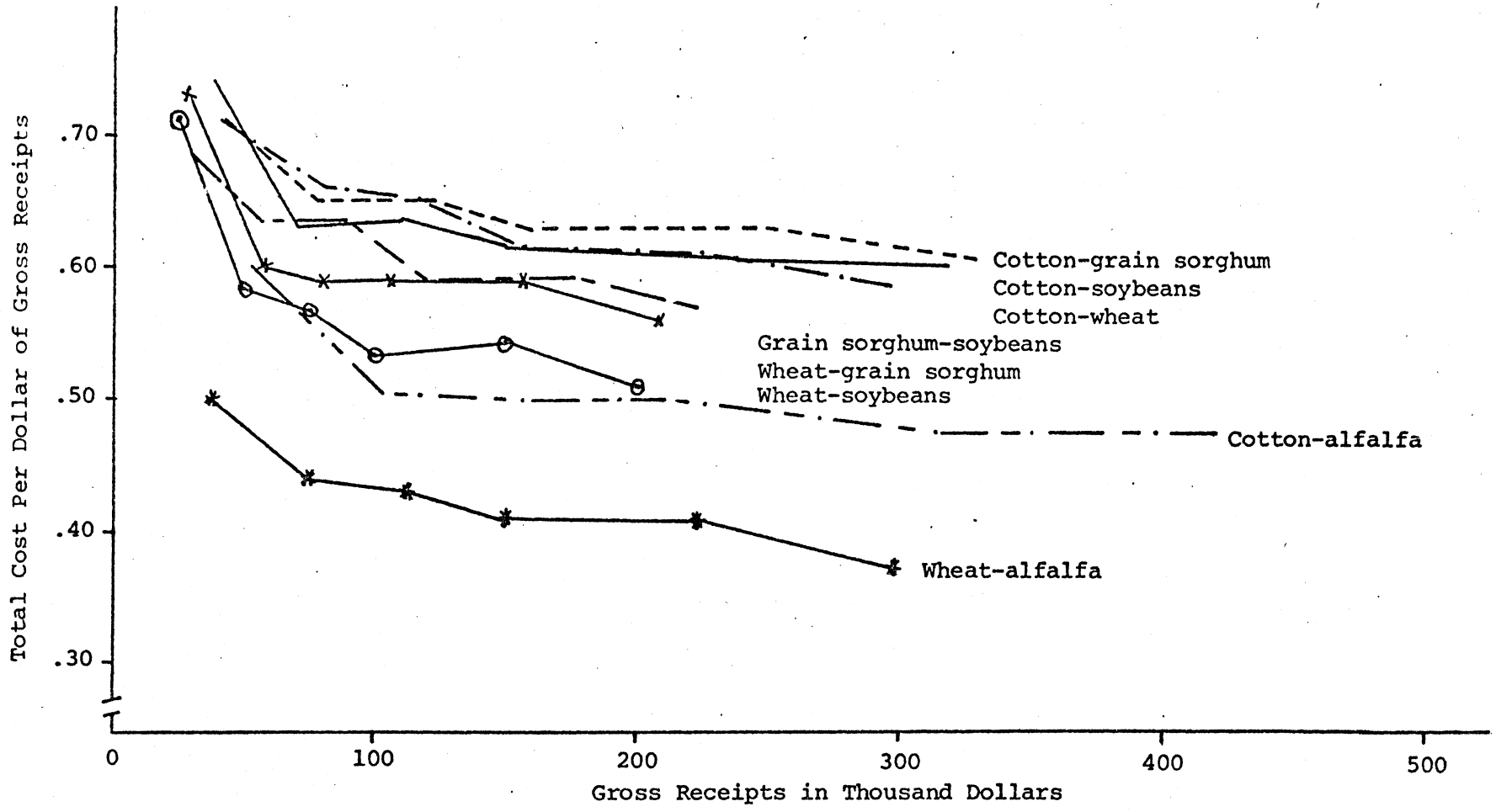

Figure 6. The Ratio of Total Cost to Gross Receipts Per Acre for Selected Farm Sizes of Two-Crop Rotations Based on a Minimum Machinery Requirement and Irrigated Cropping Systems

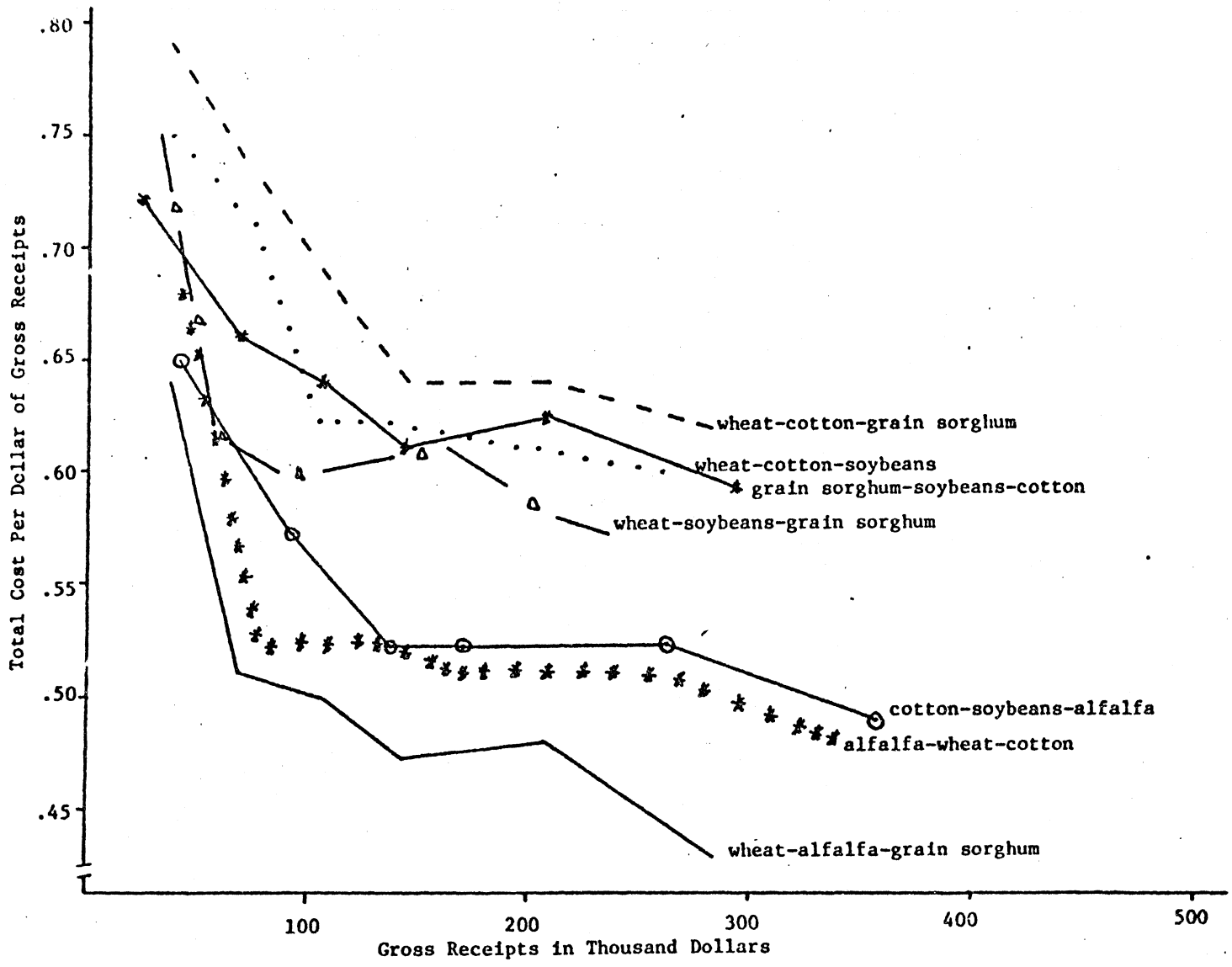

Figure 7. The Ratio of Total Cost to Gross Receipts Per Acre for Selected Farm Sizes of Three-Crop Rotations Based on a Minimum Machinery Requirement and Irrigated Cropping Systems

are derived as a function of crop acres to illustrate the nature and extent of cost economies of farm size.

The study results indicate that a reduction in total cost per acre or an increase in "Return To Land, Overhead, Risk, and Management" per acre can be obtained by increasing farm size. The main source of reduction of total average cost is the decline in total capital requirements per acre as farm size increases. This declining capital requirement per acre for various farm sizes indicates the increasing efficiency of machinery as machinery size increases with farm size. Analyses of the ratio of the return on capital invested and the ratio of total cost to gross receipts per acre show clear-cut evidence of the economies of size for the various cropping systems.

Based upon the results of this study, it can be concluded that economies of farm size occur for cropping system in the ALTUS-LUGERT Irrigation District, and farmers in that area will reduce their losses and increase their income by expanding irrigated farm sizes.

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