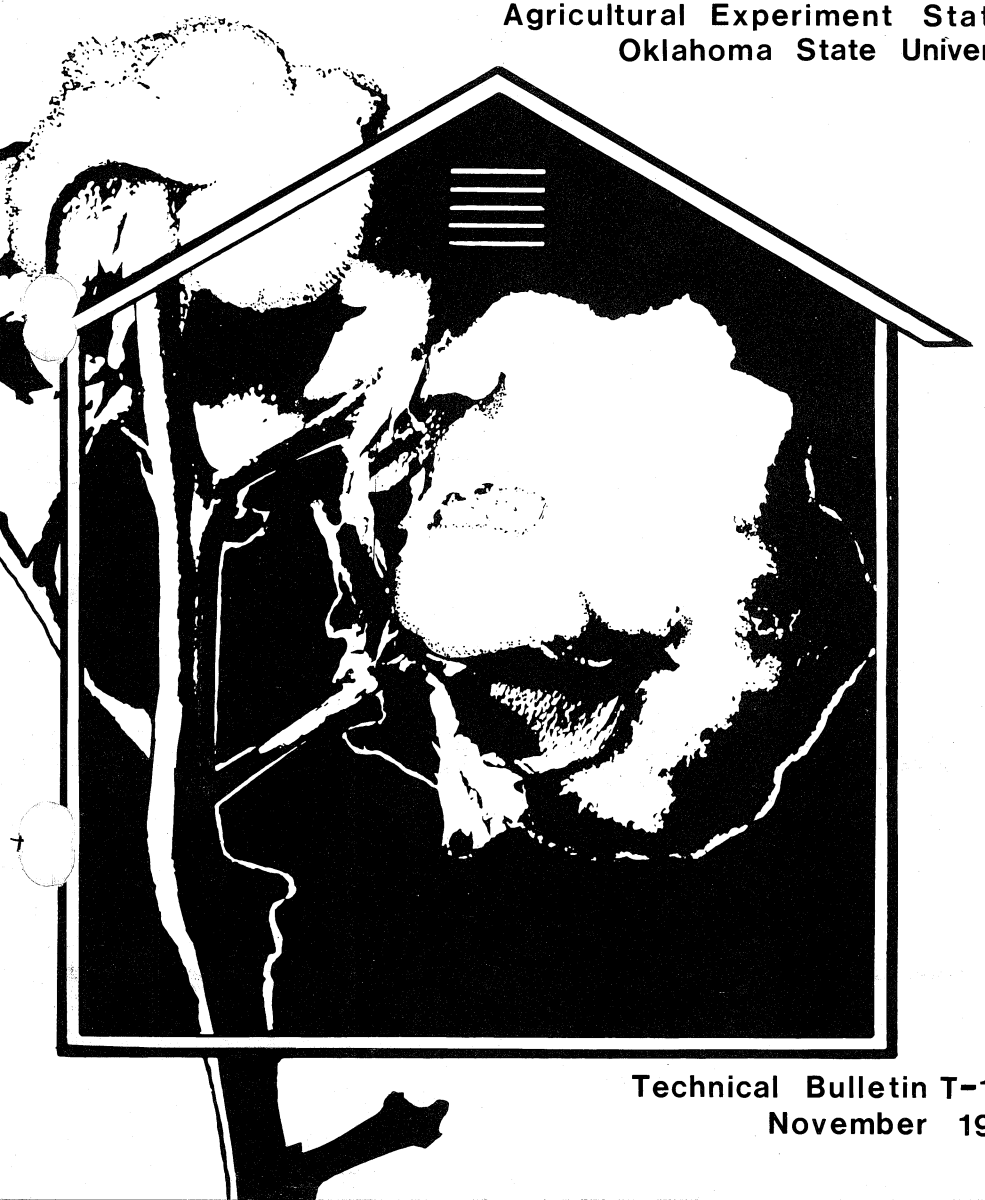
Optimum Organization of Cotton Ginning and Warehousing Facilities in the Oklahoma-Texas Plains

Agricultural Experiment Station
Oklahoma State University



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O. A. Cleveland, Jr. and Leo V. Blakley*

A casual survey of facilities producing many types of marketing services for seasonally produced agricultural products will reveal that plants typically operate for only a portion of the year and that over-capacity exists. Such is true in the Oklahoma-West Texas cotton marketing industry.

Gins have been established in almost every community of this region because (1) producers prefer to haul seed cotton only a short distance, (2) producers want their trailers emptied and returned with a minimal delay, and (3) producers feel that only the local community gin will provide the quality of service they demand. As a result there are many gins, most of which operate at capacity for a few weeks then are idle during most of the remaining months. This represents serious over-capacity in ginning facilities. Specifically, the Texas and Oklahoma plains area had the capacity to gin over seven million bales in 1974 while production was estimated to be only 2.8 million bales.

Historically, gin numbers have declined as intense competition has forced managers to attempt to minimize costs, satisfy producers and obtain higher volumes. For example, gin numbers in the Altus area decreased 19 percent from 1970 to 1974, from 48 to 39 plants. Gin numbers had already decreased 16 percent during the ten years prior to 1970. In

*Agricultural Economist, Economic Research Service, and Professor of Agricultural Economics, Oklahoma State University, respectively. The research reported herein was a joint effort of the Economic Research Service, USDA, and the Oklahoma Agricultural Experiment Station.

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addition, replacements have been minimal with only a few very modern gins built in recent years.

Warehouse facilities, unlike gin plants, operate throughout the year. However, their peak operation corresponds to the ginning season and complete utilization during the remainder of the year does not occur. Warehouse capacity must be large enough to store approximately 80 percent of the annual production. Physical storage capacity for 1974 was 4.6 million bales for the Texas-Oklahoma plains area, one and one-half times the level of production.

The principal problem confronting gin and warehouse operations is the need for increased annual volume per plant. Managers also face difficulty in finding skilled labor willing to work for the short period during peak ginning and warehouse operations. A major change in the system may be required to solve these problems.

Sandel, Smith and Fowler; and Moore and Courtney indicated that the cost of marketing raw cotton could be significantly reduced if the ginning season could be extended. Increasing ginning hours by extending the ginning season would require storage of seed cotton when the harvesting rate exceeded the ginning rate. Significant increases in plant volume by this method would require extensive seed cotton storage but would allow ginning to be independent of harvesting, therefore eliminating problems for gins and warehouses created by peak capacity limitations. Increasing volume would lower cost primarily through a more intensive use of mixed factors. In addition, gin managers would find it easier to employ gin crews since crews could be offered employment over a longer period of time and neither gin nor warehouse managers would need to employ additional crews since peak operating conditions would be eliminated.

Objectives of the Study

The purpose of this study was to determine the size, number and location of gins and warehouses that would minimize the total cost of farm assembly, ginning, warehousing and merchandising under two alternative ginning seasons and estimate the savings that would result from a relocation of gins and warehouses for each ginning season. Cost data used in the analysis were developed specifically for this study and are reported in Ag. Econ. Paper 7604.[1] Copies of the paper may be obtained from the authors.

The objectives of this study differ from other objectives in other

[1] O. A. Cleveland, Jr. and Leo Blakley, *Costs of Marketing Cotton under Alternative Gin Size and Length of Season Operations in Oklahoma-Texas Plains,* Okla. Agri. Exp. Station, Ag. Econ. Paper No. 7604, August 1976.

studies of the industry in that an attempt was made to consider simultaneously all sectors of the marketing system. Research linking the various sectors of the marketing system could, for example, better indicate the effects of changes in the size, number and location of cotton gins on the warehouse sector and related effects on the delivery of raw cotton to the mill.

Efforts to specify an optimum organization of the marketing system in a dynamic economic environment may not succeed; however, a partial equilibrium analysis will provide the direction and magnitude for desirable changes. An analysis of the optimum marketing system should provide (1) guidelines to firms to eliminate unnecessary inefficiencies in their existing organization, and (2) guidelines to public policymakers to facilitate the needs of producers and consumers.

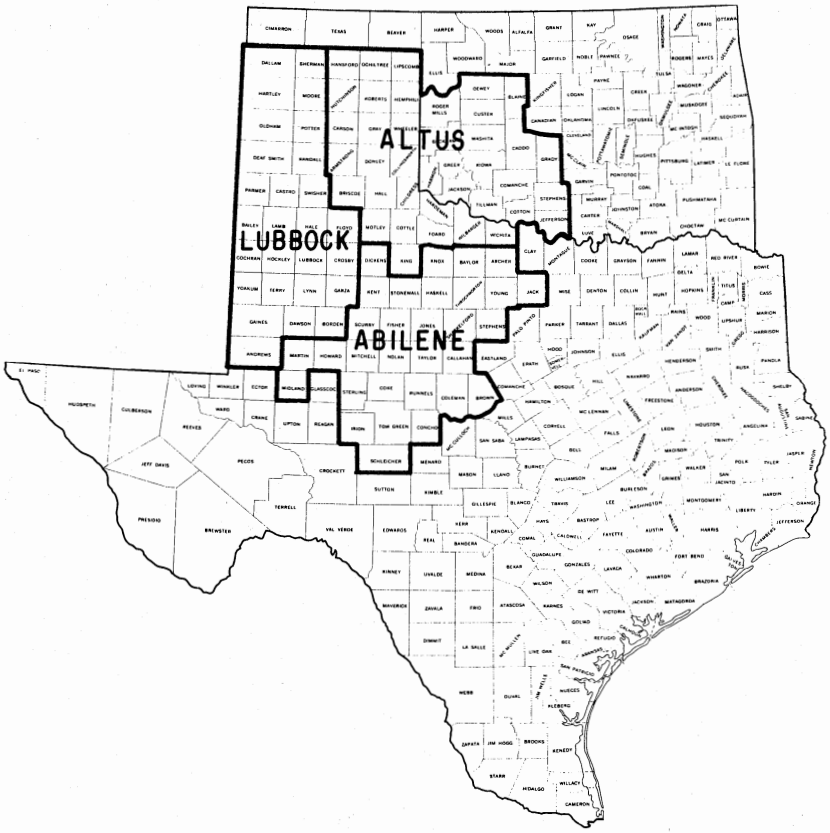


Figure 1. Cotton Classing Territories in the Oklahoma-Texas Plains.

The Study Area

The Oklahoma-Texas plains region was divided by the Smith-Doxey Cotton Classing Act into three territories: Altus, Lubbock and Abilene classing territories (Figure 1). A multi-county area of each territory was selected as a study area and is identified by the classing territory name. The delineation of each study area was based on conditions prevalent in each classing territory. Ginning data are presented in Table 1.

The Altus area includes the Oklahoma counties of Greer, Tillman, Kiowa, Jackson and Harmon and is characterized by large amounts of production in some counties and small amounts in other counties. This area accounts for over 50 percent of Oklahoma cotton production and had 39 gins and seven warehouses operating in 1974.

The Lubbock study area includes the Texas counties of Lamb, Hale, Floyd, Crosby, Lubbock, Hockley, Terry, Lynn and Garza and is the center of production in West Texas. There were 217 gins and 22 ware-

Table 1. Cotton Ginnings by Study Area and Classing Territory, 1968-1973

Study Area/County	GINNINGS					
	1968	1969	1970	1971	1972	1973
	BALES					
Altus						
Greer	14,932	14,802	8,482	10,223	18,977	26,982
Harmon	20,670	13,583	10,695	11,793	20,364	28,249
Jackson	31,545	29,893	28,881	16,325	38,910	59,943
Kiowa	20,852	26,927	13,524	23,199	26,900	43,121
Tillman	32,708	29,557	19,424	13,415	39,483	62,870
Study Area Total	120,707	114,762	81,006	74,954	144,634	221,165
Classing Territory Total	**447,385**	**408,161**	**392,121**	**300,448**	**542,307**	**729,804**
Lubbock						
Crosby	74,381	78,759	117,408	78,237	156,130	189,244
Floyd	40,502	62,802	77,748	44,195	113,971	131,386
Garza	21,717	15,901	17,640	11,283	28,198	34,612
Hale	68,297	79,073	140,178	89,869	143,406	157,797
Hockley	168,808	132,718	153,447	93,470	122,484	212,403
Lamb	106,707	67,754	119,966	84,747	106,069	141,567
Lynn	172,311	150,568	152,886	97,697	230,717	309,356
Lubbock	180,765	173,086	215,485	152,052	226,837	310,481
Terry	117,615	90,954	103,514	81,310	121,357	172,896
Study Area Total	951,103	851,615	1,098,272	732,860	1,121,069	1,541,542
Classing Territory Total	**1,462,776**	**1,286,810**	**1,587,724**	**1,080,859**	**1,911,223**	**2,418,987**
Abilene						
Fisher	47,771	17,684	37,110	24,461	42,056	56,494
Jones	67,160	43,478	58,643	38,378	70,443	89,117
Nolan	26,286	16,323	21,326	9,113	25,353	28,980
Taylor	10,482	7,190	9,672	5,942	6,781	10,031
Study Area Total	108,699	84,675	126,751	77,894	166,832	184,622
Classing Territory Total	**579,376**	**326,946**	**446,280**	**346,482**	**582,515**	**717,836**

Source: U. S. Department of Commerce, pp. 13-17.

houses operating in 1974. Over 30 percent of the cotton produced in Texas is grown in these nine counties.

The Texas counties of Taylor, Jones, Fisher and Nolan are included in the Abilene area and had 33 gins and eight warehouses operating in 1974. This area is representative of one declining in cotton production relative to other areas. Only four percent of the 1973 Texas crop was produced in this region.

Sector Classification

The marketing system for raw cotton can be divided into four subsystems:

1. On-farm assembly of seed cotton and transportation to the gin,
2. Ginning of seed cotton and transportation to the warehouse,
3. Storage at the warehouse and recompression for shipment, and
4. Merchandising services and market distribution performed by merchants in moving cotton to weaving mills, yarn mills, and export outlets.

Most producers in the Oklahoma-West Texas region haul seed cotton to gins in their own trailers as soon as it is harvested; however, some producers in West Texas utilize gin owned trailers. Regulations in Oklahoma prohibit gins from owning trailers. The trailers are transported in tandem by a farm tractor or pickup truck. Producers haul from three to twelve bales of lint cotton per trailer depending on trailer size with six bale trailers being the most common size. Generally, producers demand that their cotton be ginned as soon as possible. Given the numerous gins located throughout the area, producers are seldom required to transport their crop more than five miles.

The ginning period is tied closely with the harvesting period, differing only by a few days at most. Consequently, ginning varies with weather and crop conditions. The ginning season in the machine stripped area is between October 1 and March 1. Gin facilities with insufficient capacity to meet demands lose customers to competing gins; therefore, most cotton is ginned and transported to a warehouse with minimal delay. Producers expect fast ginning service for three reasons: (1) trailers must be emptied for immediate reuse, (2) the lint cotton sample taken after ginning is generally required before producers can sell their crop, and (3) the government loan program is more attractive for lint cotton than seed cotton. The latter reasons make apparent why the demand for ginning parallels harvesting-rates. However, gins seldom can handle cotton as rapidly as it is harvested, particularly during the peak of the harvest period, usually between November 10 and December 20. Gins often operate 24 hours a day during this peak period, but only sporadically

during the remainder of the ginning season. The persistent trend in yearly decreases in machine harvest time has placed an increased burden on peak ginning capacity.

Most gins press "modified flat" bales, however, some have a universal density press. Shortly after being baled and wrapped at the gin, the bale is transported to a warehouse in a gin-owned or commercial truck. Transportation is provided by the gin and usually paid by the producer as part of his ginning charges. Once at the warehouse most cotton is sampled, stored and a negotiable warehouse receipt issued. Modified flat bales are recompressed to universal density before being shipped to the mill-export point.

Nearly 72 percent of the machine stripped cotton is shipped by rail to the Houston-Galveston area for export (Table 2). Cotton for domestic use is generally shipped by rail to five major mill areas: (1) South Carolina, hereafter referred to as Group 201 mills, (2) North Carolina, hereafter referred to as Group 200 mills, (3) New England mills, (4) Alabama-Georgia mills and (5) other domestic mills.

The Model

Determination of the least cost marketing structure was based on the mixed integer programming model. The integer routine was meshed with transportation properties of the problem to consider economies of scale in processing facilities while minimizing the combined assembly, processing and distribution cost.

Table 2. Estimated Cotton Warehouse Shipping Distribution by Destination Area, and Shipments by Study Area, Oklahoma and West Texas, 1974

Destination	Percent of Shipments	Study Area		
		Altus	Abilene	Lubbock
	Percent		Bales	
Group 201 Mills[1]	14.9	18,978	18,940	172,364
Group 200 Mills	0.5	637	636	5,784
New England Mills	0.8	1,019	1,017	9,25
Alabama-Georgia Mills	11.0	14,011	13,982	127,24
Other Domestic Mills[2]	1.0	1,274	1,271	11,56
Foreign Mills	71.8	91,451	91,265	830,587
Total	**100.0**	**127,370**	**127,111**	**1,156,806**

[1] Group 201 and Group 200 mills are those located in the two Carolina states; generally, mills located in the western portion of these states comprise Group 201 mills.

[2] Principally Texas.

Source: Chandler and Glade 1975, p. 22.

The model is as follows:

Minimize

$$Z = \sum_{j=1}^{m}\sum_{i=1}^{n} C_{ij}Q_{ij} + \sum_{h=1}^{g}\sum_{j=1}^{m}\sum_{i=1}^{n} C_{jh}Q_{ijh} +$$

$$\sum_{k=1}^{p}\sum_{j=1}^{m}\sum_{i=1}^{n} C_{jk}Q_{ijk} + \sum_{k=1}^{p}\sum_{j=1}^{m}\sum_{i=1}^{n} C_{k}Q_{ijk} +$$

$$\sum_{l=1}^{t}\sum_{k=1}^{p}\sum_{j=1}^{m}\sum_{i=1}^{n} C_{kl}Q_{ijkl}$$

where

Q_{ij} = quantity of seed cotton transported from supply area i to gin area j

C_{ij} = unit transfer cost from supply area i to gin area j

Q_{ijh} = quantity of seed cotton ginned at gin area j, gin size h

C_{jh} = unit cost of ginning seed cotton at gin area j, gin size h

Q_{ijk} = quantity of lint cotton transported from gin area j to warehouse area k for storage

C_{jk} = unit transfer cost from gin area j to warehouse area k

C_{k} = unit cost of warehousing lint cotton in warehouse area k

Q_{ijkl} = quantity of lint cotton transported from warehouse area k to demand area l.

The assumptions regarding the objective function and constraints are as follows:

(1) The supply of the resource from each production area is known,

(2) Unit costs associated with assembly and distribution are known and independent of volume shipped,

(3) Unit costs associated with processing are known for each potential plant location and size, and

(4) The demand for each market is known.

Production and Marketing Facilities by Areas

The areas of study for the analysis were previously identified as the five southwestern Oklahoma Counties around Altus, the four county Abilene area and the nine county area whose center is Lubbock, Texas.

Production regions supplying seed cotton to gins were established based on present gin locations and were sub-county regions. The center of each sub-county supply region was assumed to be a gin location. Therefore, for each alternative gin location within a county there existed a supply region where it was assumed seed cotton would be assembled and ginned or would then be transferred for ginning at another alternative gin location. Production was assumed to be uniform throughout a county and was equal for supply sources within the same county.

Production estimates for each county unit within the three study areas were based on average county production of the four years 1970-73. Alternative gin locations, the number of gins at each location in 1974 and estimated production of the county and associated supply regions are contained in Tables 3 through 5 for the Altus, Abilene and Lubbock study areas, respectively. Alternative warehouse locations for the above corresponding study areas are presented in Table 6.

Warehouse to mill shipments were restrained such that each ware-

Table 3. Alternative Gin Locations and Number of Gins, Estimated County and Supply Source Production, Altus Study Area, 1974

Alternative Location	Number of Gins	Production	
		County	Supply Source
County and Town	Firms	Bales	
Tillman County:		36,490	
Davidson	3		7,298
Grandfield	1		7,298
Manitou	1		7,298
Tipton	1		7,298
Frederick	3		7,298
Kiowa County		23,622	
Mt. View	2		3,937
Hobart	1		3,937
Gotebo	1		3,937
Lone Wolf	1		3,937
Roosevelt	2		3,937
Snyder	1		3,937
Jackson County		32,562	
Altus	5		5,427
Blair	1		5,427
Eldorado	1		5,427
Headrick	1		5,427
Martha	1		5,427
Olustee	1		5,427
Greer County		14,368	
Mangum	3		3,592
Granite	1		3,592
Reed	1		3,592
Willow	2		3,592
Harmon County		20,328	
Gould	1		6,776
Hollis	3		6,776
Vinson	1		6,776

house shipped a given percentage of its volume to each mill area. The estimated distribution shipped to each demand area, Table 2, was taken from Chandler and Glade (p. 22).

Optimum Size, Number and Location of Cotton Ginning and Warehousing Facilities

Altus Study Area

The 24 potential gin sites and five warehouse locations included in the analysis are spatially dispersed throughout the primary cotton producing areas of the study area (Figure 2). Locations selected comprise the existing network of ginning and warehousing facilities. The model was specified such that both Altus (12) and Frederick (5) were permitted

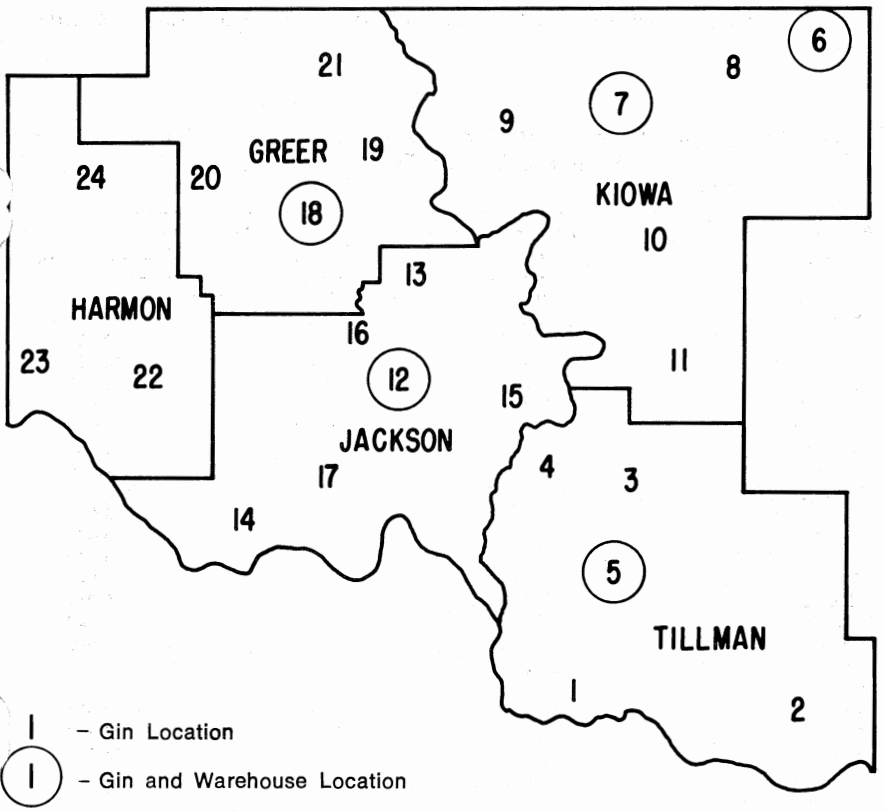


Figure 2. Gin, Warehouse and Supply Source Locations, Altus Study Area, 1974.

to have two warehouses. The locations selected consist of the following towns:

1. Davidson	9. Lone Wolf	17. Olustee
2. Grandfield	10. Roosevelt	18. Mangum
3. Manitou	11. Snyder	19. Granite
4. Tipton	12. Altus	20. Reed
5. Frederick	13. Blair	21. Willow
6 Mt. View	14. Eldorado	22. Gould
7. Hobart	15. Headrick	23. Hollis
8. Gotebo	16. Martha	24. Vinson

14-Week Ginning Season—The minimum cost mix of cotton processing plants (Figure 3 and Table 7) consists of four gins and one ware-

Table 4. Alternative Gin Locations and Number of Gins, Estimated County and Supply Source Production, Abilene Study Area, 1974

Alternative Location	Number of Gins	Production	
		County	Supply Source
County and Town	Firms	Bales	
Fisher County:		42,036	
Rotan	3		10,509
Longworth	1		10,509
Roby	2		10,509
Sylvester	1		10,509
Jones County:		55,539	
Hamlin	1		5,049
Anson	2		5,049
Radium	1		5,049
Avoca	2		5,049
Neinda	1		5,049
Hodges	1		5,049
Stith	1		5,049
Noodle	1		5,049
Tuxedo	1		5,049
Corinth	1		5,049
Stamford	3		5,049
Nolan County:		23,511	
Roscoe	4		7,837
Nolan	1		7,837
Sweetwater	1		7,837
Taylor County:		6,025	
Abilene	1		1,205
Merkel	1		1,205
Trent	1		1,205
Tuscola	1		1,205
Lawn	1		1,205

Table 5. Alternative Gin Locations and Number of Gins, Estimated County and Supply Source Production, Lubbock Study Area, 1974

Alternative Location	Number of Gins	Production	
		County	Supply Source
County and Town	Firms	Bales	
Lamb County:		113,136	
Littlefield	7		14,142
Sudan	3		14,142
Amherst	4		14,142
Earth	4		14,142
Fieldton	2		14,142
Olton	3		14,142
Spade	3		14,142
Springlake	3		14,142
Hale County:		133,343	
Plainview	11		19,049
Abernathy	8		19,049
Cotton Center	2		19,049
Edmondson	2		19,049
Hale Center	7		19,049
Petersburg	2		19,049
Halfway	2		19,049
Floyd County:		97,610	
Floydada	6		19,522
Lockney	8		19,522
Sterley	1		19,522
Dougherty	1		19,522
Aiken	1		19,522
Crosby County:		129,270	
Ralls	8		21,545
Robertson	1		21,545
Lorenzo	6		21,545
Cone	1		21,545
Kalgary	1		21,545
Crosbyton	3		21,545
Lubbock County:		218,603	
Lubbock	16		31,229
Slaton	6		31,229
Shallowater	5		31,229
Hurlwood	1		31,229
Idalou	4		31,229
New Deal	2		31,229
Wolfforth	1		31,229
Hockley County:		132,840	
Levelland	13		16,605
Anton	3		16,605
Smyer	2		16,605
Pep	1		16,605
P ttit	1		16,605
Ropesville	5		16,605
Sundown	1		16,605
Witharral	3		16,605
Terry County:		124,240	
Brownfield	14		31,060
Meadow	4		31,060
Tokio	1		31,060
Wellman	2		31,060
Lynn County:		176,140	
O'Donnell	6		35,228
Tahoka	7		35,228
Grassland	1		35,228
Wilson	4		35,228
New Home	3		35,228
Garza County:		31,624	
Post	8		15,812
Southland	1		15,812

Table 6. Alternative Cotton Warehouse Locations, Altus Study Area, Abilene Study Area, and Lubbock Study Area, 1974

Altus	Study Area Abilene	Lubbock
	Location	
Frederick	Rotan	Littlefield
Mt. View	Hamlin	Sudan
Hobart	Stamford	Plainview
Altus	Sweetwater	Abernathy
Mangum	Abilene	Floydada
		Lockney
		Ralls
		Lubbock
		Slaton
		Levelland
		Brownfield
		O'Donnell
		Tahoka

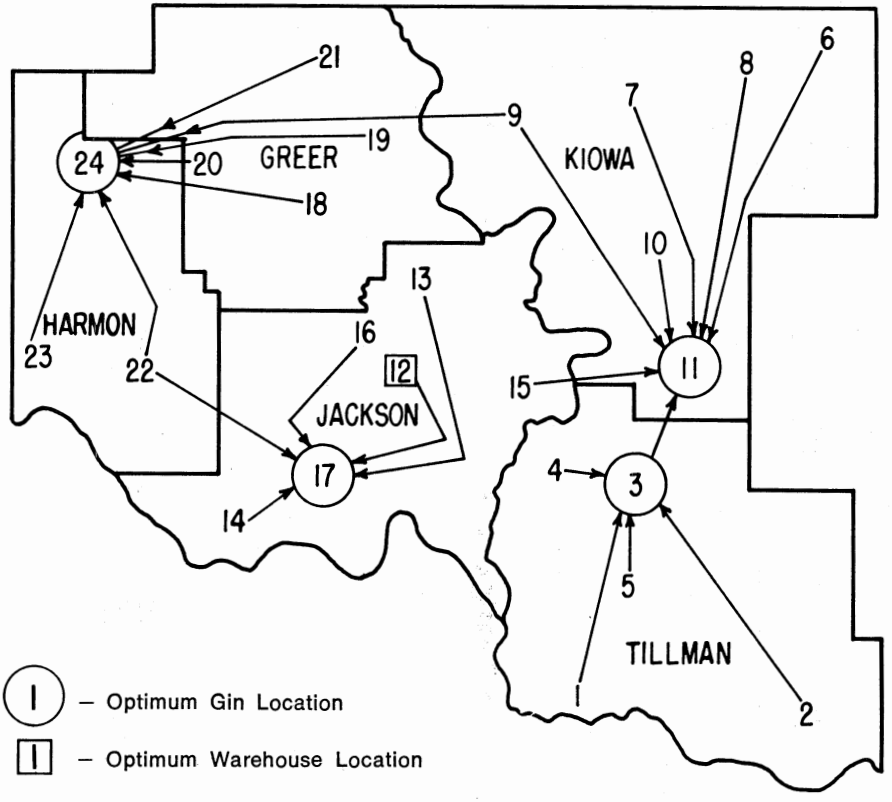


Figure 3. Gin, Warehouse and Supply Source Locations in the Optimum Market Organization, Altus Study Area, 14-Week Ginning Season, 1974.

Table 7. Gin and Warehouse Locations, Volumes, and Supply Sources for the Optimum Market Organization, Altus Study Area, 14-Week Ginning Season, 1974

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
3-Manitou	32,344	32,344	1-Davidson, 2-Grandfield, 3-Manitou (3,152), 4-Tipton, 5-Frederick
11-Snyder	32,344	32,344	3-Manitou (4,146), 6-Mt. View, 7-Hobart, 8-Gotebo, 9-Lone Wolf (3,086), 10-Roosevelt, 11-Snyder, 15-Headrick
17-Olustee	32,344	32,344	12-Altus, 13-Blair, 14-Eldorado, 16-Martha, 17-Olustee, 22-Gould (5,209)
24-Vinson	32,344	30,338	9-Lone Wolf (851), 18-Mangum, 19-Granite, 20-Reed, 21-Willow, 22-Gould (1,567), 23-Hollis, 24-Vinson
		Warehouses	
12-Altus	98,903	127,370	3-Manitou, 11-Snyder, 17-Olustee, 24-Vinson

[1] Location is given by code number and town name.
[2] Supply source is given by code number and supply area; if a supply area transports all of its production to a given point then only the location is listed; for areas with split shipments the volume is in parentheses.

house.[2] Gin plants, each with a seasonal capacity of 32,344 bales, are located at Manitou (3), Snyder (11), Olustee (17) and Vinson (24). All operate at full capacity except for the Vinson plant which operates at a level of 2,006 bales less than capacity. Only one warehouse activity, Altus (12), is included in the optimum solution. Warehouse capacity is 98,903 bales with volume handled being 127,370 bales.

A pictorial representation of the farm-to-gin flow of cotton is also contained in Figure 3. Gin market areas are well defined and only three of the 23 supply sources split their production between gins. The volume and flow of shipments from production areas to gin points are also given in Table 7. The four gins transship their cotton to the Altus warehouse which is located in the center of the study area.

The flow pattern of cotton from warehouse to mill was specified in the previous chapter and is the same for all warehouses within study areas. Shipments originating in the Altus study area and designated for the six mill demand points are given in Table 2.

[2] Several alternative suboptimum market organizations were also developed for the Altus 14- and 32-week seasons as well as for the other study areas. These structures can be found in Chapter VI of Cleveland.

The cost of marketing cotton as given by the optimum market organization is $8,059.415 or $63.28 per bale (Table 8). This compared with present system costs of $11,249,014 or $88.32 per bale. Therefore, a reorganization of the market could result in a savings of $25.04 per bale. This savings is delineated by major activity in Table 8 and represents a 28 percent decrease in present system costs.

The present market organization has 39 gins located at or near the 24 sites previously presented. Since the optimum includes only four gins, farm to gin assembly cost might be expected to increase.[3] This anticipation is justified since trailer cost per bale remains constant and total transfer cost varies only with respect to farm to gin distance. Assembly cost of the optimum market organization is approximately $130,000 over the present cost. This results in an average increase of $1.02 per bale. Since this is an average for the area, the impact on individual producers would vary. Some producers would incur a smaller assembly cost while the cost to others could be expected to be greater. Further, this cost would be more visible to producers whose cost is relatively near or greater than the $1.02 per bale.

The most significant savings over the present system occurs in the ginning activity and amounts to $16.70 per bale. This represents a reduction of over two million dollars, or a decrease in ginning cost of over 50 percent, and accounts for 67 percent of the total savings that could be realized through the optimum market organization. This reduction suggests significant economies of size exist in cotton ginning. Gins in the proposed organization are 42-bale per hour plants with a seasonal capacity of 32,344 bales, the largest and most modern operations technically feasible. Most gin plants in the present market structure have capacities under nine bales per hour. If the estimated production of 127,370 bales were distributed evenly, each gin would process only 3,266 bales. This contrasts sharply to the three gins that receive 32,344 bales and the fourth whose volume is 30,338 bales. Further, this contrasts to actual ginning records which indicate that since 1970 there have been only four times when any gin received more than 10,000 bales, the largest of which was 12,000 bales.

As a result of the proposed one warehouse market structure, as opposed to the present seven, gin to warehouse transportation cost increases $.16 per bale. However, warehousing costs, reflecting economies of size in warehousing, decrease by $9.52 per bale or more than 1.2 million dollars. Another factor leading to decreased warehouse cost is associated with the utilization of modern ginning equipment. Since all bales are

[3] Farm to assembly cost is hereafter referred to as assembly cost.

Table 8. Cotton Marketing Costs of the Present System and Optimum Market Organization by Major Activity, 14-Week Ginning Season, Altus Study Area, 1974

Activity	Present Market Organization		Optimum Market Organization		Savings	
	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale
Assembly	1,128,498	8.86	1,258,508	9.88	—130,010	—1.02
Ginning	4,228,684	33.20	2,101,643	16.50	2,127,041	16.70
Gin-Warehouse Transportation	95,528	0.75	115,849	0.91	—20,321	—0.16
Warehousing	1,685,105	13.23	472,216	3.71	1,212,889	9.52
Merchandising	4,111,199	32.28	4,111,199	32.28	0	0
Total Cost	**11,249,014**	**88.32**	**8,059,415**	**63.28**	**3,189,599**	**25.04**

compressed to universal density at the gin, cotton does not have to bear the expense of recompression.

Merchandising cost adds over 4.1 million dollars, $32.28 per bale, to the cost of the farm-to-mill flow of cotton produced in the Altus study area. Since each study area was assumed to be a single resource point for mill areas, merchandising cost is the same for all market structures of a particular study area; and, thus does not affect market organizations.

32-Week Ginning Season—The adoption of new practices are necessary industry adjustments if the present 14-week ginning season is extended. Lengthening the ginning season requires seed cotton storage and alters lint storage requirements. The industry organization discussed here, like the 14-week season, specifies the use of modern ginning equipment and the adoption of new ginning techniques such as automatic unloading, sampling and bale packaging as well as universal density compression at the gin.

Given the adoption of this extended ginning season, the optimum market organization includes gin plants at Manitou (3) and Reed (20), with warehouse facilities at Frederick (5) and Mangum (18). Both gin plants have a seasonal capacity of 64,688 bales. The Manitou plant processes at a rate equal to its capacity while the Reed plant gins 62,682 bales. Farm-to-gin flows and warehouse locations are presented in Figure 4 and Table 9. This solution may be compared with the present system

Table 9. Gin and Warehouse Locations, Volumes, and Supply Sources for the Optimum Market Organization, Altus Study Area, 32-Week Ginning Season, 1974

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
3-Manitou	64,688	64,688	1-Davidson, 2-Grandfield, 3-Manitou, 4-Tipton, 5-Frederick, 6-Mt. View, 8-Gotebo (106), 10-Roosevelt, 11-Snyder, 14-Eldorado, 15-Headrick, 17-Olustee
20-Reed	64,688	62,682	7-Hobart, 8-Gotebo (3,831), 9-Lone Wolf, 12-Altus, 13-Blair, 16-Martha, 18-Mangum, 19-Granite, 20-Reed, 21-Willow, 22-Gould, 23-Hollis, 24-Vinson
		Warehouses	
5-Frederick	24,795	64,688	5-Manitou
18-Mangum	24,027	62,682	20-Reed

[1] Location is given by code number and town name.

[2] Supply source is given by code number and supply area; if a supply area transports all of its production to a given point then only the location is listed; for areas with split shipments the volume is in parentheses.

of 39 gins and seven warehouses (Figure 2) and with the four gin plants and one warehouse minimum cost solution of the 14-week ginning system (Figure 3 and Table 7). The optimum market structure of both ginning seasons indicates a gin plant will be located at Manitou. Further, these are 42-bale per hour plants. However, these are the only similarities of the two market structures except for a portion of the Manitou plant market area. The market areas for each of the plant locations are well defined and only one production source, Gotebo, splits seed cotton between gin sites. The Mangum warehouse draws its resources from the Reed ginning facility while the Frederick warehouse draws from Manitou.

The cost associated with this optimum market organization is $7,647,515 and is given in Table 10 by major activity. This represents a

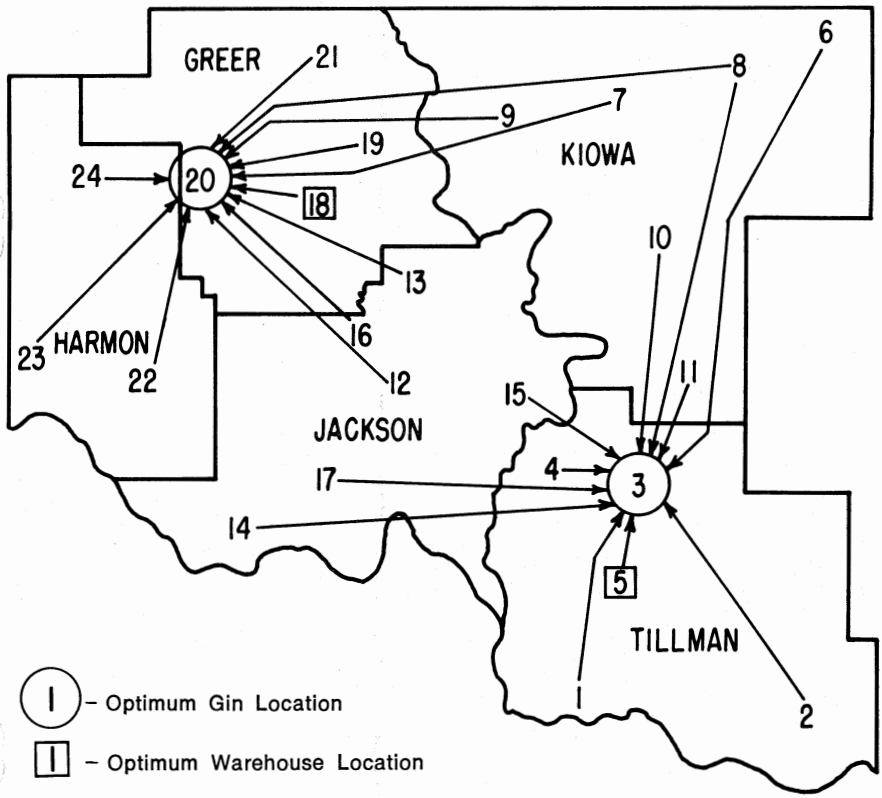


Figure 4. Gin, Warehouse and Supply Source Locations in the Optimum Market Organization, Altus Study Area, 32-Week Ginning Season, 1974.

Table 10. Cotton Marketing Costs of the Present System and the Optimum Market Organization by Major Activity, 32-Week Ginning Season, Altus Study Area, 1974.

Activity	Present Market Organization		Optimum Market Organization		Savings	
	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale
Assembly	1,128,498	8.86	1,491,559	11.71	—363,061	—2.85
Ginning	4,228,684	33.20	1,542,338	12.11	2,686,346	21.09
Gin-Warehouse Transportation	95,528	0.75	89,059	0.70	6,469	0.05
Warehousing	1,685,105	13.23	413,360	3.24	1,271,745	9.99
Merchandising	4,111,199	32.28	4,111,199	32.28	0	0
Total Cost	**11,249,014**	**88.32**	**7,647,515**	**60.04**	**3,601,499**	**28.28**

[1] Zero.

per bale cost of $60.04. Excluding the predetermined merchandising cost of $32.28 per bale, the major cost activities are assembly and ginning. Ginning cost is $12.11 while assembly contributes $11.71 to the total per bale cost. Warehousing adds $3.24 and gin-warehouse transportation cost is nearly $.70 per bale.

The annual opportunity cost of not achieving this long run optimum, both on a per bale basis and as a total cost, for producers in the Altus area is also given in Table 10. This opportunity cost amounts to $28.28 per bale or just over 3.6 million dollars. A total savings of 32 percent could be realized if this market organization were achieved. Major cost savings are in ginning, $21.09 per bale, and warehousing, $9.99 per bale, or in excess of 2.6 and 1.2 million dollars, respectively. This reflects a decrease in present costs of 64 percent in ginning and 75 percent for warehousing. This reduction in ginning cost points to the economies possible in high ginning capacity and the extended ginning season. Again, a portion of the reduction in warehouse cost is due to universal density compression at the gin plant, but a major share of the decrease can be attributed to increased warehouse utilization. The economies in warehousing are not as great as those of ginning since the capacities of the two warehouses are only slightly greater than the constrained minimum capacity. The remaining activity, gin to warehouse transportation, is $.05 per bale less than present cost. The optimum organization increases assembly cost by $2.85 per bale and thus reflects a 32 percent increase over present costs. As might be anticipated, this results indirectly from economies available in ginning.

Optimum in Both Ginning Season Lengths—Manitou is part of both optimum structures and represents the only common processing site. Ginning economies are great enough that the minimum number of possible gin plants are included in both structures.

However, the inclusion of two warehouse sites in the longer ginning season operation indicates warehousing economies are not great enough to offset an increase in gin-warehouse transportation cost that would occur if only one warehouse site were selected. The opportunity cost of achieving the 14-week optimum structure and not the 32-week organization is $3.24 per bale. This amounts to over $400,000 for the study area.

Abilene Study Area

The Abilene study area is a four-county region located on the rolling plains of Texas. In 1974 there were 33 gins located at or near the 23 sites considered in the study. The warehousing sector included five sites and seven warehouses. Model specifications permitted Hamlin (5) and Sweetwater (18) to have two warehouses. The present gin and warehouse

location pattern was used to represent the alternative sites considered in the study. These 23 gin plant locations and potential warehouse sites are spatially dispersed throughout cotton producing regions of the area and are shown in Figure 5.

The locations include sites at or near the following towns:

1. Rotan	9. Neinda	17. Nolan
2. Longworth	10. Hodges	18. Sweetwater
3. Roby	11. Stith	19. Abilene
4. Sylvester	12. Noodle	20. Merkel
5. Hamlin	13. Tuxedo	21. Trent
6. Anson	14. Corinth	22. Tuscola
7. Radium	15. Stamford	23. Lawn
8. Avoca	16. Roscoe	

14 Week Ginning Season—The optimum market structure for the 14-week ginning season includes gin plants of the maximum seasonal capacity at Roby (3), Anson (6), Neinda (9) and Sweetwater (18). Three of these plants operate at full capacity while the other, Sweetwater, processes 30,079 bales. The solution does not call for a gin site in Taylor County, an area that presently has five gins. However, given the high economies in ginning and county production of only 6,025 bales, this is not surprising. Warehouse facilities are located at Hamlin (5) and handle all bales produced in the study area. Warehouse capacity is 98,702 bales.

Gin and warehouse locations as well as farm to gin flows are presented in Figure 6 and listed in Table 11. Three farm production areas, Longworth (2), Sylvester (4) and Merkel (20), split their shipments between two ginning sites while the remaining 20 areas supply one plant site. Specific farm to gin shipments are presented in Table 11. Model specifications constrained mill demand to follow the historical patterns.

The total cost for marketing raw cotton as specified by the optimum market structure is $7,967,100 (Table 12). This represents a cost of $62.68 per bale and compares with the present system cost of $88.29. The opportunity cost of not achieving this optimum structure is therefore $25.61 per bale and amounts to over 3.2 million dollars for the study area. This is equivalent to a 29 percent decrease in conventional system cost.

Such a market reorganization would increase assembly cost $.56 per bale or less than $71,000 for the area. This represents a 6 percent increase in cost. Costs associated with other functions decrease, except for gin-warehouse transportation which increases by $0.03 per bale. The reduction in ginning cost of over 2.1 million dollars, $16.68 per bale, accounts for 50 percent of the savings. Ginning cost is reduced from $33.20 to $16.52 per bale. Further, a major decrease is indicated in warehousing cost, from $13.23 to $3.71 per bale. This reduction ($9.52) amounts to

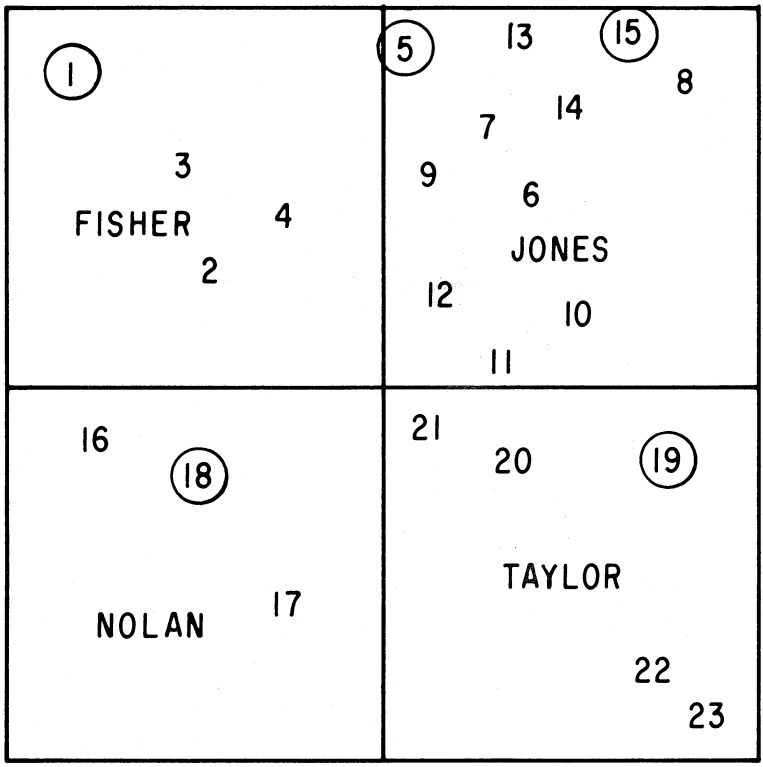


Figure 5. Gin, Warehouse and Supply Source Locations, Abilene Study Area, 1974.

over 1.2 million dollars for the area and reflects a decline from conventional cost of 72 percent.

The decrease in ginning cost represents the high economics of size available in the modern high capacity gins. Warehousing economies are also evident in that gin plants located at Roby and Sweetwater bypass closer potential warehouse sites in favor of Hamlin. This optimum market structure increases the cost of the gin-warehouse flow by some $4,000 ($.03 per bale) but, as indicated, decreases warehousing cost by more than 1.2 million dollars.

32-Week Ginning Season—The results indicate ginning economies to be so great that by extending the ginning season, only two gin plants

are required to process the area's 127,111 bales. As might be anticipated these plant sites are near regions of high farm production density. These plant sites, Longworth (2) and Radium (7), along with farm-gin movements are depicted in Figure 7. Plant capacities processing levels and farm to warehouse movements may be found in Table 13. The minimum cost warehouse site is Hamlin (5). The relationship of capacity to volume allows a 48,722 bale warehouse to handle all of the study area's production.

Gin plant market areas depict the right half of the study area as the resource supplier for Radium with production in the left half going to Longworth. An exception to this flow exists in the Rotan (1) assembly region as both ginning sites draw seed cotton from the area. However, 92 percent of the Rotan farm production flows to the gin plant located at Longworth.

This market structure allows Abilene study area cotton to be marketed for approximately 7.5 million dollars. This is equivalent to $59.39 per bale (Table 14). Potential cost reduction over the present market structure is $28.90 per bale or almost 3.7 million dollars for the four county area. This savings, delineated by major activity, along with the

Table 11. Gin and Warehouse Locations, Volumes, and Supply Sources for the Optimum Market Organization, Abilene Study Area, 14-Week Ginning Season, 1974

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
3-Roby	32,344	32,344	1-Rotan, 2-Longworth (7,916), 3-Roby, 4-Sylvester (3,410)
6-Anson	32,344	32,344	6-Anson, 8-Avoca, 10-Hodges, 11-Stith, 14-Corinth, 15-Stamford, 19-Abilene, 20-Merkel (845)
9-Neinda	32,344	32,344	4-Sylvester (7,099), 5-Hamlin, 7-Radium, 9-Neinda, 12-Noodle, 13-Tuxedo
18-Sweetwater	32,344	30,079	2-Longworth (2,593), 16-Roscoe, 17-Nolan, 18-Sweetwater, 20-Merkel (360), 21-Trent, 22-Tuscola, 23-Lawn
		Warehouses	
5-Hamlin	98,702	127,111	3-Roby, 6-Anson, 9-Neinda, 18-Sweetwater

[1] Location is given by code number and town name.

[2] Supply source is given by code number and supply area; if a supply area transports all of its production to a given point then only the location is listed; for areas with split shipments the volume is in parentheses.

optimum and present structure costs, represents 33 percent of the present cost.

The difference between assembly and ginning costs is $24.34 per bale in the conventional structure as compared with only $.93 in the optimum, again reflecting ginning economies. By incurring an additional $2.33 per bale assembly cost, producers could reduce their ginning cost by $21.08, a 64 percent decrease. Total assembly cost increases by nearly $300,000 while ginning cost falls about 2.7 million dollars. The increase in assembly cost, from $8.86 to $11.19 per bale, is 26 percent.

A small decrease, less than $.05 per bale, in gin-warehouse transportation is also available in the optimum market structure. Warehouse cost

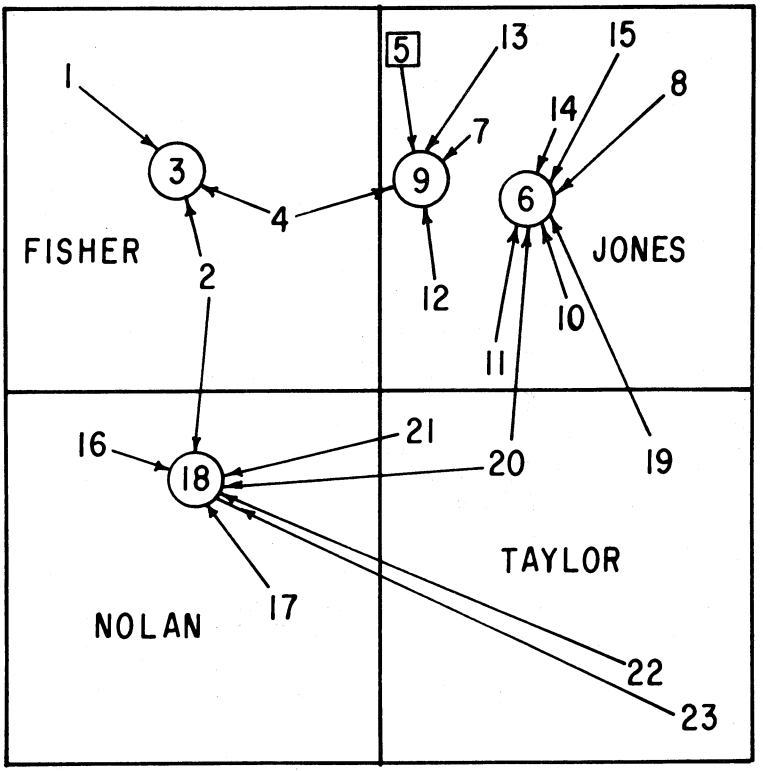


Figure 6. Gin, Warehouse and Supply Source Locations in the Optimum Market Organization, Abilene Study Area, 14-Week Ginning Season, 1974.

Table 12. Cotton Marketing Costs of the Present System and the Optimum Market Organization by Major Activity, 14-Week Ginning Season, Abilene Study Area, 1974

Activity	Present Market Organization		Optimum Market Organization		Savings	
	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale
Assembly	1,126,203	8.86	1,197,045	9.42	—70,842	—0.56
Ginning	4,220,085	33.20	2,099,370	16.52	2,120,715	16.68
Gin-Warehouse Transportation	95,333	0.75	99,618	0.78	—4,285	—0.03
Warehousing	1,681,679	13.23	471,286	3.71	1,210,393	9.52
Merchandising	4,099,781	32.25	4,099,781	32.25	0	0
Total Cost	**11,223,081**	**88.29**	**7,967,100**	**62.68**	**3,255,981**	**25.61**

decreases by $10.10 to $3.13 per bale, 1.3 million dollars for the study area. Therefore ginning and warehousing account for nearly all of the 3.7 million dollar net reduction.

Optimum in Both Ginning Season Lengths—Economies possible with high ginning capacity are evident in that mainly the 42-bale per hour gin plants are included in optimum market structures of both the 14- and 32-week ginning season.

While Hamlin (5) is the optimum site for warehousing facilities in both solutions, gin plant locations of the optimum market structures

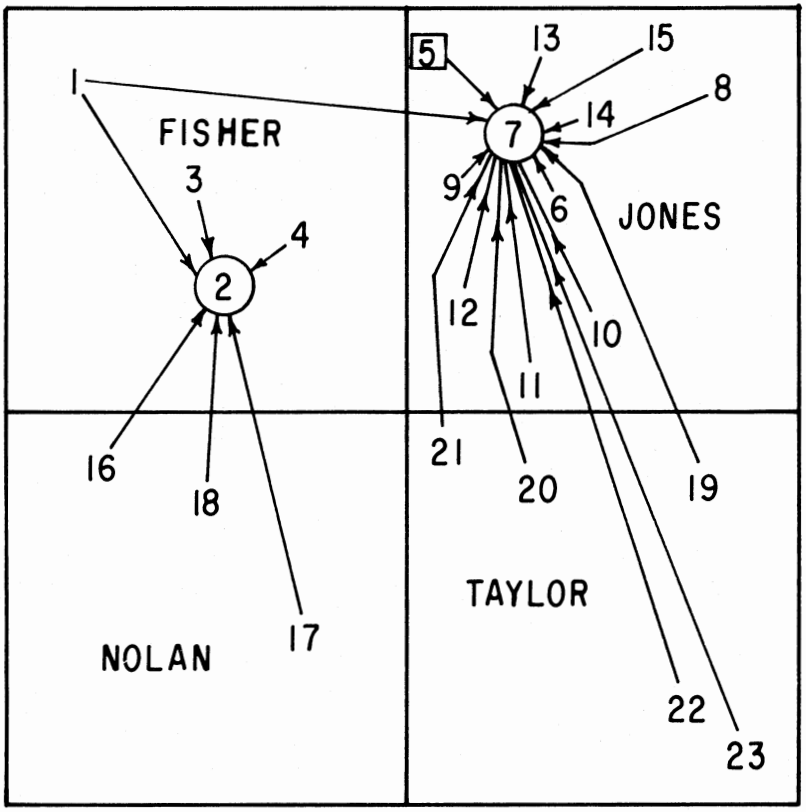


Figure 7. Gin, Warehouse and Supply Source Locations in the Optimum Market Organization, Abilene Study Area, 32-Week Ginning Season, 1974.

do not correspond. However, the gin plant location Radium (7) is very near two of the gin plants included in the 14-week season. The remaining gin plant in the 32-week ginning season is Longworth (2) and is centrally located between the other gin plants of the 14-week market structure.

Warehousing economies are great enough that a warehouse is not specified at Sweetwater (18) even though it is selected as a gin site. The opportunity cost of achieving the 14-week ginning season structure and not the 32-week ginning season optimum is $3.29 per bale or over $400,000 for the Abilene study area.

Lubbock Study Area

In 1974 the market structure of the Lubbock study area included 217 gins located at or near 52 towns spatially dispersed throughout the major cotton producing sections of the nine county area. Most of these facilities had capacities of less than 10-bales per hour. Warehousing facilities numbered 16 with 13 towns represented. This organization is depicted in Figure 8. These sites were specified as potential locations within the framework of the model. Lubbock (27) was permitted the option of two separate warehousing facilities.

Table 13. Gin and Warehouse Locations, Volumes, and Supply Sources for the Optimum Market Organization, Abilene Study Area, 32-Week Ginning Season, 1974

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
2-Longworth	64,688	64,688	1-Rotan (9,650), 2-Longworth, 3-Roby, 4-Sylvester, 16-Rosoe, 17-Nolan, 18-Sweetwater
7-Radium	64,688	62,423	1-Rotan (859), 5-Hamlin, 6-Anson, 7-Radium, 8-Avoca, 9-Neinda, 10-Hodges, 11-Stith, 12-Noodle, 13-Tuxedo, 14-Corinth, 15-Stamford 19-Abilene, 20-Merkel, 21-Trent 22-Tuscola, 23-Lawn
		Warehouses	
5-Hamlin	48,722	127,111	2-Longworth, 7-Radium

[1] Location is given by code number and town name.

[2] Supply source is given by code number and supply area; if a supply area transports all of its production to a given point then only the location is listed; for areas with split shipments the volume is in parentheses.

Table 14. Cotton Marketing Costs of the Present System and the Optimum Market Organization by Major Activity, 32-Week Ginning Season, Abilene Study Area, 1974

Activity	Present Market Organization		Optimum Market Organization		Savings	
	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale
Assembly	1,126,203	8.86	1,422,725	11.19	—296,522	—2.33
Ginning	4,220,085	33.20	1,540,278	12.12	2,679,807	21.08
Gin-Warehouse Transportation	95,333	0.75	89,091	0.70	6,242	0.05
Warehousing	1,681,679	13.23	398,087	3.13	1,283,592	10.10
Merchandising	4,099,781	32.25	4,099,781	32.25	0	.00
Total Cost	**11,223,081**	**88.29**	**7,549,962**	**59.39**	**3,673,119**	**28.90**

The locations selected consist of the following towns:

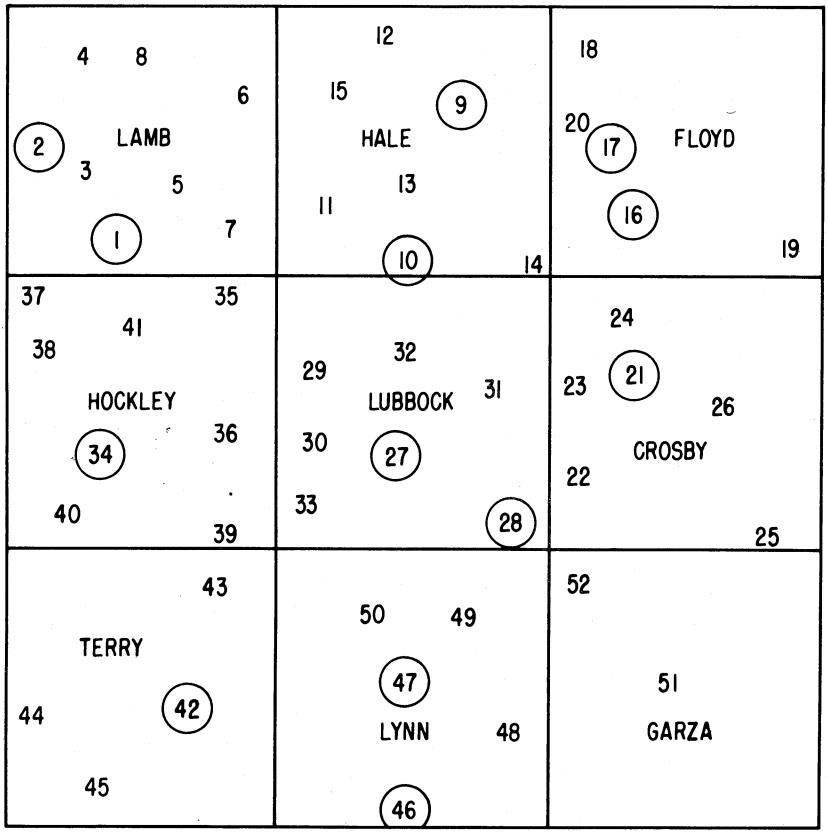
1. Littlefield	19. Dougherty	37. Pep
2. Sudan	20. Aiken	38. Pettit
3. Amherst	21. Ralls	39. Ropesville
4. Earth	22. Robertson	40. Sundown
5. Fieldton	23. Lorenzo	41. Whitharral
6. Olton	24. Cone	42. Brownfield
7. Spade	25. Kalgary	43. Meadow
8. Springlake	26. Crosbyton	44. Tokio
9. Plainview	27. Lubbock	45. Wellman
10. Abernathy	28. Slaton	46. O'Donnell
11. Cotton Center	29. Shallowater	47. Tahoka
12. Edmonson	30. Hurlwood	48. Grassland
13. Hale Center	31. Idalou	49. Wilson
14. Petersburg	32. New Deal	50. New Home
15. Halfway	33. Wolfforth	51. Post
16. Floydada	34. Levelland	52. Southland
17. Lockney	35. Anton	
18. Sterley	36. Smyer	

The numbers and town names correspond with the numbers in Figure 8.

14-Week Ginning Season—The optimum market structure (Table 15) consists of 36 gin sites. All locations have one plant, each with a capacity of 42-bales per hour. There are eight warehouse plants which range in capacity from 75,346 to 172,920 bales. The volume handled in these facilities ranges between 97,032 and 221,692 bales. Gin plant volume is equal to processing capacity for all but five plants and capacity utilization is between 88 and 100 percent. Farm-to-gin flows, ginning sites and warehouse locations are shown in Figure 9.

Compared with the present, the minimum cost structure represents a decrease of 181 gin plants and 16 plant sites. However, optimum plant location remains unchanged in three counties: Lubbock, Terry and Lynn. Compared with the optimum, the seven site, 35-plant structure of Lubbock County is reduced to one plant at each site, a decrease of 28 gin plants. A similar reduction is also indicated for Terry and Lynn Counties, from 21 plants each to four and five, respectively. Changes in both plant numbers and locations are indicated for the remaining six counties, with plant numbers being greatly decreased.

Of the eight potential locations in Lamb County, only three are included in the optimum solution: Amherst (3), Earth (4) and Spade (7). Plant numbers totaled 29 in 1974. One of the potential sites not included, Littlefield (1), presently has eight gins. Five of the existing seven loca-



1 – Gin Location

(1) – Gin and Warehouse Location

Figure 8. Gin, Warehouse and Supply Source Locations, Lubbock Study Area, 1974.

tions in Hale County are included; however, 31 fewer gin plants are required. Lockney (17), Sterley (18) and Dougherty (19) are locations selected within the boundaries of Floyd County. Of the two potential sites not included, Floydada (16) has six gin plants. The 20 ginning facilities in Crosby County are reduced to four, and two sites are not part of the minimum cost solution.

The optimum market organization specifies four locations: Levelland (34), Smyer (36), Pettit (38) and Whitharral (41) in Hockley County, thus representing a major reorganization in this region. Only one of the two present locations of Garza County is included.

Table 15. Gin and Warehouse Locations, Volumes and Supply Sources for the Optimum Market Organization, Lubbock Study Area, 14-Week Ginning Season, 1974

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
3-Amherst	32,344	32,344	1-Littlefield, (8,120) 2-Sudan (10,082), 3-Amherst
4-Earth	32,344	32,344	2-Sudan (4,060), 4-Earth, 8-Springlake
7-Spade	32,344	32,344	5-Fieldton, 7-Spade, 35-Anton (4,060)
9-Plainview	32,344	32,344	9-Plainview, 12-Edmonson (12,355), 20-Aiken (940)
10-Abernathy	32,344	32,344	10-Abernathy, 11-Cotton Center (13,295)
13-Hale Center	32,344	32,344	11-Cotton Center (5,754), 12-Edmonson (6,694), 13-Hale Center, 15-Halfway (847)
14-Petersburg	32,344	28,627	14-Petersburg, 24-Cone (9,578)
15-Halfway	32,344	32,344	6-Olton, 15-Halfway (18,202)
17-Lockney	32,344	32,344	16-Floydada (7,062), 17-Lockney, 20-Aiken (5,760)
18-Sterley	32,344	32,344	18-Sterley, 20-Aiken (12,822)
19-Dougherty	32,344	31,989	16-Floydada (12,460), 19-Dougherty
21-Ralls	32,344	32,344	21-Ralls (10,746), 22-Robertson (9,631), 24-Cone (11,967)
23-Lorenzo	32,344	32,344	22-Robertson (11,914), 23-Lorenzo (20,430)
25-Kalgary	32,344	30,547	25-Kalgary, 51-Post (9,002)
26-Crosbyton	32,344	32,344	21-Ralls (10,799), 26-Crosbyton (21,545),
27-Lubbock	32,344	32,344	27-Lubbock (30,114), 50-New Home (2,230)
28-Slaton	32,344	32,344	28-Slaton, 49-Wilson (1,115)
29-Shallowater	32,344	32,344	29-Shallowater, 35-Anton (1,115)
30-Hurlwood	32,344	32,344	30-Hurlwood, 33-Wolfforth (1,115)
31-Idalou	32,344	32,344	23-Lorenzo (1,115), 31-Idalou
32-New Deal	32,344	32,344	27-Lubbock (1,115), 32-New Deal
33-Wolfforth	32,344	32,344	33-Wolfforth (30,114), 39-Ropesville (1,576), 50-New Home (654)
34-Levelland	32,344	32,344	34-Levelland, 40-Sundown (15,739)
36-Smyer	32,344	32,344	35-Anton (2,579), 36-Smyer, 39-Ropesville (13,160)

Table 15. (Continued)

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
38-Pettit	32,344	32,344	37-Pep (15,739), 38-Pettit
41-Whitharral	32,344	32,344	1-Littlefield (6,022), 35-Anton (8,851), 37-Pep (866), 41-Whitharral
42-Brownfield	32,344	32,344	42-Brownfield, 43-Meadow (585), 47-Tahoka (699)
43-Meadow	32,344	32,344	39-Ropesville (1,869), 43-Meadow (30,475)
44-Tokio	32,344	31,926	40-Sundown (866), 44-Tokio
45-Wellman	32,344	31,060	45-Wellman
46-O'Donnell	32,344	32,344	46-O'Donnell (32,344)
47-Tahoka	32,344	32,344	46-O'Donnell (2,884), 47-Tahoka (29,460)
48-Grassland	32,344	32,344	43-Grassland (32, 344)
49-Wilson	32,344	32,344	47-Tahoka (5,069), 49-Wilson (27,275)
50-New Home	32,344	32,344	50-New Home (32,344)
52-Southland	32,344	32,344	48-Grassland (2,884), 49-Wilson (6,838), 51-Post (6,810), 52-Southland
		Warehouses	
1-Littlefield	100,461	129,376	3-Amherst, 4-Earth, 7-Spade, 41-Whitharral
		Warehouses	
10-Abernathy	172,920	221,691	10-Abernathy, 13-Hale Center, 14-Petersburg, 27-Lubbock, 29-Shallowater, 32-New Deal, 33-Wolfforth
17-Lockney	125,295	161,358	9-Plainview, 15-Halfway, 17-Lockney, 18-Sterley, 19-Dougherty
21-Ralls	124,181	159,923	21-Ralls, 23-Lorenzo, 25-Kalgary, 26-Crosbyton, 31-Idalou
28-Slaton	75,346	97,032	28-Slaton, 49-Wilson, 52-Southland
34-Levelland	100,461	129,376	30-Hurlwood, 34-Levelland, 36-Smyer, 38-Pettit
42-Brownfield	99,139	127,674	42-Brownfield, 43-Meadow, 44-Tokio, 45-Wellman
47-Tahoka	100,461	129,376	46-O'Donnell, 47-Tahoka, 48-Grassland, 50-New Home

[1] Location is given by code number and town name.

[2] Supply source is given by code number and supply area; if a supply area transports all of its production to a given point then only the location is listed; for areas with split shipments the volume is in parentheses.

Warehousing facilities of the optimum market structure are Littlefield (1), Abernathy (10), Lockney (17), Ralls (21), Slaton (28), Levelland (34), Brownfield (42) and Tahoka (47). The gin-warehouse flow of cotton is also listed in Table 15. Gins are located at all these sites except for Littlefield. The relative location of warehouses is given in Figure 9. One warehouse is located in each of the eight counties presently having such facilities. However, two present warehouse sites, Plainview (9) and Lubbock (27), are not part of the optimum market structure. This change in gin-warehouse flow is significant as over half of the cotton presently

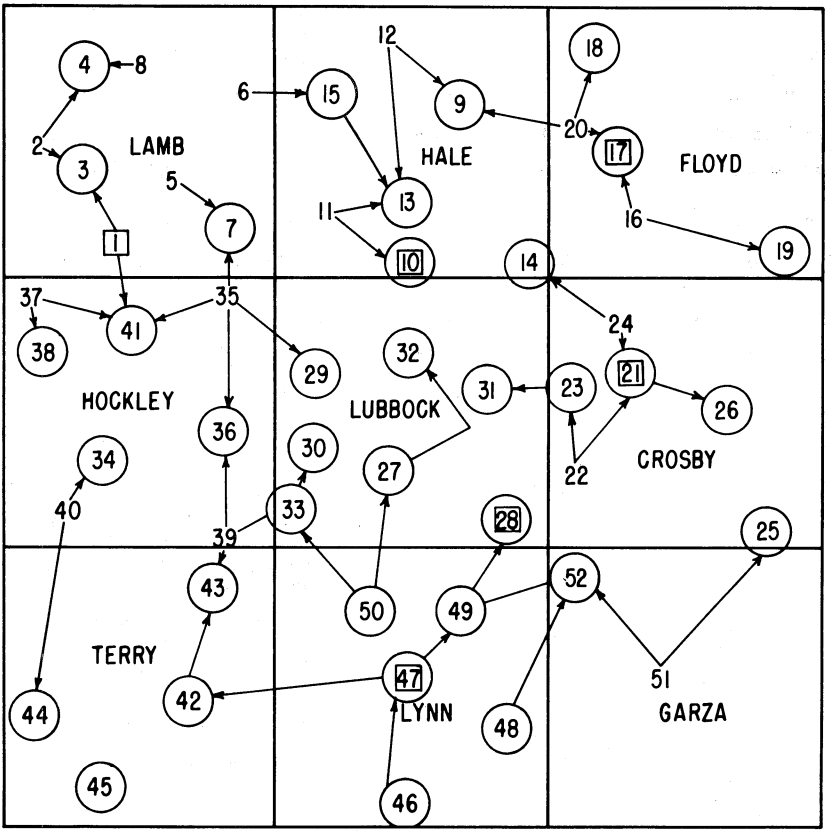


Figure 9. Gin, Warehouse and Supply Source Locations in the Optimum Market Organization, Lubbock Study Area, 14-Week Ginning Season, 1974.

ginned in the study area moves to warehousing facilities located in Lubbock. In fact, only in the case of Levelland does optimum volume correspond with the present system. For other warehouse sites, the optimum market structure specifies a much greater volume than presently received.

Costs of the present and optimum market structures, segregated by major activity, are presented in Table 16. The cost of preparing seed cotton for commercial use under the optimum structure is $62.37 per bale. This is in comparison with the present system cost of $88.48 and reflects a difference of $26.11 per bale. Thus, the annual opportunity cost of not achieving the optimum is over 30 million dollars for the study area. Primary cost reductions are in ginning and warehousing. Ginning cost drops to $16.43 per bale and amounts to a savings of $16.77 per bale. This represents 19.4 million dollars for the nine-county Lubbock study area. Area warehousing cost decreases over 11 million dollars, to $3.69 per bale.

A portion of the decreased ginning cost is offset by increased assembly cost. With the increased farm-gin hauling distance of the optimum structure comes an increase in the total transfer cost at this level. This increase is from $8.86 to $9.08, or $.22 per bale, an increase of $253,405 for the area. Even though warehouse numbers decrease, gin-warehouse transportation cost of the optimum market structure is $.02 less that of the present structure. The percentage of shipments from each warehouse to each mill area was held constant in the model.

32-Week Ginning Season—By taking advantage of economies associated with the 32-week ginning season, the one million plus bale production of the Lubbock study area can be processed by 18 gins and eight warehouse plants. Further, the total cost of transferring cotton from farms to mill points could be reduced by nearly 34 million dollars.

This 32-week ginning season optimum market structure is presented in Figure 10. The direction of the farm-gin flow of cotton is also included. The quantities of farm-gin and gin-warehouse movements are outlined in Table 17. Further, both gin and warehouse capacities and volumes are included. All 18 gin plants are spatially separated. However, Hale County has two warehouse facilities while Floyd and Garza Counties have none. Warehouse capacities range between 64,688 bales at Littlefield (1) and Levelland (34) and 251,174 bales at Tahoka (47).

A primary reorganization of gin plants is required to meet this optimum market structure. A total of four gins is specified for the northern portion of the study area. Plant location sites are Amherst (3), Hale Center (13). Halfway (15) and Lockney (17). Presently there are 82 gins operating at or near the 20 potential sites included in this area. One-half of the present Crosby County sites are included and three of seven Lubbock County locations are represented in the optimum organization.

Table 16. Cotton Marketing Costs of the Present System and the Optimum Market Organization by Major Activity, 14-Week Ginning Season, Lubbock Study Area, 1974

Activity	Present Market Organization		Optimum Market Organization		Savings	
	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale
Assembly	10,249,301	8.86	10,502,706	9.08	—253,405	—0.22
Ginning	38,405,959	33.20	19,006,901	16.43	19,399,058	16.77
Gin-Warehouse Transportation	867,605	0.75	844,640	0.73	22,965	0.02
Warehousing	15,304,543	13.23	4,273,253	3.69	11,031,290	9.54
Merchandising	37,531,231	32.44	37,531,231	32.44	0	0.00
Total Cost	**102,358,639**	**88.48**	**72,158,731**	**62.37**	**30,199,908**	**26.11**

Lubbock County locations are Lubbock (27), New Deal (32) and Wolfforth (33). Of the eight potential sites in Hockley County, only Levelland (34) and Anton (35) are included. This represents a decrease of 27 plants compared with the present structure.

Other gin sites include Brownfield (42) and Meadow (43) in Terry County as well as four of the present five sites in Lynn County. These are Tahoka (47), Grassland (48), Wilson (49) and New Home (50). O'Donnell (46) is not included. Neither Post (51) nor Southland (52), the only potential locations in Garza County, are included, as all seed cotton from this area flows to Grassland or Wilson for ginning.

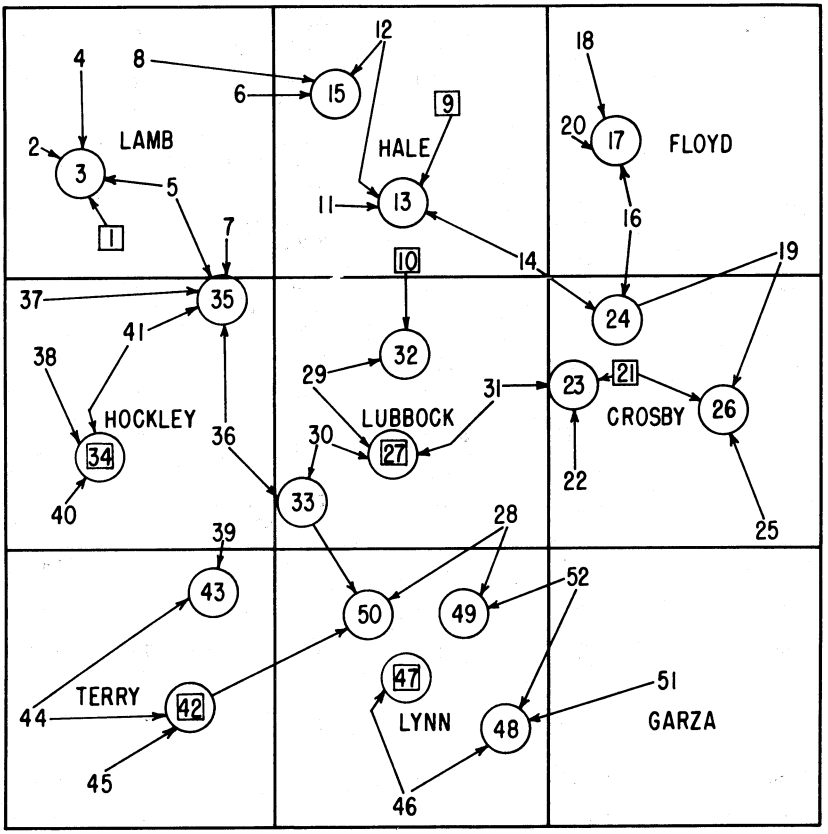


Figure 10. Gin, Warehouse and Supply Source Locations in the Optimum Market Organization, Lubbock Study Area, 32-Week Ginning Season, 1974.

Table 17. Gin and Warehouse Locations, Volumes and Supply Sources for the Optimum Market Organization, Lubbock Study Area, 32-Week Ginning Season, 1974

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Gins	
3-Amherst	64,688	64,688	1-Littlefield, 2-Sudan, 3-Amherst, 4-Earth, 5-Fieldton (8,120)
13-Hale Center	64,688	64,688	9-Plainview, 11-Cotton Center 12-Edmonson (1,654), 13-Hale Center, 14-Petersburg (5,847)
15-Halfway	64,688	64,688	6-Olton, 8-Springlake, 12-Edmonson (17,355), 15-Halfway
17-Lockney	64,688	64,688	16-Floydada (6,122), 17-Lockney, 18-Sterley, 20-Aiken
23-Lorenzo	64,688	64,688	21-Ralls (2,928), 22-Robertson, 23-Lorenzo, 31-Idalou (18,670)
24-Cone	64,688	64,688	14-Petersburg (13,202), 16-Floydada (13,400), 19-Dougherty (16,541), 24-Cone
26-Crosbyton	64,688	64,688	19-Dougherty (2,981), 21-Ralls (18,617), 25-Kalgary, 26-Crosbyton
27-Lubbock	64,688	64,688	27-Lubbock, 29-Shallowater (16,819), 30-Hurlwood (4,081), 31-Idalou (12,559)
32-New Deal	64,688	64,688	10-Abernathy, 29-Shallowater (14,410), 32-New Deal
33-Wolfforth	64,688	64,688	30-Hurlwood (27,148), 33-Wolfforth (30,517), 36-Smyer (7,023)
34-Levelland	64,688	64,688	34-Levelland, 38-Pettit, 40-Sundown, 41-Whitharral (14,873)
35-Anton	64,688	64,688	5-Fieldton (6,022), 7-Spade, 35-Anton, 36-Smyer (9,582), 37-Pep, 41-Whitharral (1,732)
42-Brownfield	64,688	64,688	42-Brownfield (19,591), 44-Tokio (14,037), 45-Wellman
43-Meadow	64,688	64,688	39-Ropesville, 43-Meadow, 44-Tokio (17,023)
47-Tahoka	64,688	64,688	46-O'Donnell (29,460), 47-Tahoka
48-Grassland	64,688	64,688	46-O'Donnell (5,768), 48-Grassland, 51-Post, 52-Southland (7,880)
49-Wilson	64,688	64,688	28-Slaton (21,528), 49-Wilson, 52-Southland (7,932)
50-New Home	64,688	57,110	28-Slaton (9,701), 33-Wolfforth (712), 42-Brownfield (11,469), 50-New Home

Table 17. (Continued)

Location[1]	Bales		Supply Source[2]
	Capacity	Volume	
		Warehouses	
1-Littlefield	24,795	64,688	3-Amherst
9-Plainview	49,590	129,376	15-Halfway, 17-Lockney
10-Abernathy	74,385	194,064	13-Hale Center, 32-New Deal, 35-Anton
21-Ralls	74,385	194,064	23-Lorenzo, 24-Cone, 26-Crosbyton
27-Lubbock	49,590	129,376	27-Lubbock, 33-Wolfforth
34-Levelland	24,795	64,688	34-Levelland
42-Brownfield	49,590	129,376	42-Brownfield, 43-Meadow
47-Tahoka	96,275	251,174	47-Tahoka, 48-Grassland, 49-Wilson, 50-New Home

[1] Location is given by code number and town name.

[2] Supply source is given by code number and supply area; if a supply area transports all of its production to a given point then only the location is listed; for areas with split shipments the volume is in parentheses.

The optimum warehouse structure includes six plants with a capacity of less than 50,000 bales and two plants with a capacity between 50,000 and 100,000 bales, Table 17. These capacities are much less than facilities presently at these sites. However, the present volume handled at Littlefield is similar to the 64,688 bales specified in the optimum. Nearly twice this much volume is received at Levelland. Five warehouse plants are in the range of 49,590 and 74,385 bales .These plants are Plainview (9), Abernathy (10), Ralls (21), Lubbock (27) and Brownfield (42). For all but Abernathy, this represents a considerable decrease in capacity. The reverse is true for Abernathy. The volume of cotton stored at these warehouses is representative of the present system only in the case of Plainview. Considerably less is warehoused at Abernathy while the opposite is true for Ralls, Lubbock and Brownfield. The present facility at Tahoka is about one-half the optimum size and receives less than twenty percent optimum volume.

The nearly 69 million dollar cost of transferring cotton from the farm to the mill under the optimum market structure represents a cost of $59.31 per bale, Table 18. Compared with the present market structure, this is a 33 percent decrease, or $29.17 per bale. Major cost reductions are realized in ginning and warehousing, 24.4 and 11.1 million dollars, respectively. On a per bale basis these costs amount to $21.13 and $10.11. Therefore, ginning cost is $12.07 per bale and warehousing cost is $3.12 per bale. However, the increased cost of ricking over

Table 18. Cotton Marketing Costs of the Present System and the Optimum Market Organization by Major Activity, 32-Week Ginning Season, Lubbock Study Area, 1974

Activity	Present Market Organization		Optimum Market Organization		Savings	
	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale	Dollars	Dollars Per Bale
Assembly	10,249,301	8.86	12,712,035	10.99	—2,462,734	—2.13
Ginning	38,405,959	33.20	13,964,322	12.07	24,441,637	21.13
Gin-Warehouse Transportation	867,605	0.75	802,916	0.69	64,689	0.06
Warehousing	15,304,543	13.23	3,606,941	3.12	11,697,602	10.11
Merchandising	37,531,231	32.44	37,531,231	32.44	0	0.00
Total Cost	**102,358,639**	**88.48**	**68,617,445**	**59.13**	**33,741,194**	**29.17**

the conventional trailer system and the increased farm-gin transportation distances result in greater assembly cost. For the study area this is nearly a 2.5 million dollar increase or $2.13 per bale. Assembly cost is $10.99 per bale. A small decrease in gin-warehouse transportation cost of $.06 is realized.

Optimum in Both Ginning Season Lengths—Achieving the 14- rather than the 32-week ginning season optimum market organization would result in an opportunity cost of $3.06 per bale. This represents over 3.5

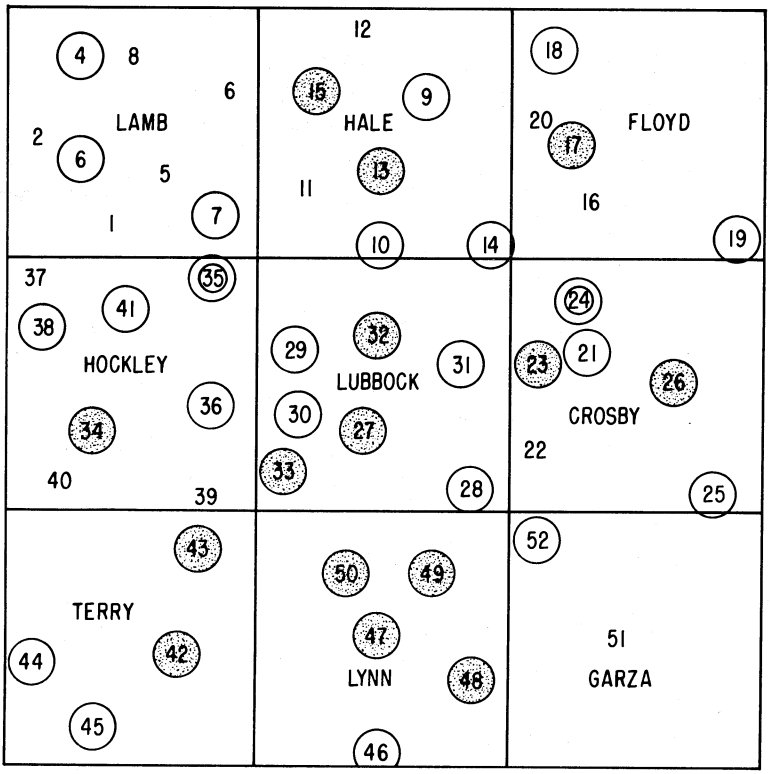


Figure 11. Common and Contrasting Locations of Facilities in the 14-Week and 32-Week Ginning Seasons Optimum Market Organizations, Lubbock Study Area, 1974.

million dollars for the nine-county study area. The location of gin plants of these seasonal optimum market structures are contrasted in Figure 11.

Compared with the 14-week seasonal structure, the 32-week optimum organization ginning cost of $12.07 per bale is $4.36 lower. For the study area this difference is over five million dollars. However, assembly cost is $1.91 per bale more. Being a direct cost to the producer, this cost will be more visible, especially since it is $2.13 per bale larger than present assembly cost. However, given that ginning charges accurately reflect ginning costs, producers should be willing to incur this increased assembly cost to realize the savings in ginning and warehousing costs. Warehouse cost is $.57 per bale lower for the 32-week season compared with the 14-week optimum market organization. Similarly, gin-warehouse transportation cost is $.04 per bale lower.

There was some locational variation of warehouse facilities. Warehouse sites Lockney (17) and Slaton (28) of the 14-week structure are replaced by Plainview (9) and Lubbock (27) in the 32-week operational structure. The remaining sites are common between each market structure. Economies of warehousing are evident in the organization; however, they are not as great as ginning economies.

Summary and Conclusions

This study investigates structural adjustments of the ginning and warehousing industries of three multi-county areas in the machine stripped region of Oklahoma and Texas. These areas are identified as the Altus, Abilene and Lubbock study areas. The major objectives of this study were to determine optimum market organizations for the raw cotton marketing system assuming the conventional 14-week and an extended 32-week ginning season. Conventional methods of handling seed cotton are used for the short season while the longer ginning season specified seed cotton storage in ricks.

The use of the most advanced ginning and warehousing technologies is specified for the analysis. Ginning costs are constructed for six model gin plants for each seasonal operation. Warehousing costs associated with each ginning season are estimated from secondary data.

Six mill-export points are specified and distribution costs are estimated for each study area. Each study area is assumed to be a single point of origin for mill-export points. Further, the flow pattern of warehouse to mill-export point shipments is held fixed for each study area. Therefore, merchandising cost did not affect the size, number and location of plants, but was included so as to estimate total marketing costs.

The least cost market organization for the five-county Altus study area and 14-week ginning season consists of four 42-bale per hour gins

and one warehouse plant. Total marketing cost for this organization is $8,059,415 or $63.28 per bale. The savings over the current organization, is 3.1 million dollars or $25.04 per bale and represents 28 percent of the present $88.32 cost per bale. The results reflect economies available in ginning and warehousing. Ginning cost is reduced 50 percent of $16.50 per bale and warehouse cost is reduced 72 percent, to $3.71 per bale. Small increases over present system costs are given for farm assembly and gin-warehouse transportation activities.

Two 42-bale per hour gin plants and two warehouses are included in the least cost market structure for the Altus area 32-week ginning season. The cost of marketing cotton as given by the optimum solution is just over 7.6 million dollars and represents $60.04 per bale. This is a 3.6 million dollar savings ($28.28 per bale) compared with the present system. Primary cost reductions occur in ginning and warehousing as per bale costs are reduced to $12.11 and $3.24 per bale, respectively. However, optimum organization farm assembly cost shows a significant increase over the present system cost. The present cost of $8.86 per bale is increased to $11.71 per bale, an increase in farm assembly cost of $2.85 per bale. The opportunity cost of achieving the 14-week structure and not the 32-week market structure is $3.24 per bale. This represents over $400,000 for the study area.

The optimum market structure for the Abilene study area 14-week ginning season includes four 42-bale per hour gin plants and one warehouse facility. The cost associated with this organization is about 8 million dollars or $62.68 per bale. Compared with the present market organization, the opportunity cost of not achieving the optimum is 3.2 million dollars or $25.61 per bale. Ginning cost is reduced 2.1 million dollars, from $33.20 to $16.52 per bale. Warehousing cost for the area is reduced 1.2 million dollars, from $13.23 to $3.71 per bale. However, there would be increased costs for farm assembly ($.56 per bale) and gin-warehouse transportation ($.03 per bale).

The least cost solution for the Abilene 32-week ginning season is $7,549,962, or $59.39 per bale. The market organization specified two 42-bale per hour gin plants and one warehouse facility, and indicates a possible savings of nearly 3.7 million dollars over present structure cost of 11.2 million dollars. As was the case with the 14-week ginning season, primary cost reductions are in ginning and warehousing. Ginning cost is reduced to $12.12 per bale, a reduction of $21.08 per bale or nearly 2.7 million dollars. Warehousing cost per bale is reduced $10.10 to $3.13. Contrasted to present warehouse cost of $13.23 per bale, this represents a savings of over 1.2 million dollars for the area. Achieving this optimum structure would decrease gin-warehouse transportation cost only slightly, but would increase farm assembly cost $2.33 per bale. For the area this

is less than $300,000. The opportunity cost of achieving the 14-week optimum structure and not that of the 32-week ginning season is $3.29 per bale or over $400,000 for the study area.

The nine-county Lubbock study area differs from the other two areas in that production is about nine times greater than that of the Altus or the Abilene area. The optimum market organization for the conventional ginning season consists of 36 gin plants and 8 warehouse plants. All gin plant capacities are 42-bales per hour and warehouse capacities range from 75,346 to 172,920 bales. The cost of moving cotton from farm to mill as given by this optimum market organization is 72.2 million dollars ($62.37 per bale) and is 30 percent less than the 102.4 ($88.48 per bale) million dollar current cost. The potential savings is 30.2 million dollars for the area or $26.11 per bale. Ginning cost saving is $16.77 per bale and is 51 percent or 19.4 million dollars less than present cost. Warehousing cost of $3.69 per bale is 11 million dollars or $9.54 per bale less than current system cost. The reduction in warehouse cost is 72 percent. Gin-warehouse transportation cost remains relatively unchanged; however, farm assembly cost increases by 3 percent, from $8.86 to $9.08 per bale or $253,405 for the area.

Eighteen 42-bale per hour gin plants and eight warehouse facilities are specified in the optimum market organization for the Lubbock area 32-week ginning season. Warehouse capacity ranges from 24,795 to 96,275 bales. The functional value of the associated least cost solution is $68,617,445 and is $33,741,194 or 33 percent less than currently expended to move cotton from farm to mill-export points. The per bale costs of the optimum and present organizations are $59.31 and $88.48, respectively.

The least cost 32-week solution indicates an increase in farm assembly cost over current cost; however, significant decreases are indicated for the ginning and warehousing activities. Assembly cost increases 2.5 million dollars (24 percent) or $2.13 per bale. The total ginning cost in the optimum structure is 24.4 million dollars less than the 38.4 million dollar cost presently incurred. Similarly, warehouse cost is reduced 77 percent, from 15.3 to 3.6 million dollars. Warehousing cost is $3.12 per bale. Gin-warehouse transportation cost decreases by six cents per bale. The opportunity cost of achieving the 14-week optimum organization as opposed to the 32-week ginning season organization is $3.06 per bale or 3.5 million dollars.

The analysis suggests a substantial reorganization of the industry in all study areas if costs are to be minimized. Specifically, if cost efficiency is an industry goal, gin plant capacity must be substantially increased throughout the machine stripped region. Further, the analysis indicates a substantial reduction in the number of processing plants.

Some producers would benefit more than others from industry reorganization. Producers located close to gin sites would incur a smaller farm assembly cost than those who have to transport their seed cotton further. Additionally, any plant not operating at full seasonal capacity would incur a higher per bale cost than plants operating at full capacity.

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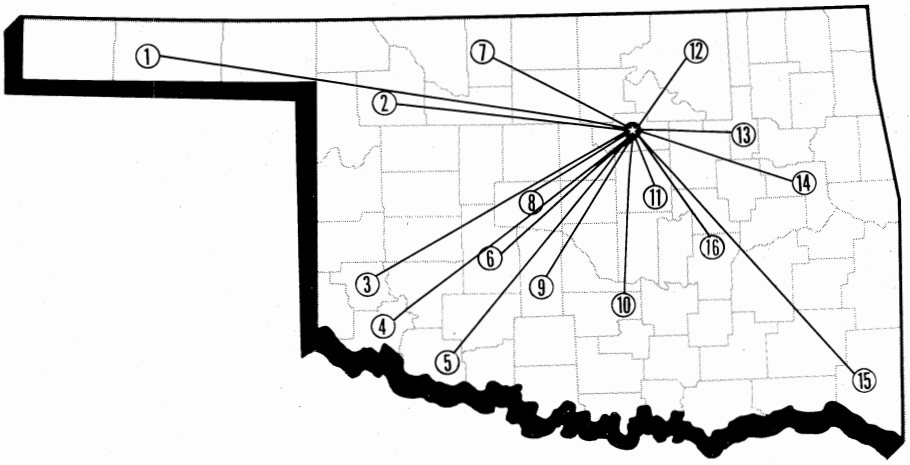

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