FACTORS AFFECTING MECHANICAL COTTON HARVESTING IN OKLAHOMA

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Bachelor of Science

Central State College

Edmond, Oklahoma

1948

Submitted to the Faculty of the Graduate School of

the Oklahoma Agricultural and Mechanical College

in Partial Fulfillment of the Requirements

for the Degree of

MASTER OF SCIENCE

1953

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ACKNOWLEDGMENT

Acknowledgment and appreciation are due the Department of Agricultural Economics, Oklahoma Agricultural and Mechanical College, for the privilege of making this study.

The writer is indebted to Mr. Raymond B. Marshall, Assistant Professor of Agricultural Economics, for his advice and assistance in the writing of this thesis.

The writer also expresses appreciation to Mr. John D. Campbell, former Assistant Professor of Agricultural Economics, for his many helpful suggestions; to Dr. F. L. Underwood, Associate Professor of Agricultural Economics, for assistance with statistics and with several of the tables; and to Mr. Leo V. Blakley, Assistant Professor of Agricultural Economics, for assistance in reading and correcting the manuscript.

Appreciation is expressed to Mrs. Fern B. Hall for her efforts in preparing the manuscript for presentation.

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CHAPTER I

INTRODUCTION

One assumption of competitive economic theory is that each entrepreneur will strive to organize his business so as to bring him the largest net return.[1]

> Under perfect competition the success of the entrepreneur is generally considered to depend on the skill with which he combines the factors of production to bring forth his product since he is unable to influence prices. This is no less true in agriculture.[2]

Mechanization may be a means of achieving a more economic production pattern. The reason for this is that greater control and flexibility of choice are given the producer over the factors of production whereby he can combine those factors so as to achieve optimum organization.

Mechanization is a new technique or innovation and this innovation may create a series of adjustment problems for those entrepreneurs who adopt the new technique. This was illustrated by Cochran and Butz as follows:

> Most often new technological practice or innovation represents for the farmer concerned a discreet jump to a wholly new combination of inputs.

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[1] H. C. Taylor, Outline of Agricultural Economics, (McMillan Company, New York, 1925), p. 134.

[2] Conrad Gilason, "The Nature of the Aggregate Supply of Agricultural Product", Journal of Farm Economics, Vol. XXXIV, No. 1, February 1952, p. 88.

> Since the results of the new combinations are unknown, the change means a turn from combinations of which he is relatively certain to a combination of which he is relatively uncertain.[3]

However, the adoption of a new technique may mean windfall gains for the innovator in the short run. It is generally accepted as true that, under competitive conditions, the producer that is among the first to recognize the potential capacity of a technological change, and adjusts operations accordingly, will gain a net advantage until the industry has adjusted to the innovation.

In the case of cotton production, the change to mechanization has been slow. While other producers have accepted new mechanical developments, the cotton grower has relied heavily upon hand labor for the production process. This has been especially true in the case of mechanical harvesting. This study will examine the problems of and limitations upon this phase of cotton production.

Purpose of Study

World War II brought on a chronic labor shortage with high wages in the cotton producing areas. Cotton production was peculiarly vulnerable to rising wage rates because of the relatively large quantity of hand labor commonly employed. Thus more economical methods of harvest were demanded by producers. In addition, prices were rising which permitted increasing mechanization through the lessening of the effects of capital rationing.

The primary purpose of this study is to evaluate the progress and

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[3] W. W. Cochran and W. T. Butz, "Outward Response of Farm Firms", Journal of Farm Economics, Vol. XXXIII, No. 3, Part 1, November 1951, p. 452.

problems involved in machine harvesting of cotton in Oklahoma. Incorporated in this evaluation are: a review of the history of mechanical harvesting, a comparison of the costs and quantities of time involved in machine stripping as compared with hand snapping cotton, some indication of the applicability of the sled and the machine picker, and a review and evaluation of the problems of machine harvesting of cotton in Oklahoma.

Procedure

The primary data used in this study were obtained from a survey of 23 stripper operators in Western Oklahoma during the summer of 1951 pertaining to operations during the 1950-51 crop year. This is a continuation of a study which began in 1948. Consequently, the results from the analyses of previous years were drawn upon freely and in many cases integrated with the results obtained from the 1951 survey. In the comparison of costs of machine harvesting versus hand snapping, the conclusions are based primarily on these previous Oklahoma studies.

In addition, use was made of research results and secondary data from Agricultural Colleges and Experiment Stations, the United States Department of Agriculture, and other agencies engaged in research related to the problem of mechanical harvesting of cotton.

CHAPTER II

THE DEVELOPMENT OF MECHANICAL HARVESTING

The two methods of machine harvesting are machine picking and machine stripping. The machine picker picks the locks of cotton from the opened bolls as in the case of hand-picking. In the machine stripping operation all of the bolls on the stalk as well as some foreign material is stripped from the stalk in one operation.

In this chapter the development of these two methods of harvest will be reviewed to trace the origin and development of the machines used in harvesting cotton and to point out some of the general problems associated with machine harvesting.

The Development of Machine Picking

The first record of an attempt to develop a machine picker was in 1850.[1] This machine was equipped with both picking cylinders and picking disks; the cylinders were placed on vertical shafts, and the disks on horizontal shafts.

A number of other types of mechanical pickers have been invented. The types of machine pickers as summarized from a study by Texas include:[2]

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[1] H. P. Smith, et al. The Mechanical Harvesting of Cotton, Texas Agricultural Experiment Station, Bulletin No. 452, August 1932, (College Station, Texas), p. 6.

[2] Ibid, pp. 6-13.

1. a thresher type, by which the whole plant could be taken into a machine and the cotton threshed from the rest of the plant;
2. a suction or vacuum principle by which the cotton was drawn from the plant by suction or vacuum;
3. a blast type, by which blasts of currents of air were directed against the bolls to separate the cotton from the stalk and propel it into a suitable receptacle;
4. an electric type, described as "the arrangement and application of belts or bands at each side of the machine, charged with electricity for the purpose of attracting and collecting the loosened fibers of the cotton bolls; and carrying the same into a receiving box";
5. the spindle type picker by which vertical cylinders are used, the spindles projecting horizontally into the cotton plant to pick the cotton from the burs.

A large portion of the patents on these inventions were granted in the two decades preceding and following the turn of the 20th Century. An indication of the progress being made at that time is shown in a statement made by O. F. Cook in 1911:[3]

> The mechanical harvesting of cotton is now considered a possibility of the near future. Even though none of the existing machines proves to be entirely successful, the progress already being made is an assurance of further improvement and ultimate solution of this difficult problem.

The introduction of machine picking did not come until well over thirty years later. One part of Cook's statement was substantiated, however, in that it has been a difficult problem to develop a successful machine harvester.

International Harvester has worked longer perhaps than any other major machine company to develop a successful machine picker. They

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[3] O. F. Cook, "Cotton Improvement on a Community Basis", Yearbook of Agriculture, United States Department of Agriculture, 1911, pp. 408-409.

began research in the 1920's with spindle type machine pickers.[4]

John and Mack Rust obtained patents on a machine picker using a moistened smooth spindle.[5]

W. N. Berry of Mississippi did much early work on developing a machine picker. The rights to the "Berry" picker were acquired by Deere and Company about 1945.[6]

In recent years modern spindle pickers have been used to pick a substantial portion of the cotton in the "Delta", the Rio Grande Valley, and the irrigated sections of New Mexico, Arizona and California.

The Development of Machine Stripping

Not many years after the first patent was granted on a machine picker, efforts were made to develop machines which would strip the cotton from the plant. The first patent on record for a machine stripper was granted in 1871 to John Hughes, of New Berne, North Carolina.[7] This machine was described as follows:

> the machine may be constructed to a single or double team, and to gathering or picking of one row or more at a time... This machine strips from the plants the unopen as well as the open bolls or cups, and loose cotton, which can afterward be separated by another machine for that purpose.

A patent was granted for a finger-type stripper in 1872 and for a

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[4] H. P. Smith and D. L. Jones, Mechanized Production of Cotton in Texas, Texas Agricultural Experiment Station, Bulletin No. 704, September 1948, (College Station, Texas), p. 54.

[5] Ibid., p. 56.

[6] Ibid., p. 55.

[7] H. P. Smith, et al. The Mechanical Harvesting of Cotton, Texas Agricultural Experiment Station, Bulletin No. 452, August 1932, (College Station, Texas), p. 11.

roller-type stripper in 1874.[8] Apparently, however, the machines were used primarily as experimental models at this time.

The Texas Agricultural Experiment Station has records of one farmer who used a machine harvester in 1892.[9] The Station also has records showing the probable introduction of the "sled" stripper in 1914 when a farmer used sections of a picket fence held together by strands of wire to strip cotton.[10]

In 1926, sled stripping came to be used extensively throughout the High Plains Area of Texas.[11] According to work done in Texas in 1928, it was indicated that:[12]

> during seasons of adverse weather conditions, low prices for cotton and scarcity of labor, with consequent high charges for picking and hand-snapping, made a more rapid and economical method of harvesting cotton imperative. The sled method has been used quite successfully during several seasons.

Presumably these are the conditions which were operative during 1926 when the number of sleds in operation significantly increased. Records also show that some sledding was done in Oklahoma during 1926.[13] Apparently, several thousand bales were harvested by that method during the 1926 season. These sleds were of both the finger and slot-types.

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[8] Ibid., p. 13

[9] G. W. Curtis and J. W. Carson, Cost of Cotton Production and Profit per Acre, Texas Agricultural Experiment Station, Bulletin No. 26, March 1893. (College Station, Texas), p. 10.

[10] D. L. Jones, W. M. Hurst and D. Scoates, Mechanical Harvesting of Cotton In Northwest Texas, Texas Agricultural Experiment Station, Circular No. 52, November 1928. (College Station, Texas), p. 5.

[11] Ibid., p. 5.

[12] Ibid., p. 3.

[13] Official Record, United States Department of Agriculture, Volume 6, No. 14, April 6, 1927, p. 3.

No record could be found of the use of sleds in states other than Texas and Oklahoma during the 1926 season. Brodell explains the limitations upon the use of sleds and hand-snapping in other regions as follows:[14]

> The use of sleds, or the snapping method of harvesting cotton, in the eastern Cotton Belt would be of doubtful value. Before cotton can be harvested by either of these methods it must be frosted. Much crop damage would occur in these eastern areas if the cotton was left in the field until after frost, since fall rains are often heavy and killing frosts usually occur late in the season. Then, too, cotton acreages are smaller, labor is more plentiful and wages are usually lower than in the western areas.

There was some evidence of prejudice of gin managers against "sledded" cotton. The farmer's "stripped" bale in 1914 was refused by the gin until it had been threshed, in order to break open the unopen bolls and remove some of the trash. However, much of the prejudice of ginners against machine-stripped cotton was overcome in 1926 when it was found that a better sample was obtained from "stripped" than from hand-snapped cotton.[15]

There was also some evidence of prejudice in the grading of snapped and stripped cotton when the method of harvesting was known. Some in the trade apparently discounted cotton harvested by these methods more than hand-picked cotton of the same grade. This evidence was found in the report of a conference held by the Bureau of Agricultural Economics

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[14] A. P. Brodell "Cotton Harvesting by Newer Methods Saves Much Labor", Yearbook of Agriculture, United States Department of Agriculture, 1927, p. 224.

[15] D. L. Jones, W. M. Hurst and D. Scoates, Mechanical Harvesting of Cotton in Northwest Texas, Texas Agricultural Experiment Station, Circular No. 52, November 1928, (College Station, Texas), p. 5.

in 1927. This report read in part:[16]

> New methods of harvesting cotton are "snapping" and "sledding" in which the bolls are stripped from the plants with a machine. It has been alleged that cotton harvested by the newer methods is inferior to hand-picked cotton.
>
> Representatives of the agricultural colleges, cotton manufacturer's associations, cotton cooperatives, cotton exchanges, and shipper's organizations, met to consider questions which have arisen over the development of the new harvesting methods in their relation to tendency on the future contracts.
>
> The feeling was generally expressed at the meeting that the present procedure of classing cotton under the cotton futures act was the most practical method under the circumstances. It was the consensus of opinion that nothing should be done to cause cotton to be sold at discounts, but the cotton should stand on its own merits, which is the policy the bureau always has followed.

After the extensive use of sled strippers in 1926, several machine companies became interested in manufacturing commercial machine strippers. International Harvester devised a stripping machine with a chain having lugs or fingers. As the machine moved forward the plants were stripped between these fingers, which retained the cotton and carried it back to a box in the rear.[17] Another company, The General Cotton Harvester Company, devised a finger-type stripper which threshed the cotton as a combine.[18]

Deere and Company conceived the roller-type harvester with a stripping unit of metal rolls studded with short pins. The Texas Station

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[16] Official Record, United States Department of Agriculture, Volume 6, No. 3, January 19, 1927, p. 5.

[17] Smith, et al., The Mechanical Harvesting of Cotton, Op. Cit., p. 15.

[18] Ibid., p. 15.

then obtained Deere and Company's permission to experiment with rubber rolls on a roller-type stripper. From this machine was developed what was known as the "Texas Station" Harvester.[19] During the depression of the 1930's the severe poverty of the farmers slowed the progress of farm mechanization of all types including the progress of machine harvesting cotton. The Texas Station, however, continued its experiments with the Texas Station Harvester. Progress was also made in the development of varieties better adapted to the machine stripping operation.[20]

The difficulty of the variety problem was evidenced in a statement made in 1931 by H. P. Smith:[21]

> After considering all the various types of cotton harvesters, the conclusion is drawn that it is difficult for any and all types to handle the crop, largely because the nature of the cotton plant itself is largely responsible for retarding the development of a successful cotton harvester. With this in mind the Station is attempting to not only develop a cotton harvester but also to develop a variety of cotton which will be suited to mechanical harvesting.

The variety problem has been only partially solved. Varieties have been developed that are adapted to particu lar areas such as the High Plains of Texas, but climate, soil types, and other physical factors restrict the use of the varieties in other areas.

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[19] Ibid., p. 24.

[20] H. P. Smith, et al, Mechanical Harvesting of Cotton as Affected by Varietal Characteristics and Other Factors, Texas Agricultural Experiment Station, Bulletin No. 580, December 1939, (College Station, Texas), pp. 6-9.

[21] Experiment Station Record No. 65, United States Department of Agriculture, p. 676.

The Progress Made In Recent Years

During World War II the labor shortage again created the need for a harvesting method other than by hand labor. The farmers of West Texas and Western Oklahoma turned to sled stripping as it was the only form of mechanical harvesting which could be made available in a short time. Again the machine companies began developing and manufacturing commercial machine strippers. In recent years the commercial machines have been rapidly replacing sled stripping and hand snapping in Western Oklahoma and West Texas. By 1951, Texas was estimated to have over 7500 commercial machine strippers available;[22] by 1951, Oklahoma was estimated by one source to have more than 1500 commercial machine strippers in use (Appendix Table 1).

The two forms of commercial machine strippers currently produced and utilized are the finger-type and the roller-type. In both types the cotton is removed with the aid of the forward motion of the stripper. The finger-type has fingers made of steel, which may either remain stationary or on some types move with an up and down motion. The roller strippers may consist of either a one-roller or a double-roller type. The one-roller stripper has one-roller and a stationary bar. The double-roller type has two rollers which move outward in the stripping operation.

The practice of machine stripping has been largely limited to West Texas and Western Oklahoma up to the present time.

The use of commercial machine pickers seems to have begun about 1943. By the end of 1951, one commercial company had made about 5000 machine

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[22] D. T. Killough, et at. Performance of Cotton Varieties In Texas (1948-50), Texas Agricultural Experiment Station, Bulletin No. 739, September 1951, p. 16.

pickers.[23] California was estimated to have about 3000 machine pickers available for the 1951 crop.[24] However, little machine picking has been done in Oklahoma because of both physical and economic limitations.

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[23] C. R. Hagen, Twenty-five Years in Machine Picking Development, a report released by International Harvester, 1951, p. 15.

[24] Marvin Hoover, "Pickers and Strippers", Second-Panel Discussion, Fifth Annual Cotton Mechanization Conference, Chickasha, Oklahoma, November 8-9, 1951. Cotton Mechanization, (National Cotton Council, Memphis, Tennessee), p. 34.

CHAPTER III

A COMPARISON OF THE DIFFERENT METHODS OF HARVEST

In an attempt to compare the methods of cotton harvesting two sources of information were utilized. First, the cost estimates are based on data and conclusions drawn from previous research done in Oklahoma.[1] Second, comparisons on performance were calculated from data collected from 20 stripper operators surveyed in 1951 concerning the operation of the machines during the 1950 crop. Although some caution must be observed in the use of the latter data, since only a limited number of operators were surveyed, it is felt that the comparison is an indication of machine stripper performance under Western Oklahoma conditions.

Machine Stripping Versus Hand-Snapping

A Comparison of Costs

It was estimated that the total average cost per bale on cotton yielding one third of a bale an acre, was slightly over $15 per bale during the 1950 season.[2] The most common rate for hand-snapping during

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[1] Cost data used in this chapter are primarily those compiled by John D. Campbell in Economic Aspects of Machine Harvesting Cotton, Oklahoma Agricultural Experiment Station, Bulletin B-364, 1951 and Oklahoma Farmers Experiences With Cotton Strippers, Oklahoma Agricultural Experiment Station, Bulletin 324, 1948, (Stillwater, Oklahoma).

[2] J. D. Campbell, Economic Aspects of Machine Harvesting Cotton in Oklahoma, Oklahoma Agricultural Experiment Station, Bulletin No. 364, Table 1, p. 11, (Stillwatater, Oklahoma). (The cost of machine stripping is composed of the actual 1947 average cost per acre adjusted for 1950 conditions and for the yield per acre and includes allowances for waste, loss in grade and extra ginning charges as well as for cost attributable to the stripper itself).

the same season was $2 per hundred or $40 per bale. Thus a saving of slightly less than $25 per bale could be realized from machine stripping during the 1950 season.

In view of the generally higher price level in 1951 as compared with 1950 it is felt that both the cost of hand-snapping and machine stripping have increased. Since no specific data on these costs are available it is problematical as to the actual net advantage of the stripper in 1951 as compared with the previous year.

A Comparison of Efficiency*

Of the 20 stripper operators in the 1951 survey who furnished information concerning the use and performance of their strippers in the 1950 crop year, 5 stripped less than 100 acres each. The average time required by the 5 machines was 1.2 hours per acre. The machines stripping from 100 to 299 acres, required .7 hour per acre stripped. No apparent change in the time required per acre was noted for the largest number of acres (300 or more acres) stripped per machine (Table 1).

Since the yield stripped per acre was greater from the smaller acreages, it might be inferred that this factor was responsible for the increased time required per acre on the smaller acreages stripped. In order to determine whether this was so, the strippers in each acreage group were subdivided according to the yield stripped** per acre (Table 2).

In none of the acreage groups was there any significant direct relationship between the yield stripped per acre and the number of hours

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* Efficiency in this comparison concerns time required per acre or per bale stripped.

** Yield stripped per acre is the amount, in some cases, of yield stripped per acre after the cotton had been hand-snapped.

Table 1. Relation of Acreage of Cotton Stripped to Hours Required Per Acre By 20 Machines Operating in Western Oklahoma, 1950.

Acres Stripped Per Machine		Number of	Average Bales Stripped	Average Hours Required
Range	Average	Strippers	Per Acre	Per Acre
Less than 100	54.1	5	.42	1.20
100 to 299	188.5	9	.27	.67
300 or more	504.8	6	.22	.70
All Strippers	249.8	20	.25	.70

Source: Appendix Table 2

Table 2. Relation of Bales Stripped Per Acre to Hours Required Per Bale of Cotton Harvested By 20 Strippers, By Range in Acreage, Western Oklahoma, 1950.

Acres Stripped Per Machine and Bales Stripped Per Acre	Number of Strippers	Average Acres Per Stripper	Bales Stripped Per Acre	Hours Per Acre	Hours Per Bale
Less than 100 Acres:					
Less than .25 Bale Per Acre	1	51.0	.22	1.47	6.8
.25 Bale or More	4	54.9	.47	1.14	2.4
100 to 299 Acres:					
Less than .25 Bale Per Acre	5	204.3	.21	.70	3.4
.25 Bale or More	4	168.8	.35	.66	1.9
300 or More Acres:					
Less than .25 Bale Per Acre	3	533.0	.13	.64	4.9
.25 Bale or More	3	476.7	.32	.70	2.2

Source: Appendix Table 2.

required per acre stripped (Table 2). It was noted, however, that more time was required per acre for those machines stripping under 100 acres than for the machines stripping over 100 acres, regardless of the yield stripped. However, this is probably a chance relationship and little significance should be attached to this comparison.

On the other hand, within each acreage group, marked reductions in hours required to strip a bale were noted with increased yield per acre. These data indicate that machines stripping yields of one-fourth or more bale per acre required about one-half the time per bale required for those machines stripping yields of less than one-fourth bale per acre. (Table 2). That increased yield stripped meant reduced hours per bale is important because it tends to reduce cost per bale. Also from the producers' point of view, the hours required per acre are important only if they are associated with reduced costs per bale stripped. In either case the producer is interested in that relationship between cost and yield per acre that will result in the greatest total net income.

The average yield stripped for all machines was one-fourth bale per acre, with an average of .7 hours in time required per acre and an average of 2.8 hours in time required per bale stripped (Appendix Table 2). These averages compare closely with the results found in a previous study in which estimates on cotton yielding one-third bale per acre, required one hour per acre and 3 hours per bale stripped.[3]

It was also estimated in a previous study that it would require 50 hours to hand snap one bale with a yield of 1/3 bale per acre.[4] If this

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[3] Ibid., p. 11.

[4] Ibid., p. 11.

estimate is valid, then logically the time required to hand snap a bale should be equal to or greater than for the previous estimate for cotton yielding one-fourth bale per acre, because of the inverse relationship existing between yield and the time required to harvest a bale. Accordingly, the machine stripper method of harvesting would have saved an average of at least 47.2 hours per bale compared with the hand snapping harvesting method.

Other factors besides yield and acres stripped have a bearing on the individual stripping operations. This is shown by the data of the 20 strippers with a range of from .32 hours to 1.47 hours in time required per acre stripped, and a range of from .8 hours to 9.3 hours in time required per bale stripped (Appendix Table 2).

The skill of the individual operator and the condition of the particular cotton field at the time of harvest may have contributed much toward the efficiency of the individual stripping operations.

Most Profitable Production Practice

In the 1951 survey, one question asked of the stripper operators pertained to which variety of cotton combined with which harvesting practices would result in the most profitable production (Table 3).

Of the 23 stripper operators, 20 preferred storm-resistant varieties such as Macha and Lankart; 2 operators preferred open boll varieties; one operator showed no preference of variety but indicated the harvesting practices most profitable to follow with a storm resistant variety, an open boll variety and a compromise variety such as Northern Star.

Of the 20 operators indicating preference for storm resistant

varieties, 11 preferred to hand snap once and then machine strip; 5 preferred to strip only; one preferred to hand snap twice and then strip; and 3 preferred to strip only if Macha were grown or to hand snap once then strip if Lankart were grown (Table 3).

The two operators preferring open boll varieties, preferred to hand snap twice or more and then strip.

The one operator showing no preference as to variety indicated that open boll varieties should be hand snapped twice then stripped; compromise varieties such as Northern Star should be snapped once then stripped; and that storm resistant varieties should be stripped only for most profitable results.

Expected Use of Strippers in 1951

Of the 23 stripper operators, 6 indicated they had intentions of harvesting all their 1951 acreage with a stripper; 11 had intentions of harvesting part of their acreages entirely with a stripper; and the remaining 6 indicated they would harvest none of their acreages entirely with a stripper but hand snap once or more before stripping (Table 4).

Custom Harvesting Rates Versus Hand Snapping Rates

The most common rate for hand snapping in 1950 was $2 per hundred. The common rate for machine stripping was $1 per hundred or $3 per acre when the cotton was thin (Appendix Table 3).

These rates indicate that saving could be made under the proper conditions by hiring a custom stripper instead of hiring hand labor. Thus custom harvest might be a profitable alternative method of harvest for many producers either unable or unwilling to purchase a stripper.

Table 3. Relation of Variety to Preferred Harvesting Procedure.

Harvesting Procedure Preferred	Storm-Resistant Varieties	Open-Boll Varieties	No Variety Preference	Total
Strip Only	5	—	—	5
Snap Only then Strip	11	—	—	11
Snap Twice or More, then Strip	1	2	—	3
Conditional Answers	3*	—	1**	4
Total	20	2	1	23

Source: Survey of Stripper Operators in Western Oklahoma, 1951.

* Three operators preferring storm-resistant varieties preferred to strip only with Macha; or with Lankart to hand snap once then strip.

** One operator had no choice as to varieties but preferred to strip only with storm-resistant varieties; snap once then strip with compromise varieties such as Northern Star; and to snap twice then strip with open boll varieties.

Table 4. Proportion of Cotton Acreages Stripped Entirely, 1951.

Intentions as to 1951 Harvest	Number of Operators
Harvest All of Acreage Entirely With Stripper	6
Harvest Part of Acreage Entirely With Stripper	11
Hand Snap Once or More Before Stripping	6
Total	23

Source: Survey of Stripper Operators in Western Oklahoma, 1951.

Sled Stripping

No data was taken on sled stripping in the 1951 survey. However, previous studies indicated sleds were uneconomical when commercial machines were available. Sleds have been used largely in salvage operations.[5]

Machine Picking

Under California conditions during the 1949 season the cost estimates, made after an extensive study, ranged from $20.97 to $41.67 in total costs per bale.[6] High cotton yields are obtained in California and the cotton grown is adapted to machine picking; it has long staple and open bolls.

No estimates based on original data could be found on the costs of machine picking in Oklahoma. One study estimated machine picking per bale would cost about $60 under 1950 conditions in Oklahoma.[7] Low yields and high wastage from partially opened bolls which the machine picker could not pick were the main causes given for the high cost estimate under Oklahoma conditions.

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[5] J. D. Campbell, Oklahoma Farmers' Experiences With Cotton Strippers, Oklahoma Agricultural Experiment Station, Bulletin No. B-324, October 1948, (Stillwater, Oklahoma), pp. 6-7.

[6] W. R. Bailey and T. R. Hedges, Economics of Mechanical Cotton Harvesting, Summary of Mimeograph Report No. 111, January 1951, College of Agriculture, University of California, (Berkeley, California), p. 8.

[7] J. D. Campbell, Economic Aspects of Machine Harvesting in Oklahoma, Oklahoma Agricultural Experiment Station, Bulletin No. 364, April 1951, Table 1, (Stillwater, Oklahoma), p. 11.

CHAPTER IV

PROBLEMS OF MACHINE STRIPPING COTTON

In machine stripping cotton a number of problems arise many of which apparently have been only partially solved. As a part of this study some of the more important problems are examined to determine their effect upon the economical operation of machine strippers under Western Oklahoma conditions.

Some of the problems which will be examined are: loss in grade, wastage, declining basis, gin equipment, defoliation, and the mechanical characteristics of existing machines. In addition some economic factors of significance will be examined.

Loss In Grade From Stripping

In the comparison of grades, the grade index set up by the Production and Marketing Administration was used to compare the grades between hand snapped and machine stripped cotton (Appendix Table 4).

In the 1951 survey of the 1950-51 crop data were collected from which an average was derived of the grade indexes of 123 bales of machine stripped cotton. The average grade index for this group was 93.9. This was higher than the grade index for all cotton harvested in District I for the 1950-51 season, which was 93.6.[1]

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[1] Oklahoma Grade and Staple Report, Production & Marketing Administration, United States Department of Agriculture, 1950-51 crop.

Studies made in previous years also indicate only slight variation between the grades of the cotton harvested by machine strippers as compared to hand snapped cotton.[2] A large majority of stripper operators and gin managers interviewed during the 1947-48 season were of the opinion that the grades of machine stripped cotton were about the same as for similar cotton when hand snapped. In the comparisons between the two methods for 1948-49 the grade index for the machine stripped bales averaged about one-twelfth of a grade lower than the average grade for the hand snapped bales.[3] During the 1949-50 season the machine stripped cotton had an average grade index slightly less than one-third of a grade lower than the average grade index of all cotton harvested in

Table 5. Grade Indexes By Weeks of Cotton Harvested Entirely With Strippers as the 1949 Season Progressed.

	Weeks of 1949 Harvesting With Strippers*										
	1st	2nd	3ed	4th	5th	6th	7th	8th	9th	10th	11th	Aver
Grade Index	93.5	93.0	92.2	93.8	93.5	91.1	90.4	86.7	85.9	86.8	85.6	90.3

Source: J. D. Campbell, Economic Aspects of Machine Harvesting Cotton, Oklahoma Agricultural Experiment Station, Bulletin No. B-364, April 1951, (Stillwater, Oklahoma), p. 13.

* The first week was November 6th to 12th inclusive.

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[2] J. D. Campbell, Oklahoma Farmers' Experiences with Cotton Strippers, Oklahoma Agricultural Experiment Station, Bulletin No. B-324, October 1948, (Stillwater, Oklahoma), p. 9.

[3] J. D. Campbell, Economic Aspects of Machine Harvesting Cotton, Oklahoma Agricultural Experiment Station, Bulletin No. B-364, April 1951, (Stillwater, Oklahoma), p. 13.

District I the same season.[4]

The previous studies have shown that the grade of cotton may be expected to decline as the season progresses. An indication of how the grade declined during the 1949 season, with cotton harvested entirely by stripper, is shown in Table 5 on the preceding page.

Degree of Wastage

Factors which are related to Stripper efficiency defined in terms of wastage are: "(1) the use of storm resistant varieties; (2) stripping as soon as ready; and (3) skillful operation of the stripper".[5]

In 1947-48 the estimates of wastage by the stripper averaged 4.3 percent as compared to an estimate of 3.4 percent for hand snapping. These estimates showed 1.7 percentage points less wastage by hand snapping compared with machine stripping.[6]

In 1948-49 the estimates of wastage by strippers averaged 5.3 percent as compared to an average estimate of 3.0 percent for hand snapping. These estimates showed 2.3 percentage points less wastage by hand snapping.[7]

In the 1951 survey three questions were asked of the stripper operators concerning wastage; (1) percent of cotton wasted by weather when the entire crop is stripped; (2) percent of cotton wasted by stripper when the entire crop is stripped; (3) percent wasted by the stripper of the remainder of the crop after it has been hand snapped once.

In the first instance the estimate of average wastage was 4.2 percent; under the second condition the estimated average wastage was 3.9 percent; and in the last case an estimated average wastage of 2 percent was reported. However, it is doubtful that these estimates are directly comparable with the estimates for previous years.

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[4] Ibid., p. 9

[5] Ibid., p. 8; [6] Ibid., p. 8; [7] Ibid., p. 8.

Adaptability of Varieties for Machine Stripping

One problem that has been partially overcome is the development of varieties adapted to machine stripping. In a previous survey of stripper-operators in Western Oklahoma the following characteristics were given as desirable for cotton harvested with a machine stripper: "(1) high degree of storm resistance, (2) short limbs, (3) medium size stalks, (4) uniform maturity of bolls, (5) easy separation of bolls from stalks, (6) medium high fruiting, and (7) light foliage".[8]

For the years 1947, 1948 and 1949 the more common varieties grown in Western Oklahoma were rated by the stripper operators interviewed according to the desirability for machine stripping. The results of these ratings are shown in Table 6.

Table 6. Ratings of the More Common Varieties of Cotton in Western Oklahoma for Harvesting With Strippers; (Ratings by stripper operators; combined for 1947, 1948 and 1949).

Varieties	Ratings				Total Number
	Very Good	Good	Fair	Poor	
D. & PL. or (Deltapine)	None	1	10	8	19
Half & Half & Hi-Bred	7	14	35	45	101
Lankart #57	60	43	9	3	115
Mebane 140's (Lockett 140 A Marvl-S-Cluster)	16	32	22	14	84
Macha	27	10	3	None	40
Northern Star	13	48	38	15	114

Source: J. D. Campbell, Economic Aspects of Machine Harvesting Cotton, Oklahoma Agricultural Experiment Station, Bulletin No. B-364, April 1951, (Stillwater, Oklahoma), p. 13.

[8] J. D. Campbell, Oklahoma Farmers' Experiences With Cotton Strippers, Oklahoma Agricultural Experiment Station, Bulletin No. B-324, October 1948, (Stillwater, Oklahoma), p. 10.

To show the preference of the stripper operators the classifications in Table 6 were weighted as follows: very good - 4 points, good - 3 points, fair - 2 points, poor - 1 point. The resulting index showed the preferences by varieties for machine stripping as follows:

1.	Macha	3.6
2.	Lankart	3.4
3.	Northern Star	2.4
4.	Half & Half & Hi-Bred	1.7
	Mebane 140's	1.7
5.	Deltapine	1.6

Stormproof #1 was included in the questionnaire but insufficient numbers of the operators interviewed had had experience with this variety at the time to rate it;since it has been classified as one of the better "stripper" varieties.[9]

Declining Basis

With a decidedly declining basis on the lower grades of cotton in the market for the 1951-52 crop, some producers seemed to feel that this was the pattern to be expected every season. If this were true, there would tend to be a definite loss on machine stripped cotton, since much of the machine stripped cotton is harvested and marketed after frost or in the latter part of the season, compared to hand snapped cotton where the cotton is harvested by hand labor and marketed as early in the season as possible. For comparison, six of the lower grades were checked for each of the five crop years, 1947-48 through 1951-52, to determine the rate of discount on each grade by months for the season (Appendix Table 5). September and October were classified as early marketed cotton while

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[9] J. M. Green, et al, Oklahoma Cotton Varieties, Varietal Descriptions and Performance Tests, Oklahoma Agricultural Experiment Station, Bulletin No. B-381, February 1952, (Stillwater, Oklahoma), p. 10.

November and December were classified as late marketed cotton. An average discount on each of the grades was determined and a comparison made between the early and late marketed cotton. The results of the comparison seem to indicate that the basis showed no definite pattern, either rising or declining, as the harvest progressed.

The condition of the market during the harvest in question seems to be the determining factor as to whether the basis will rise or fall. The results were in line with the findings of a previous study: "the variations in the basis are accounted for by changes in the relative supply-and-demand situation for cotton of the various grades and by changes in the general level of prices".[10]

Gin Equipment for Machine Harvested Cotton

It is essential for the proper ginning of machine harvested cotton that gins have certain equipment. The special equipment that has been recommended for gins handling machine stripped cotton in addition to that required for hand picked cotton includes: "(1) a cylinder cleaner, (2) tower drier, (3) screentype cleaner, (4) full size bur machine, (5) cylinder drier, (6) large extractor feeders and (7) perhaps lint cleaners".[11]

Gins which cannot handle snapped cotton certainly could not handle machine stripped cotton. Most gins in Southwestern Oklahoma are equipped

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[10] Horace McGee, "Quality of Oklahoma Cotton and the Competitive Outlook", Master of Science Thesis, Oklahoma Agricultural and Mechanical College 1949, (Stillwater, Oklahoma), p. 14.

[11] L. J. Watson, "The Effect of Mechanical Harvesting on Quality", Proceedings of Fifth Annual Cotton Mechanization Conference, (Chickasha, Oklahoma), November 8-9, 1951. Cotton Mechanization, (National Cotton Council, (Memphis, Tennessee), p. 25.

for handling rough-harvested cotton.[12] In Eastern Oklahoma more than half the gins are equipped to handle hand snapped cotton.[13] But in Southeastern Oklahoma very few gins have been equipped for handling rough harvested cotton.[14]

Gins may not be able to handle cotton as fast as it comes to the gins in areas where mechanical harvesting becomes the principal method of harvest. Two alternatives have been visualized, either the producer can store his cotton on the farm temporarily, or the gins may build additional storage space to keep the cotton until it can be ginned.[15] This is an important problem confronting the cotton industry at the present time.

Defoliation

Defoliation has been recognized as one of the essentials in some areas if best results are to be obtained in machine harvesting. It seems to have been used only on a very limited scale in Western Oklahoma. Only one of the 23 stripper operators interviewed in 1951 had used a defoliant during the 1950-51 crop. A few other operators had purchased

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[12] W. F. Lagrone, Cotton Growing in Southwestern Oklahoma, Oklahoma Agricultural Experiment Station, Bulletin No. B-350, June 1950, (Stillwater, Oklahoma), p. 18.

[13] W. F. Lagrone, Cotton Growing in Eastern Oklahoma, Oklahoma Agricultural Experiment Station, Bulletin No. B-345, February 1950, (Stillwater, Oklahoma), p. 14.

[14] W. F. Lagrone, Cotton Growing in Southeastern Oklahoma, Oklahoma Agricultural Experiment Station, Bulletin No. B-358, September 1950, (Stillwater, Oklahoma), p. 17.

[15] J. D. Campbell, "Should Machine Harvested Seed Cotton be Stored on Farms?", Current Farm Economics, Oklahoma Agricultural Experiment Station, Volume No. 23, October 1950, (Stillwater, Oklahoma), pp. 150-153.

a defoliant but did not use it because conditions were never considered proper for its application.

Another study indicated the following results from the use of defoliation in Southwest Oklahoma.

> In the survey of the 1947-48 season, 19 operators indicated they had used defoliant at some time previous to machine stripping. Of the 19, four reported they were well pleased with the results; three others were fairly well satisfied; twelve indicated their results were irregular; and six reported they were not well satisfied with the results.[16]

A number of conditions are apparently essential for good results from defoliation. Some conditions listed as factors favoring good defoliation are:

(1) high humidity,

(2) high temperature,

(3) no wind,

(4) adequate soil moisture,

(5) proper plant growth,

(6) ample nutrients, but not too much nitrogen,

(7) leaves which are turgid or green, and

(8) well matured bolls on the plants.[17]

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[16] J. D. Campbell, Oklahoma Farmers' Experiences with Cotton Strippers, Oklahoma Agricultural Experiment Station, Bulletin No. B-324, October 1948, (Stillwater, Oklahoma), pp. 13-14.

[17] Summarized from Chemical Defoliation of Cotton, Prepared by the Steering Committee of the Beltwide Cotton Defoliation Conference. (National Cotton Council, Memphis, Tennessee) 1951, p. 3.

Mechanical Characteristics of Existing Machine Strippers

The roller-type and finger-type strippers each have mechanical characteristics which limit their operation to a certain degree. In recent tests made by the Texas Station it was found that:

> Cotton must be planted in 40 inch rows when using roll-type strippers, except in rare cases where some adjustment is possible on certain small row-crop tractors...finger-type strippers would not harvest cotton successfully where either large stalks or root rot was present.[18]

Problems of Topography

Machine operations of all types are apparently affected by badly eroded fields, or by fields that have excessively contoured rows. Land drainage may also be a problem in mechanical harvesting. Most of the farms in Western Oklahoma are not concerned with these problems but they may be factors that require further study if machine stripping is adapted in other areas of the state.

Cultural Practices

Clean cultivation is essential for best results in machine harvesting. A summary of some recent recommendations by research workers in Oklahoma includes:

(1) a well prepared seedbed with a minimum of trash and stalks left in the field,

(2) 40 inch row widths for most machine harvesters,

(3) minimum of scatter of seed sideways in the row,

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[18] H. F. Miller, et al, Mechanical Harvesting of Cotton in Texas, Texas Agricultural Experiment Station, Progress Report No. 1337, March 1951, (College Station, Texas), p. 13.

(4) precision planting from 6 to 12 inches on the sandy land,

(5) slight ridging of the row during the final cultivation.[19]

Transporting the Seed Cotton to Gin

Since machine stripping increases the rate of harvesting cotton, problems of seed cotton transportation arise. One trailer is needed in the stripping operation and a number of trailers may be needed for transporting machine stripped cotton to the gin as the cotton is harvested. If the cotton is transferred from the trailer to a truck to be transported to the gin a device for transferring this cotton may be used to speed up transportation. Some producers have devised a suction type system similar to that used at the gin for this operation in order to more fully utilize their transportation facilities.[20]

Opinion's of Stripper Operators on Factors Affecting the Use of Strippers

In the 1951 survey the stripper operators were asked to list the factors that they felt now restrict the wider use of strippers. Included in the list were most of the problems of agronomy and engineering, which have already been mentioned in this chapter. In addition some problems of a purely economic nature were mentioned to which little significance has been attached in many previous studies. These include: initial cost

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[19] R. T. Humpreys, J. M. Green, and E. S. Oswalt, Mechanization of Cotton for Low-Cost Production, Oklahoma Agricultural Experiment Station, Bulletin No. B-382, March 1952, (Stillwater, Oklahoma), pp. 6-12.

[20] J. D. Prewitt, "Intregrating Mechanization, Education and Research", Proceedings of Fifth Annual Cotton Mechanization Conference, (Chickasha, Oklahoma), November 8-9, 1951. Cotton Mechanization, (National Cotton Council, (Memphis, Tennessee), p. 28.

of machine, reluctance to change methods, farm too small for capacity production, too small an acreage, and alternative opportunities in other crops (Table 7).

Some of the economic factors named may become of more importance if the machines are used in areas of production other than Western Oklahoma and West Texas.

Adaptability of Stripper to Different Areas

Figure 1 shows the concentration of strippers by counties in the fall of 1951. Of the 15 counties having 25 or more strippers at that time, all were located in West-Central or Southwestern Oklahoma.

If strippers are to be used in areas of the state such as Eastern Oklahoma there will likely be a number of factors which will affect their performance. In some areas of Eastern Oklahoma the storm-resistant varieties may not be well adapted to growing conditions.[21] Also a portion of the gins are not equipped to handle even hand snapped cotton.[22] Since special types of gin equipment seem to be required to best handle machine stripped cotton it is likely that most gins in Eastern Oklahoma would need some additional equipment to properly clean machine stripped cotton.

Certain economic factors associated with the farm organizations in the Eastern area of Oklahoma may also constitute barriers to the most economic performance of cotton strippers. These are indicated in a comparison of the census data for Beckham County in Western Oklahoma where

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[21] J. M. Green, et al, Op. Cit., p. 6.

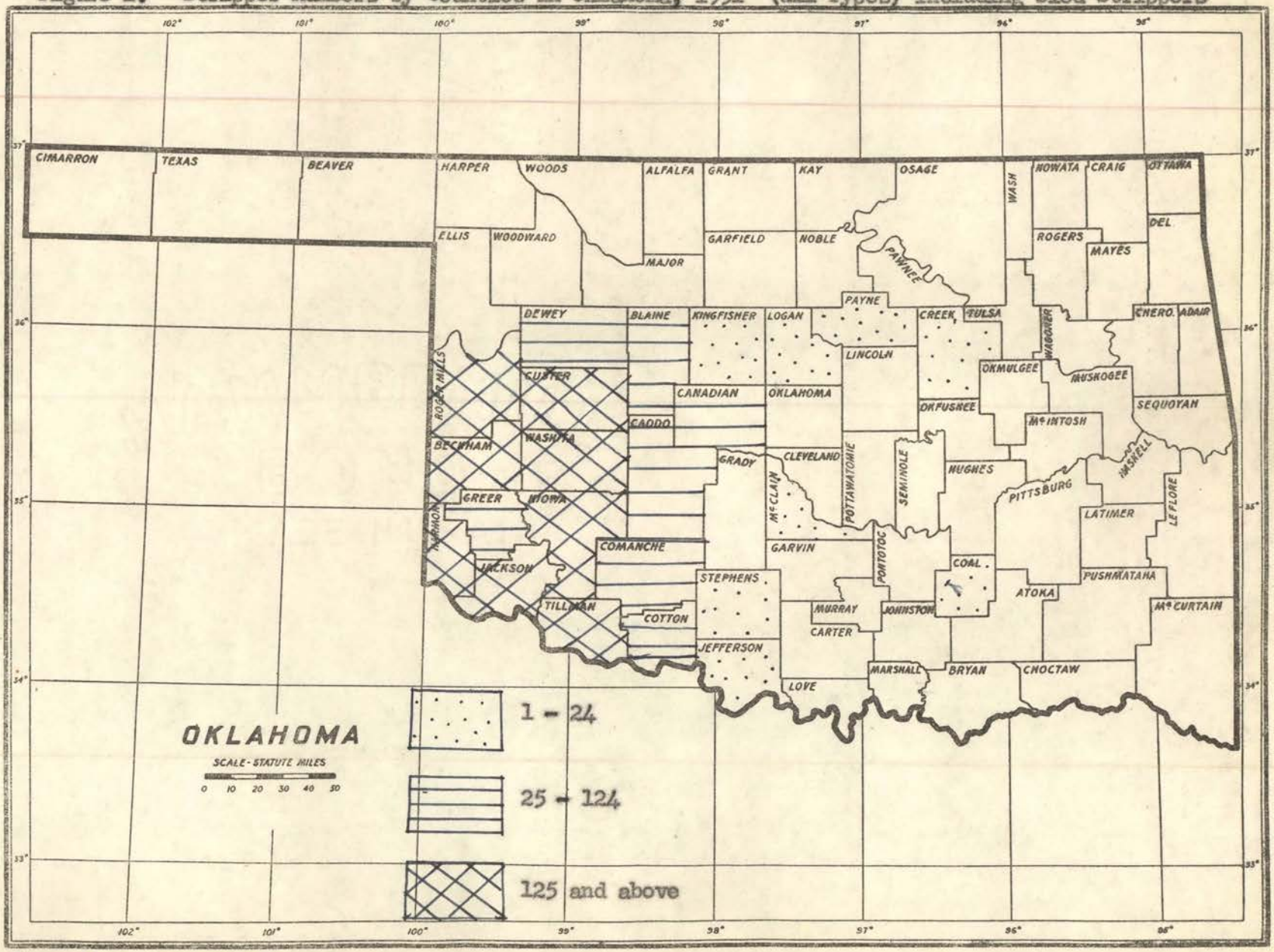
[22] W. F. Lagrone, Cotton Growing in Eastern Oklahoma, Oklahoma Agricultural Experiment Station, Bulletin No. B-345, February 1950, (Stillwater, Oklahoma), p. 14.

Table 7. Stripper Operators' Opinions as to Most Important Factors Related to the Use of Cotton Strippers.

Too Much Waste	7
Too Small Acreage	6
Initial Cost of Machine	5
Cotton Too Rank	4
Tractor Does not Fit Stripper	3
Not Enough Strippers Available	3
Lowers Grade	2
Prefer to Hire Strippers	2
Wheat Pays Better	2
Machine Not Perfected Yet	1
Not Right Kind of Strippers Besides John Deere	1
Preference of Open Boll Variety	1
Scarcity of Seed (Stormproof)	1
Need a Uniform Maturing Variety	1
Cotton Too Branchy	1
Good Cotton Pays to Hand Pull	1
Farms Too Small for Capacity Production	1
Reluctance to Change Methods	1
Not Used to Strippers	1
Weather Damage	1
Loss from Storm	1
Broom Corn Preferred to Cotton	1

Source: Survey of stripper operators in Western Oklahoma, 1951.

Figure 1. Stripper Numbers by Counties in Oklahoma, 1951 (All Types) including Sled Strippers



Source: Appendix Table 1.

strippers are used in relatively large numbers with McIntosh County in Eastern Oklahoma where no strippers have been used. Each of these two counties has a substantial portion of the harvested cropland in cotton (Table 8). Beckham County is in an area where cotton has been a predominate crop; McIntosh County also is in a type of farming area where cotton has been a significant crop.[23] For these reasons Beckham County and McIntosh County were selected for this illustration.

The land area of the two counties are about equal but the farms in Beckham County are on the average somewhat larger in total acreage, acres of harvested cropland, and acres of cotton than the farms in McIntosh County. The number of workers for each county was about equal but the cotton acreage averaged 32 acres per worker for Beckham County as compared with 12 for McIntosh County. The number of tractors averaged 1 to every 117 acres in Beckham County as compared with 1 to every 244 acres in McIntosh County; the number of horses averaged 1 for every 279 acres in Beckham County as compared with 1 for every 113 acres in McIntosh County. The expenditures for hired labor averaged $1,085 per farm in Beckham County as compared with $298 per farm for McIntosh County (Table 8).

The comparisons show smaller farms, smaller cotton acreages, lower total degree of mechanization, and less dependence on hired labor for McIntosh County compared with Beckham County.

In McIntosh County, machine strippers apparently have not been used while in Beckham County stripper performance has been proven to be econom-

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[23] Peter Nelson, "Geographic Variability of Types of Farming in Oklahoma", Type of Farming Map in Oklahoma, Current Farm Economics, Oklahoma Agricultural Experiment Station, Volume 9, No. 1, February 1936, (Stillwater, Oklahoma), p. 4.

Table 8. Some Physical and Economical Comparisons Between Beckham County and McIntosh Counties, 1949.

	Beckham	McIntosh
Land Area (Acres)	574,720	457,600
Harvested Cropland (Acres)	207,322	100,530
Number of Workers	2,688	3,166
Number of Tractors	1,766	742
Number of Horses and/or Mules	742	1,605
Harvested Cropland Per Tractor	117	279
Harvested Cropland Per Horse and/or Mule	244	113
Average Size of Farm (Acres)	277	154
Harvested Cropland Per Farm	126	59
Percent of Harvested Cropland In Cotton	36	31
Average Cotton Acreage Per Farm	45	18
Acres Cotton Per Worker	32	12
Number Farms Hiring Labor	1,330	983
Dollars Expended for Labor	1,443,926	293,740
Average Labor Expenditure Per Farm	1,085	298

Source: 1950 Census (McIntosh and Beckham Counties).

ical. It would seem logical that the differences which exist in the conditions in McIntosh County as compared with conditions in Beckham County likely would be significant in any consideration of the adaptability and performance of cotton strippers in McIntosh County or in any area of Eastern Oklahom with similar conditions. However, further research and study is needed to isolate specific economic determinants associated with the possible use of cotton strippers under Eastern Oklahoma conditions.

CHAPTER V

AN EVALUATION OF THE ECONOMIC PROBLEMS OF MECHANICAL HARVESTING

In the South and other cotton producing areas of the Southwest, farm labor has been relatively plentiful until recent years. In fact it is contended that there have been too many people on the land in the South which have prevented an efficient combination of labor and other productive factors.[1] For example, in 1944 there was one farm person for each 6.2 acres of cropland in the Southeast and one farm person for each 9.2 acres of cropland for the 10 Southern States including Oklahoma and Texas. This compares with a ratio of 1 to 27 for Illinois and Iowa, and 1 to 19 for the United States exclusive of the 10 Southern States (Table 9). This may partially indicate why the progress of mechanization in the South has been slow in comparison with other sections of the country.

In addition, the South is characterized by low acreages of cropland per farm. In 1945 sixty-five percent of the farms in the South had less than 30 acres of harvested cropland per farm and eighty-two percent had less than 50 acres per farm (Table 10). Although it is difficult to determine the minimum acreage that is needed for a mechanized farm unit, it seems logical to assume that small acreages have been associated with

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[1] F. J. Welch, et al, Study of Agriculture and Economic Problems of the Cotton Belt, Hearings Before Special Subcommittee on Cotton of the Committee on Agriculture, House of Representatives, Eightieth Congress, First Session, July 7 and 9, 1947. (U. S. Government Printing Office, Washington, D. C.), p. 11.

Table 9. Land-to-man Ratio in Different Parts of the United States, 1944.

Area	Area of Cropland Per Farm Inhabitant
Southeast (exclusive of Oklahoma & Texas)	6.2
South (10 Southern States including Oklahoma and Texas)	9.2
Illinois and Iowa	27.0
United States (exclusive of 10 Southern States)	19.0

Source: F. J. Welch, et al, Study of Agriculture and Economic Problems of the Cotton Belt, Hearings Before Special Subcommittee on Cotton of the Committee on Agriculture, House of Representatives, Eightieth Congress, First Session, July 7 and 8, 1947. (U. S. Printing Office, Washington, D. C.), p. 11.

Table 10. Acres Harvested Cropland Per Farm in South, 1945.

Harvested Cropland Per Farm (Acres)	Percentage In Group
Less than 30	65
30 to 49	17
Less than 50	82
50 or more	18
Total	100

Source: B. T. Lanham, Jr., "World Prospects in Cotton--Discussion", Journal of Farm Economics, Volume XXXII, No. 4, Part 2, November 1950, p. 771.

the relatively low degree of mechanization for certain types of farms which exist in the South.

On the other hand in areas where large scale farming is practiced conditions exist which prevent complete dependence upon mechanization. Bachman states these retarding conditions which exist in certain areas as follows:[2]

> Trends in numbers of those farms that require large amounts of hired labor for their operation apparently vary considerably among the different regions of the country. Available evidence indicates a long term downward trend in the number of large-scale units operated primarily by wage labor in the Corn Belt and Great Plains. An upward trend is indicated in the Pacific region. Production conditions in the Corn Belt and Plains areas perhaps discourage an increase in the size of farms much above that which can be handled by family labor. This is true even though a high degree of mechanization is possible. In the Corn Belt the diversified character of the farming increases problems of coordination. In much of the Great Plains, the weather and price risks are such as to discourage farmers from accentuating these risks by developing a form of organization which would be dependent on hired labor for continued production. In cotton farming, a significant decrease in large-scale tenant plantations is probablyytied in with the increasing complexities of production operations as a result of mechanization and other technological developments.

The introduction of innovations on a farm may mean the introduction of an entirely new series of inputs. When new technologies are introduced there is usually a substitution of capital for labor or land. This substitution is largely restricted to the medium and large scale farms. Bachman explains this substitution in the different groups as

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[2] K. L. Bachman, "Changes in Scale in Commercial Farming", Journal of Farm Economics, Volume 34, No. 2, May 1952, p. 164.

follows:[3]

> Contrary to popular conceptions, operators of large scale farms frequently have chosen to substitute capital for labor rather than to increase their size of business consistent with the increased command of labor over other resources. The middle groups have been characterized by the most rapid growth in acreage and output. This has occurred largely by adding land and capital to a relatively fixed labor supply centered around the farm family. The smaller business units in agriculture have faced more difficult problems of adjustment in meeting the challenge inherent in modern technological developments.

Schumpeter explains the substitution of factors of production which are plentiful for the more perfect methods as follows:[4]

> These values of alternative production show themselves in capitalist society in the money price of the means of production and would show themselves in equivalent expressions in any form of society. This explains why technically backward methods of production may still be the most rational one provided the more perfect methods would require less of a plentiful factor and more of one which is less plentiful, and why the technically most perfect method of production is so often a failure in economic life.

As an innovation machine harvesting would raise the level of mechanization in cotton farming to a par more nearly that of the mechanization for other crops. This would increase the flexibility of choice for the farmer since he might plant either cotton or some other crop depending upon the anticipated returns. The methods employed in production involve the rational allocation of resources and the allocation in turn,

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[3] Ibid., p. 159.

[4] J. A. Schumpeter, "The Nature and Necessity of a Price System", Essays of J. A. Schumpeter, (Addison-Wesley Press, Inc., Cambridge, Massachusetts, 1951), p. 121.

has both technical and economic considerations. In the case of machine harvesting this is equally true. Schumpeter illustrates a similar consideration as follows:[5]

> If a man produces whisky rather than bread from his rye, then what he does can be interpreted as bartering bread for whisky, and at the point at which he stops doing this, we shall again be able to obtain a quantitative expression of his preferences and again get a coefficient of choice which in all respects is the same thing as price in a market. It is obvious that the choice between these two alternatives is not determined by technical considerations. It should be equally obvious that economic considerations of precisely the same kind enter into the choice of the method of producing either bread or whisky, and that it would be incorrect to say that the decision about the what of production is an economic matter and the rest, namely, the decision about the how of production, a technological matter.

Even though a harvesting method may be technically adapted to a particular area or be the technically "best" method this does not imply that from an economic standpoint this method will yield the greatest returns when all the factors of production are considered.

The cruder methods of cotton production may have kept some farmers from producing cotton because of their intense dislike of the back-breaking work involved. A higher degree of mechanization in cotton farming could increase the alternatives for these producers in the use of their land and labor provided the resources could be recombined in appropriate size units.

The extent of mechanical harvesting in a new area will likely be limited to a great extent by the degree of mechanization already in use. A producer using horses or small tractors, which cannot handle a

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[5] Ibid., p. 120.

mechanical harvester, would be slower in purchasing a picker or stripper, since it would mean a complete change in other equipment used in production.

A harvesting method which is adapted to a particular area may be completely uneconomical in areas where it is not adaptable. For example, no reference could be found where machine stripping was recommended for the irrigated cotton fields of California. On the other hand, no recommendations have been found where machine picking was found economical for the High Plains of Texas.

Gilason recognized the limitations on the acceptance of new technologies due to the uncertainty of farm prices. He further stated that capital rationing in agriculture plays an important role in delaying improved techniques. Thus the new techniques are introduced more rapidly in periods of rising prices.[6]

Rising prices must have indirectly accounted for the rapid acceptance of new technologies during the past decade. Better prices for the farm products increased the available supply of capital. The increased capital supply made possible the change to new mechanical practices.

Along with the rising prices came a rising wage scale. The demands of industry for an increased labor supply drew much of the labor away from the farm. The mobility of the labor force has continued since the war. Thus the absence of cheap and plentiful hand labor in the cotton producing areas forced the producers' turn to other methods of harvest.

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[6] Conrad Gilason, "The Nature of the Aggregate Supply of Agricultural Products", Journal of Farm Economics, Volume XXXIV, No. 1, February 1952, pp. 88-89.

Mechanical harvesting may result in a somewhat increased cotton acreage in the areas where it is adaptable. For example, of 23 stripper operators interviewed in the 1951 survey, 21 had increased their acreages between 1950 and 1951 (Table 11). The elimination of acreage allotments in 1951, which had been in force during the 1950 crop, made possible this increased cotton acreage. However, much of the wheat had been destroyed by the green bugs in this area and this land may have been converted to cotton during 1951 to give additional stimulus to increased cotton acreage.

Of the 23 operators, 7 indicated they would have planted a smaller acreage in 1951 if they had not possessed a stripper; 13 indicated they would have planted less if no strippers were available at all during that season. Only 3 operators did not indicate an influence from strippers upon their cotton acreage (Table 11).

Machine harvesting will likely have definite influences upon the marketing procedures of cotton in those areas where it is practiced. Abrahamsen foresees its greatest influence upon the gins and ginning practices.[7] Larger and better equipped gins will be needed to handle a larger volume of cotton coming in to be ginned in a shorter harvesting season. Good gins will be essential to improve the quality of rough-harvested cotton.

There will likely be certain maladjustments in the labor forces such as in Eastern Oklahoma which have depended upon cotton for their livelihood. It has been suggested that the families on these smaller

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[7] M. A. Abrahamsen, "Cotton Mechanization: Its Probable Influence on Marketing", Journal of Farm Economics, Volume 31, No. 1, Part 2, February 1949, pp. 410-414.

Table 11. Effect of Strippers on Acreages Planted, 1951.

Effect	Number of Operators
Reduced Acreage, if no Stripper Possessed	7
Reduced Acreage, if no Strippers Available	13
No Effect From Strippers on Cotton Acreage	3
Total*	23

Source: Appendix Table 6.

* All but two operators interviewed had increased their acreage in cotton between 1950 and 1951. The removal of the acreage allotments in 1951 which had been in effect during 1950 probably influenced this increased acreage. There was also much wheat land used for cotton production after greenbugs and dry weather had destroyed the wheat in the spring of 1951.

farms might find their best alternatives in industry.[8] This may be intensified by the fact that the machine harvesting operation if adopted may make possible a more complete mechanization of cotton production practices in these areas. This assumption is based on the fact that cotton producers in many areas have depended upon hand labor in production to provide employment for the help needed later in the harvest of the crop.[9]

Progress in adoption of machine harvesting from Western to Eastern Oklahoma will likely be gradual. The physical and economical limitations cannot be easily overcome. While these factors are subject to change, their influences on mechanized cotton harvesting are likely to remain for some time. It is quite possible that cotton production in the partially mechanized areas may be reduced in that the producers will find it difficult to compete with those areas where mechanical production is more economical. This will be especially true if cotton mechanization leads to an increase in total production of cotton which, ceteris paribus, would result in a lower price in the market.

In other type of farming areas, such as in Western Oklahoma, machine harvesting of cotton has increased the economic opportunities for production by making mechanized cotton production a reality. Enough machine harvesters are now possessed in these areas that a certain portion of the crop may be mechanically harvested even with low prices for cotton. This is particularly true under present wage scales for hand labor.

Many problems still remain for machine harvesting and improvements

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[8] Bachman, Op. Cit., p. 169

[9] Abrahamsen, Op. Cit., p. 413.

in techniques could further expand the areas of economic operation. With the present levels of employment for the economy, the adoption and utilization of mechanical cotton harvesters probably will continue to increase as rapidly as the technical problems of mechanization are overcome.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Machines for harvesting cotton were designed over a century ago. However, there is little evidence to show they were used at that time for other than experimental models. In addition to the imperfections of the early machines, a number of physical and economic factors apparently delayed the use of machines by farmers in harvesting cotton.

The first large scale use of machine harvesters was in 1926, when sled strippers were used extensively in West Texas and Western Oklahoma. Some in the cotton trade felt that machines for harvesting cotton would continue to be used and a start was made to develop a commercial type stripper. This development was retarded during the 1930's when the depression slowed mechanization of all types.

The labor shortage which accompanied World War II created a demand for more economical methods of harvest. In some areas cotton producers turned to sleds and other forms of machine harvesters which could be made available. Machine companies, upon seeing this demand, intensified their efforts to develop and manufacture cotton harvesters. In recent years the use of machine harvesters has assumed a more rapid pace and by the fall of 1951, it was estimated by one source, that over 1500 commercial machine strippers were available in the cotton producing areas of Oklahoma.

Economical operation is being obtained with machine strippers. Good results are reported under Western Oklahoma conditions. One source

estimated savings of about $25 a bale from machine stripping as compared to hand snapping during the 1950 season. Stripper operators surveyed in 1951, indicated a substantial time saving from their machines during the 1950 crop. An average of 47.2 hours less time per bale was required for the strippers as compared with the time required by hand snapping.

In other states machine pickers are reported to be more economical than hand picking. Their use, however, has beem limited in Oklahoma.

A number of problems exist where the machine method is used for stripping cotton. These include both technical and economic problems. Some of the technical problems include wastage, loss in grade, adaptability of varieties for stripping, topography, dependable defoliation, and type of gin equipment. Some problems of an economic nature related to the adoption and use of the strippers as a method of harvesting include small scale farming, limited capital resources, low total degree of mechanization, and a lack of available opportunities for alternative utilization of labor in the area. The economic factors probably will exert a more important influence on the progress of cotton mechanization than will many of the technical problems. Increasing mechanization in areas where these problems exist probably will be gradual.

Mechanical harvesting has had some definite effects in those areas where it is utilized extensively. Influences have been felt on the marketing of cotton; larger and better equipped gins have been demanded; and the acreages in cotton have tended to increase.

Changing economic conditions could possibly influence the trend of mechanical harvesting in future years. However, continued expansion in those areas where mechanical harvesting is best adapted may be expected.

The present full employment conditions with relatively high prices are conducive to use of machine harvesters. Improvements in technology could further expand the areas of economical operation.

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APPENDIX

Appendix Table 1. Estimated Number of Strippers of All Types, Oklahoma by Counties, 1950 and 1951.

County	1950			1951		
	No. of Commercial Strippers	No. of Sled Strippers	No. of All Types	No. of Commercial Strippers	No. of Sled Strippers	No. of All Types
Roger Mills	6	150	156	32	200	232
Beckham	---	---	---	160 +	---	---
Harmon	75	30	105	136	35	171
Jackson	160	---	160	215	---	215
Greer	15	10	25	23	12	35
Tillman	61	---	61	160	---	160
Kiowa	---	---	---	278	80	358
Washita	89	25	114	157	40	197
Custer	6	150	156	80	250	330
Dewey	2	15	17	25	25	50
Blaine	2	---	2	37	2	39
Caddo	2	5	7	91	7	98
Comanche	4	---	4	25	---	25
Cotton	4	1	5	26	2	28
Jefferson	3	3	6	17	5	22
Stephens	---	---	---	12	---	12
Canadian	---	---	---	25 +	---	---
Kingfisher	2	---	2	20	4	24
Logan	2	---	2	6	---	6
Payne	---	---	---	5	---	5
McClain	1	---	1	2	---	2
Creek	---	---	---	1	---	1
Coal	2	---	2	1	---	1
Total*			1534			

Source: Preliminary Estimates Made by County Agents, Compiled by Errol D. Hunter, Cotton Specialist, Extension Division, Oklahoma A & M College, (Stillwater, Oklahoma), 1952.

* Estimates on stripper numbers were not given for Beckham and Canadian Counties. Errol D. Hunter, Cotton Specialist, of the Extension Division made estimates on the number of commercial machines in these counties. Therefore, the total number was complete only for the commercial machines.

Appendix Table 2. Use and Performance of 20 Cotton Strippers in Western Oklahoma, 1950-51 Crop Year.

Stripper No.	Acres Stripped	Bales Stripped	Bales Stripped Per Acre	Hours of Operation	Hours Per Acre	Hours Per Bale
1	16.0	6.0	.38	16	1.0	2.7
2	51.0	11.0	.22	75	1.5	6.8
3	54.6	42.0	.77	70	1.3	1.7
4	60.0	30.0	.50	60	1.0	2.0
5	89.0	26.0	.29	104	1.2	4.0
6	110.0	34.0	.31	45	0.4	1.3
7	120.0	25.0	.21	50	0.4	2.0
8	125.0	28.0	.22	40	0.3	1.4
9	164.0	92.0	.66	75	0.5	0.8
10	171.0	48.0	.28	176	1.0	3.7
11	230.0	65.0	.28	150	0.7	2.3
12	236.0	44.0	.19	80	0.3	1.8
13	251.5	50.0	.20	240	1.0	4.8
14	289.0	68.0	.24	310	1.1	4.6
15	430.0	115.0	.27	360	0.8	3.1
16	454.0	107.0	.24	285	0.6	2.7
17	500.0	195.0	.39	162	0.3	0.8
18	500.0	146.0	.29	480	1.0	3.3
19	520.0	80.0	.15	540	1.0	6.8
20	625.0	21.5	.03	200	0.3	9.3
Total	4996.1	1233.5		3518		
Average			.25		0.7	2.8

Source: Survey of Stripper Operators in Western Oklahoma, 1951.

Appendix Table 3. Custom Rates for Stripping and Hand Snapping, Oklahoma, 1950.

Rates Charged - Hand Snapping		Rates Charged - Machine Stripping		
Operator Number	Early Rates Before Machine Stripping Began	Later Rates After Machine Stripping Began	Per Hundred	Per Acre
1	$2.00	$2.00	---	-----
2	2.00	2.00	$1.25 to $1.50	-----
3	2.00	2.00	1.00	$2.00
4	2.00	2.00	---	-----
5	2.00	2.00	1.00	-----
6	2.00	2.50	1.00	-----
7	2.00	2.00	1.00 to $2.50	-----
8	2.00	2.00	1.25	3.00
9	2.00	2.00	1.00	-----
10	2.00	2.50	1.25	-----
11	2.00	2.00	1.00	-----
12	2.00	2.00	1.00	-----
13	1.50	2.00	1.00	3.00
14	2.00	2.00	1.50	-----
15	2.25	2.75	1.50	-----
16	2.00	2.00	1.00	3.00
17	2.00	2.00	1.00	-----
18	2.00	2.00	1.00 to $1.50	-----
19	2.00	2.00	1.00	-----
20	2.00 to $2.25	2.00 to $2.50	1.00	-----
21	2.00	2.25 to $2.50	1.00	-----
22	2.00	2.00	1.00 to $1.50	-----
23	2.00	2.00	1.00	3.00

Source: Survey of Stripper Operators in Western Oklahoma, 1951.

Index Table 4. Grade Index Used for Cotton.

EXTRA WHITE:		TINGED:	
Good Middling	105	Good Middling	94
Strict Middling	104	Strict Middling	91
Middling	100	Middling	82
Strict Low Middling	94	Strict Low Middling	75
Low Middling	85	Low Middling	68
Strict Good Ordinary	76		
Good Ordinary	70	YELLOW STAINED:	
WHITE:		Good Middling	86
		Strict Middling	81
Middling Fair	107	Middling	73
Strict Good Middling	106		
Good Middling	105	GRAY:	
Strict Middling	104		
Middling	100	Good Middling	93
Strict Low Middling	94	Strict Middling	91
Low Middling	85	Middling	84
Strict Good Ordinary	76	Below Grade	60
Good Ordinary	70		
SPOTTED:			
Good Middling	101		
Strict Middling	99		
Middling	93		
Strict Low Middling	83		
Low Middling	75		

Source: Cotton Quality Statistics, Production and Marketing Administration, United States Department of Agriculture, 1940-41. p. 2.

Quotation from above reference:

> Data showing index of grade are included for the first time. For comparative purposes the indexes of grade may be taken as overall measures of relative changes in the grade of cotton produced from year to year in a given area and of differences in grade of cotton produced in two or more areas. To construct this index, the three year (1937-39) ten-market average price of each grade of 15/16th-inch cotton was calculated. The average price of each grade was then divided by the average price for Middling White 15/16th-inch cotton. Expressing the results as percentages, the constant for Middling White equals 100 and those above and below Middling vary from 100.

Appendix Table 5. Comparison of Average Discounts of Cotton Marketed Early to Cotton Marketed Later in the Season. Dallas Market, 1947-48 through 1951-52.

Grade	Season	Rate of Discount		Average Discount Early	Rate of Discount		Average Discount Late
		Sept.	Oct.		Nov.	Dec.	
		(Nearest 10 Points)					
M(Sp)	1947-48	350	350	350	340	300	320
	1948-49	250	250	250	260	330	295
	1949-50	330	330	330	330	330	330
	1950-51	360	350	355	340	330	335
	1951-52	400	400	400	400	480	440
SLM	1947-48	150	150	150	130	100	115
	1948-49	130	130	130	130	130	130
	1949-50	200	210	205	230	230	230
	1950-51	240	280	260	210	230	220
	1951-52	230	180	205	180	210	195
SLM(Sp)	1947-48	730	680	705	710	680	695
	1948-49	850	850	850	850	800	825
	1949-50	750	800	775	900	770	835
	1950-51	580	530	555	510	440	475
	1951-52	500	500	500	500	660	580
LM	1947-48	500	500	500	430	430	430
	1948-49	550	550	550	550	500	525
	1949-50	450	530	490	590	520	555
	1950-51	430	450	440	350	300	325
	1951-52	370	390	380	380	490	435
LM(Sp)	1947-48	1200	1090	1145	1190	1040	1115
	1948-49	1250	1250	1250	1240	1200	1220
	1949-50	1150	1190	1170	1250	1010	1130
	1950-51	750	730	740	710	630	670
	1951-52	700	700	700	800	910	855
SGO	1947-48	1030	1040	1035	820	750	785
	1948-49	950	950	950	950	950	950
	1949-50	660	790	725	880	750	815
	1950-51	650	630	640	540	530	535
	1951-52	500	540	520	630	690	660

Source: Cotton Price Statistics, Production and Marketing Administration, United States Department of Agriculture (Dallas Market), for the years 1947, 1948, 1949, 1950, and 1951.

Appendix Table 6. Acreages in 1951-52, Actual and Probable Under Specified Conditions, Compared With Acreages in 1950-51 in Oklahoma.

Number of Operator	No. of Acres 1950	No. of Acres 1951	No. of Acres Planted-If No Stripper Possessed 1951	No. of Acres Planted-If No Strippers Were Available 1951
1	502.0	900	900	900
2	54.0	255	—	—
3	125.0	170	170	170
4	109.0	190	190	190
5	54.0	300	150	—
6	54.6	250	50 to 75	50
7	51.5	225	100	100
8	130.0	135	1/2 as much	—
9	89.0	120	—	—
10	76.0	190	190	190
11	36.0	58	Same	A Little Less
12	32.0	90	Same	None
13	120.0	240	240	40
14	175.0	150	150	—
15	94.5	270	—	1/2 as much
16	105.0	175	175	125
17	36.0	115	35	10
18	20.0	35	35	—
19	96.5	200	100	—
20	100.0	100	15	—
21	83.0	230	230	50
22	140.0	400	—	Not as much
23	220.0	180	Same	Same

Source: Survey of Stripper Operators in Western Oklahoma, 1951.

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THESIS TITLE: FACTORS AFFECTING MECHANICAL COTTON HARVESTING IN OKLAHOMA

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The content and form have been checked and approved by the author and thesis adviser. "Instructions for Typing and Arranging the Thesis" are available in the Graduate School office. Changes or corrections in the thesis are not made by the Graduate School office or by any committee. The copies are sent to the bindery just as they are approved by the author and faculty adviser.

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