Economic Aspects

of

MACHINE HARVESTING COTTON

In Oklahoma

THE PRESENT COSTS, and FUTURE PROSPECTS

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Bulletin No. B-364 April, 1951

What This Publication Is About

This bulletin reports the findings from a three-year study of the economic aspects of machine harvesting cotton in Oklahoma. This study was designed to find the answers to the following types of questions:

- ★ Are cotton harvesting machines practical from the cost standpoint?
- ★ Which type of cotton harvesting machines have been most profitable under Oklahoma conditions?
- ★ How much does it cost to machine harvest cotton?
- ★ How much value is lost in the cotton wasted by harvesting with machines?
- ★ How much is lost from the lowering of grades by machine harvesting?
- ★ Are any particular practices or varieties needed to obtain lower harvesting costs with strippers?
- ★ If cotton harvesting machines are practical, why are not more farmers using them?
- ★ What will cotton harvesting machines likely mean to Oklahoma farmers?

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Each year since 1944, more farmers have become convinced that cotton can be harvested satisfactorily with machines in Western Oklahoma. Cotton sleds* have been used to a limited extent for many years. About 10 or 12 cotton picking machines of the single row spindle-type have been brought into Oklahoma and tried, but most of them have been resold to farmers in other states. The factory built, roller-stripper type of machine is being increasingly used each year; and about 350 machines of this type were operated in Oklahoma in the fall of 1950.

Development of a practical cotton harvesting machine is generally expected to materially reduce the cost of harvesting cotton, as well as to reduce the labor required. Therefore, soon after factory-built harvesters began to be used in Oklahoma, Experiment Station economists began a study of the the costs and other economic aspects of machine harvesting of cotton in this State. This bulletin reports results of that study.

The information presented herein is based on personal interviews with: (1) Farmers who owned and operated cotton harvesting machines; (2) farmers who hired such machines on a custom basis; (3) gin managers who ginned machine harvested cotton and (4) implement dealers and others interested in harvesting cotton with machines.

The study began in the spring of 1948 and was continued through the following two harvest seasons.

Roller-type strippers are given major attention in this report,

* Cotton sleds are box-like devices mounted on sled runners or wheels with a stationary slot or slots (in the front) smaller than bolls, through which most of the stalks pass as the sleds are pulled through the fields. Most of the bolls are pulled off by the slots and remain in the boxes.

because they appear to be the most practical cotton harvesting machine in Oklahoma.

Figures given in the following pages are to be used only as indications or approximations, rather than specific costs. However, the figures given are the best now available, and they are accurate enough to be a useful guide if it is kept in mind that actual figures as reported by the people interviewed were in some cases much higher than the average and in others much lower.

Cost of Mechanical Harvesting

USING SLEDS

The rather limited data available indicates cotton sleds can be built for an average of about $60 per sled. This is a comparatively low first cost. However, other factors appear to more than offset the advantage of the low first cost. The estimates of cotton wasted by sleds averaged nine percent. This is almost four times the 2.5 percent estimated as wasted by hand snapping. At 1950 prices, the value of the additional cotton wasted by sleds over hand snapping would amount to about $4.35 per acre on ⅓ bale yields per acre.

Cotton sleds use less labor than hand snapping, but they use considerably more labor per acre than strippers and also require more work of the laborers. Three men are needed to operate a two-row sled in cotton making good yields. Sleds require about two and 2/5 hours labor per acre on cotton yielding ⅓ bale per acre.

It was found that the grades of sledded cotton averaged one-fourth of a grade lower than similar cotton that was hand snapped.* This was about three times as much as the reduction in grades by the machine stripper on cotton harvested at the same time. Ginning costs will also be considerably higher on most sledded cotton than for machine stripped cotton because of the greater amount of trash and limbs. In spite of the higher costs, however, sleds may stage a "comeback" as an emergency measure in 1951 or 1952, if an adequate number of machine strippers is not available.

USING MACHINE PICKERS

The data available on machine pickers on farms in Oklahoma are

* "Oklahoma Farmers Find Cotton Stripping Profitable," *Current Farm Economics*, Oklahoma Agricultural Experiment Station. Volume 22, October, 1949. pp. 144-145.

rather limited, and that part of the existing data which have been collected is inadequate for making estimates or approximations on costs.

Data obtained on a spindle-type cotton picking machine under experimental conditions at the Cotton Research Experiment Station at Chickasha, Oklahoma, showed "The picker offers no definite advantage over hand harvesting until yields of three-fourths to one bale per acre are obtained.* Furthermore, that data indicated it cost several dollars more per acre to harvest cotton with the picker than by hand where the yield was ⅓ bale per acre.

Studies made in other states on the costs of machine picking cotton under farm conditions reported costs of from about $30 to $50 per bale, varying largely with yields (of around a bale per acre) and the volumes harvested per picking machine, per season.** The costs of harvesting cotton with picking machines rise rather rapidly per bale as yields decrease below a bale per acre. Cotton picking machines available when this study was made covered only a single row at a time. They have a high capacity for high yields per acre, but tend to be limited to an area of around 200 acres per season. These characteristics of the present cotton picking machines tend to prohibit or at least restrict their use in Oklahoma.

USING ROLLER-TYPE STRIPPERS

Operating Costs

The survey on strippers used in the 1947-48 season indicated cotton stripping cost about $1.43 per acre that season when about 250 acres

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* W. J. Oates and R. H. Witt, "Engineering Management Aspects of Mechanical Cotton Harvesting in the Southwest," *Agricultural Engineering*, Vol. 30, No. 10, pp. 492-495, October, 1949.

** In "Mechanical Harvesting of Cotton in North Carolina" by Sutherland and James, Progress Report (preliminary) Information Series 22, 1950, Department of Agricultural Economics, North Carolina Agr. Exp. Sta., the costs of picking cotton with machines were reported as $40 per acre and $48 per bale in 1948.

In Mississippi Agr. Exp. Sta. Bul. No. 465, "Mechanical Cotton Picker Operation in the Yazoo-Mississippi Delta" the total cost of machine picking cotton in 1947 was reported to be $35.67 per bale and on the basis of the 1948 price of picking machines the cost would have been $39.13 per bale.

In California, Burlingame and Burley reported in "Cost of Harvesting Cotton With Mechanical Pickers in California, 1948" that it cost $29.98 per bale to machine pick California cotton.

Bruner and Stanley, in Mimeo. Circular No. 117, "Cost and Utilization of Mechanical Cotton Pickers in the Delta Cotton Areas of Louisiana, 1948 and 1949" reported the costs of machine picking cotton at $31.72 per bale in 1948 and $33.99 in 1949.

yielding an average of about 1/10 bale per acre were harvested with one stripper.*

Some adjustments need to be made to bring the 1947-48 season costs up to date. The current prices of strippers and repairs are higher. Some of the other costs are higher. It appears that an estimate of $2 per acre for the items included in the $1.43 for 1947-48 is a reasonable estimate for the 1950-51 season on cotton averaging about one-fifth to one-third bale per acre.

Higher yields would cause somewhat higher costs per acre because of the slower rates of travel, more labor used, and more cotton to dispose of. Smaller than average fields, contoured rows, etc., also cause higher costs. Conditions are assumed to be average in making the above estimate.

The cost of operating strippers on a per bale basis is also closely related to yields per acre but is not directly proportionate to yields. For example, the costs of operating a stripper on 250 acres yielding 1/10 bale per acre is probably about $16 per bale; on cotton making a yield of ⅓ bale per acre those costs would probably total around $6 per bale.

Cost of Wasted Cotton

The estimates of the cotton wasted by machine strippers also varied over an extremely wide range. For the 1947-48 season, the highest estimate of cotton wasted by strippers was 15 percent. The operator who made that estimate also estimated 5 percent was wasted by hand snapping. He stripped varieties generally rated only fair for machine stripping. The lowest estimate was ¾ of one percent for stripping and ½

* John D. Campbell, "Oklahoma Farmers' Experiences With Cotton Strippers," Oklahoma Agricultural Experiment Station Bul. No. B-324, pp. 11. Since that publication is now out of print, Table II from it showing costs is reprinted below.

TABLE II.—ESTIMATED AVERAGE COST PER ACRE OF STRIPPING COTTON IN THE 1947 SEASON.

Cost Item	Cents Per Acre	
Depreciation*	35.0	
Interest on investment at 5 percent*	08.7	
Estimated average repairs per year	09.5	
Estimated total for stripper		53.2
Tractor fuel (¼ gallon per acre at 14½¢)		09.7
Cost of labor**		80.0
Estimated average cost per acre		1[illegible]
		or $ 1[illegible]

* Based on $875, the average cost per stripper as found in the 1947 survey, an estimated life of 10 years and harvesting 250 acres per year.

** Two men harvesting 17 acres in 8 hours at an average of 85 cents per hour.

of one percent for hand snapping. The operator who made the latter estimate stripped one variety generally rated good to best for machine stripping and two other varieties usually rated poor to good.

Only 13 of the 63 operators who gave estimates on waste thought that strippers wasted over 5 percent of the cotton. Twenty-four estimated that the cotton wasted by strippers and by hand snapping was the same, and five operators thought waste was less for the strippers. The other 21 thought that strippers wasted a low percentage but more than hand labor. Many of the operators stripped varieties not especially adapted to stripping. The estimates of waste obtained on the 1947-48 season averaged 4.3 percent, or 1.7 percent greater waste for strippers than the 2.6 percent for hand snapping.

The estimates of waste in the 1948-49 season averaged 5.3 percent for strippers, which was 3.0 percent above the 2.3 percent average estimated waste by hand. Combined estimates of stripper waste for the 1947-48 and 1948-49 seasons averaged 2.4 percent more than for hand snapping.

The additional cotton wasted on the basis of 2.5 percent greater waste by strippers (allowing a slightly greater amount than the indicated difference) on cotton yielding one-third of a bale per acre when stripped, the waste would amount to about 17 pounds of seed cotton per acre. On the basis of the 1950-51 prices this amount would be worth about $1.70. The cotton wasted by strippers is often deceiving, since it appears much more important than it proves to be when checked.

Comments of the farmers who gave the estimates indicated that the percent of cotton wasted by strippers can be materially reduced by (1) Using storm resistant varieties, (2) stripping as soon as ready, and (3) skillful operation of strippers. The last plowing was reported most satisfactory for strippers when it left the stalks on a slight ridge and the middles flat or with furrows for the drive wheels of tractors and a "guide ridge" for the front wheels. These conditions allow for more control of the stripper and thereby reduce waste.

Cost of Lowered Grades

A large majority of stripper operators and gin managers interviewed on 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.*

* Ibid., p. 9.

In the 1948-49 season data were obtained on specific bales of stripped, sledded and hand snapped bales. That information covered grades and staples of 928 machine stripped bales, 311 sledded bales and 8,173 hand snapped bales. A comparison of the grades* of these groups, using grade index numbers, indicated that the machine-stripped bales averaged only about one-twelfth (1/12) of a grade lower than the hand snapped bales.** The value of one-twelfth grade would vary with the premiums, discounts, and the level of grades where it exists, but it would usually be a comparatively small amount per bale. In the previous report† it was found to amount to $0.83 or $1.67 per bale, depending on the market prices used for calculations. On current (January, 1951) market discounts, it would be less than $1 per bale.

The information obtained on the 1949-50 crop included grades on 516 bales of cotton from fields harvested entirely with machine strippers—none being hand snapped. The grades of these bales averaged slightly less than one-third of a grade below the grades of cotton as estimated for Western Oklahoma (District 1) by the U. S. Department of Agriculture. On the basis of current quotations (January, 1951) on the Dallas market, 15/16 inch staple, and at the average level of grades found for the machine stripped cotton, the discount for one-third of a grade would amount to about $1.25 per bale. The 1949-50 season was favorable for good grades from both machine stripped and hand snapped cotton.

The specific information obtained on grades for the 1948-49 and 1949-50 seasons, together with the opinions obtained on the 1947-48 season, indicate that machine stripping lowered the grades only a fraction of a grade in those seasons. On the basis of these seasons it appears that the value of the loss from the lowering of grades may average less than $3 per bale, or less than $1 per acre, on cotton yielding one-third of a bale per acre.

Cost of Ginning Machine-stripped Cotton

Conditions have been unfavorable in the three seasons studied for collecting representative figures on the amounts of stripped seed cotton required per bale and the ginning charges of it. Observations indicate considerable fluctuations in such data. For example, after the severe

* Information on grades of specific bales for this study was provided by the Altus and Oklahoma City Cotton Classing Offices of the Cotton Branch, PMA, USDA.

** "Oklahoma Farmers Find Cotton Stripping Profitable," an article in *Current Farm Economics*, Okla. Agr. Exp. St. Vol. 22, October, 1949, pp. 144-145.

† Ibid., pp. 144-146.

sandstorm in the 1948-49 season, it took several hundred pounds more of the hand snapped cotton, including dirt, at many gins to make a 500-pound bale than it did of machine stripped cotton. The conditions apparently have been reversed more than once. It seems reasonable to estimate an average of not to exceed $1 per bale extra charges for ginning machine stripped cotton. This may be excessive, since several farmers and ginners report cases where fewer pounds of machine stripped cotton than of hand snapped are required per bale.

Total Costs of Machine Stripping

As previously mentioned, the volume of acres and/or bales harvested with strippers has a very important influence on costs. It appears that an estimated average total cost of about $15 per bale or $5 per acre can be expected for machine stripping average Western Oklahoma cotton under the 1950-51 season price levels (not including tractor costs except fuel). This estimated average includes some operators who had costs equal to or exceeding the cost of snapping (about $40 per bale) because of low volumes stripped and/or for other reasons. It also includes costs of some operators considerably below the average, even to less than $10 per bale.

COMPARATIVE COSTS OF DIFFERENT METHODS

Significant differences exist between the costs of harvesting cotton by different methods (Table I). The cost of harvesting with strippers was only about one-third as much as for hand snapping, and much lower than for any other method. Harvesting cotton with the spindle-type picking machine would have involved the highest cost on yields of ⅓ bale per acre. It appears from Table I that cotton sleds can be used at a lower cost than hand labor or picking machines, but the costs shown in Table I do not include the extra cost to gins of ginning sledded cotton. Some sledded cotton has a large proportion of limbs mixed with the cotton and costs the gins a great deal more to gin it. This extra expense would have to be met by someone and would need to be included to arrive at a fully comparable figure. However, some sledded cotton is ginned about as easily as hand snapped cotton.

Hand snapping involves some factors often not included in costs, such as those in Table I. For example, some farmers have built houses primarily for use of laborers picking cotton for them. Sometimes farmers transport hand pickers and spend considerable time and money getting pickers to work for them. And sometimes they cannot obtain

Table I.—Estimates of Costs and Labor Required Per Acre and Per Bale for Harvesting Western Oklahoma Cotton by Hand and With Machines, 1950 Season. (Based on yields of ⅛ bale per acre).

Method	Per Acre		Per Bale	
	Costs	Hours	Costs	Hours
Hand snapping	$13.34	16 2/3	$40.00	50
Sledding with cotton sleds, 3-man crew	10.60*	2 2/5	31.80*	7 1/5
Stripping with factory built cotton strippers	5.05**	1	15.15**	3
Picking with spindle-type machine picker	20.00†	2	60.00†	6

* Estimate of cost of sledding is composed of the following items per acre: 6.5 percent more waste than hand harvesting at 10 cents per pound for hand snapped seed cotton equals $4.35; 2 2/5 hours labor at 85 cents amounts to approximately $2; loss on grade $3 (based on three times the loss on machine stripped cotton); extra ginning on 250 lbs. per acre equals about $1.25. This does not include any allowance for extra cost to ginner of ginning sledded cotton.

** Estimate of cost of machine stripping is composed of the following items per acre: Items included in Table 11 of footnote on page 7 adjusted to 1950 level and ⅛ bale yield (or stripper costs), $2; waste of 2.5 percent more than hand snappnig at 10 cents per pound for hand snapped cotton, $1.70; loss of ⅛ grade, $1; and cost of extra ginning charges, 35 cents.

† Based on an estimated operating cost of $10 per acre (which is close to the operating costs found by the Agricultural Engineers in experimental tests) and 20 percent waste or 17½ percent more waste than by hand. The spindle-type picker has been reported to waste around 8 to 10 percent of the cotton but the higher proportion was used to allow something for the partly opened bolls that would not be harvested by the picker in Oklahoma a good many years.

adequate numbers of hand pickers at going rates, and increased rates bring out few if any more workers.

Besides the four methods included in Table I, it would be possible physically to harvest Oklahoma cotton the first time with a spindle-type picking machine and then complete the harvest later with a stripper. This combination method was not found in use by any farmer interviewed in these surveys. Tests on an experimental basis at the Cotton Research Station at Chickasha indicated this combination method cost considerably more on cotton yielding ⅛ bale per acre than it cost to hand harvest it.*

Strippers require only about one-sixteenth as much man labor as does hand snapping. Strippers also use much less labor than the other methods. Furthermore, it appears that strippers may soon require less labor than is indicated in Table I.

The Outlook for Mechanical Harvesting

POSSIBILITIES FOR REDUCING COSTS

The wide range in the costs for machine stripping cotton, from less

* Op. cit., Oates and Witt.

than $10 to over $40 per bale, suggests that several possibilities exist for reducing the costs.

One of the most promising means of reducing costs is by increasing the volume harvested per machine. Many Oklahoma farmers have found custom stripping operations an easy way to increase the volume harvested, and also very profitable. Increasing volumes per machine greatly reduces the overhead expenses. For example, if depreciation and obsolesence are $100 per season, and 10 bales are harvested, these items alone average $10 per bale. But if 100 bales were harvested these items would amount to only $1 per bale. Cotton strippers are durable machines and will likely decline in value considerably faster from obsolesence than from wear.

Some operators reported that the addition of a fan on the elevator reduced the need for, or even eliminated, the worker commonly used in the trailer, and had other advantages also.

Regular stands of closely spaced plants reduce the "choke-ups" of strippers and speed up their operation, thereby reducing the costs. Almost three-fourths of the operators interviewed on the 1948 season preferred spacings of from 2 to 6 inches between plants when the cotton was to be stripped. Some farmers are finding it necessary to plant more pounds per acre of the larger seeded varieties, such as Lankart, in order to get as thick stands as they want for stripping. Regular stands of close spaced plants also reduce the limbs harvested with the cotton.

Stripper operators prefer certain varieties for stripping because of the lower waste before and while stripping and the consequent lower cost. Several operators estimated that the waste in the fields was no greater when varieties adapted to stripping were stripped than is normal for hand snapped cotton. The ratings for stripping as given by stripper operators on the more common varieties is shown in Table II. The comments given by the stripper operators, along with the ratings, indicate that any of the varieties commonly grown in Western Oklahoma can be harvested with strippers; but important advantages have been found in some varieties compared to others in both the physical operation of strippers and in the amount of cotton wasted.

Considerably higher grades were obtained from cotton harvested entirely by strippers in the first half of the stripper season than in the latter half, as reflected by the grade indexes in Table III. The highest grade indexes were approximately the equivalent of one grade higher than the lowest. Furthermore, the grade indexes of the cotton harvested

entirely with strippers at the optimum time averaged slightly higher than the grades of all cotton harvested in Western Oklahoma as estimated by the U. S. Department of Agriculture, and about 95 percent of that cotton was harvested by hand. It appears that most of the loss in lower grades from stripping can be eliminated by choice of varieties and by harvesting as soon as the cotton is ready after frost.

Experience and skill gained in the operation of strippers will also help reduce the costs. For example, some operators reported that the proper adjustment of rollers reduced the "bark" trash in cotton and thereby improved grades and also reduced "choke-ups" of the strippers.

It is reasonable to expect that the total costs of harvesting cotton with strippers can be reduced to between $5 and $10 per bale by many operators if not by most of them.

LIMITATIONS ON RAPID ADOPTION OF STRIPPERS

While the current models of cotton strippers tend to be restricted to use on cotton stalks not over 30 to 36 inches high, a great deal of cotton is still hand snapped that could be machine stripped. In view of the comparative costs, the question naturally follows, "Why are cotton strippers not more generally used?"

The farmers interviewed reported that the most important limita-

Table II.—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	[illegible]	[illegible]	[illegible]ting*		
D. & PL. (or Deltapine)	None	1	10	8	19
Half & Half and Hi-bred	7	14	35	45	101
Lankart 57	60	43	9	3	115
Mebane 140's (Locket 140 & Marv-L-S-Cluster)	16	32	22	14	84
Macha	27	10	3	None	40
Northern Star	13	48	38	15	114

Table III.—Grade Indexes by Weeks of Cotton Harvested Entirely With Strippers as the 1949 Season Progressed.

	Weeks of 1949 Harvesting Season With Strippers*											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	Av.
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

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

tions were (1) Lack of information as to what the strippers would do and (2) lack of information on what could be expected from the varieties that are adapted to harvesting with strippers. Very few of the stripper owners were interested in selling their strippers, and they expect a rapid increase in the number of strippers used as farmers become more familiar with what can be done with them. They expect increased use of strippers both for harvesting the latter part of crops and for harvesting entire crops. Availability of strippers will likely be a limiting factor in 1951 and 1952.

The names of several farmers who harvested some cotton entirely with strippers are listed in Appendix A.

PROBABLE EFFECTS ON COTTON PRODUCTION

It takes an average of around 16 man hours to hand snap an acre of Western Oklahoma cotton making about one-third of a bale. Two men with a tractor and stripper can harvest that amount in approximately half an hour; that is, with about one man-hour of labor. (A loading device such as a fan on an elevator apparently would reduce that by almost half.)

One of the most important effects that machine strippers will have on Oklahoma cotton production is not evident in the cost figures. It is this: The stripper frees the farm family from dependence on outside labor to harvest the cotton crop; one family can now harvest as much cotton as it can raise. Farmers who are not yet convinced that it pays to strip the entire crop at least have assurance that they can save most of the crop in case of an extreme labor shortage. The release from dependence on outside labor, together with the lower costs involved, apparently provide conditions that permit farmers in Western Oklahoma to increase their production of cotton easily and profitably.

The foregoing factors, and perhaps others such as better methods of controlling insects, may also permit farmers in Northeastern Oklahoma to also increase their cotton production, especially on prairie uplands.

APPENDIX A

A List of Some of the Farmers Who Used Strippers to Harvest All or Some Cotton in the 1949 Season:

Names	Addresses
Alvin Neal	Willow
Elland Anderton	Rt. 2, Carter
Levi Taliaferro	Rt. 3, Elk City
Austin Morrow	Moorewood
C. H. Alders	Rt. 2, Hollis
P. E. Copeland	Lone Wolf
Johnny Little	Strong City
Floyd Mace & Brothers	Rt. 2, Carnegie
Coy Brown	Rt. 1, Reed
O. D. & F. E. Nix	Rt. 3, Elk City
B. M. & K. E. Hager	Planters Gin, Elk City
George Green	Rt. 1, Erick
J. L. Anderson	Rt. 2, Mt. Park
Aubrey Haynes	Rt. 3, Elk City
H. T. Funk	Waurika
Wayne Clark	Willow

This list does not include all of those who harvested cotton entirely with strippers in 1949. Apparently a larger number of farmers harvested some cotton entirely with strippers in 1950, and the practice appears likely to increase rapidly.