Mechanical Methods of Harvesting Irrigated Cotton in Oklahoma

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The cotton acreage in Oklahoma planted to picker varieties has increased considerably within the past decade. The picker varieties are usually from one to three-sixteenths of an inch longer in staple than stripper varieties and therefore normally have a higher market value. Some picker varieties have the storm resistance and compact plant growth necessary for stripper harvesting. This study was made to determine if stripper harvesting of these picker varieties would be profitable.

Nature of Tests

Three methods of harvesting picker varieties of cotton and one method of harvesting stripper varieties were compared. The harvest methods were:

A. Machine pick in mid-season and again after frost (picker varieties).
B. Machine pick in mid-season and stripper scrap after frost (picker varieties).
C. Machine strip after frost in a once-over operation (picker varieties).
D. Machine strip after frost in a once-over operation (stripper varieties).

These methods were compared each year, 1959 through 1963, except in 1960 when the second picking was omitted because no open cotton remained on the plants. Appropriate adjustments of the 1960 data were made to compensate for this omission.

The cotton was grown under irrigation at Altus and ginned at the Oklahoma Cotton Research Station, Chickasha. Harvesting was performed with tapered-spindle pickers and brush-roll strippers. No field data were taken other than the area harvested by each method. Ginning, fiber, and classification data were used in evaluating the various harvesting methods.

Research reported herein was done under Oklahoma Station project numbers 578 & 753.

Test Cotton

Acala 44 was the picker variety planted each year; but the field was replanted to Austin in 1960 following a June hailstorm. Western Stormproof was the stripper variety planted the first three years of the tests; but the area was replanted to Paymaster 101 in 1960. Paymaster 101 was the stripper variety planted during the last two years of the tests.

Growing conditions were very favorable in 1959, 1961, and 1963, resulting in yields of approximately 1½ to 1⅞ bales per acre for both the picker and stripper varieties. In 1962, late-season insect damage reduced the yields of both varieties to approximately ½ bale per acre. In 1960, the late planting and a defoliating hailstorm in mid-October limited the yield of Austin to approximately ½ bale per acre. But under the same conditions in 1960, the earlier maturing Paymaster 101 yielded 1⅓ bales per acre.

Procedures

In four years of the tests, all cotton was defoliated (by hail in one instance) 10 to 25 days before the initial machine picking. In the fifth year, all harvesting was performed without defoliation. The initial picking was made each year between Oct. 9 and Nov. 12, depending upon the condition of the plants. The second picking, stripper scrapping, and once-over stripping were all performed after frost two to seven weeks after the initial picking.

One bale of cotton from each method of harvest was ginned with 11 cylinders of screen cleaning, extraction, and two-stage lint cleaning, except in 1959 when only seven cylinders of screen cleaning were used with picked cotton and only single-stage lint cleaning was available. Drying was used as necessary to maintain lint moisture contents in the five to seven percent range. In most years, the speed of the first cylinder of the airline cleaner was increased with stripped cotton to provide additional boll opening.

Samples were taken from each bale of harvested material to determine initial moisture content and the amount and kinds of foreign material. While ginning each bale, seedcotton samples were taken at various stages in the cleaning process and lint samples were taken from the lint slide. Lint classifications were obtained from a cotton classing office of the U.S. Department of Agriculture. Lint values were determined from the classification data and Commodity Credit Corporation loan schedules.

An analysis of variance was made each year of the data obtained from the various samples.

Returns to the producer were computed for each method of harvest, taking into account differences in yields of lint and seed, harvesting costs, and ginning and bagging fees. Production costs were not deducted from returns; they were assumed equal for all harvest methods. Custom rates in the Altus area were used to assess harvesting costs and standard commercial rates were used for ginning and bagging fees.[1]

Results

Although the results were analyzed statistically each year, they were combined in many instances to simplify their presentation and discussion. Those attributes of importance to economic evaluations were measured every year; some measures of fiber quality were not taken every year.

The results are presented as bar graphs in Figures 1 through 17. The vertical line within each bar represents the average value of the attribute over all years in which it was measured. The right and left ends of each bar represent the highest and lowest mean values. These graphs portray the variability as well as the average performance of each harvest method.

The most obvious differences among harvest methods occurred in the burr and stick contents of the harvested material. In the gin, removing burrs from stripped cotton is no problem but it is sometimes difficult to adequately remove sticks. Stripper scrapping harvested many more sticks than did once-over stripping (Figure 1), presumably because the previous operation of the picker broke or damaged some plant limbs making them more susceptible to removal by the stripper rolls. The relationship among harvest methods in stick content was little changed by the gin cleaning machines (Figure 2).

The high stick content of the stripper scrapped cotton resulted in barky lint grade designations each year for 33 to 100 percent of the samples from this method. No lint samples from other harvest methods were designated barky. The effect of other harvesting methods on lint grade were not consistent during the five harvest seasons. In many instances, lint from once-over stripping was one grade lower than from picking. But in a few instances, once-over stripping produced as high

[1] Custom harvesting rates: Picking—$0.06 per pound of gross bale weight.
Once-over stripping—$0.03 per pound of gross bale weight.
Stripper scrapping—$0.01 per pound of harvested material.
Ginning fees: $0.65 to $0.70 per hundredweight of harvested material.
Bagging fees: $4.00 to $5.00 per 500-pound bale.

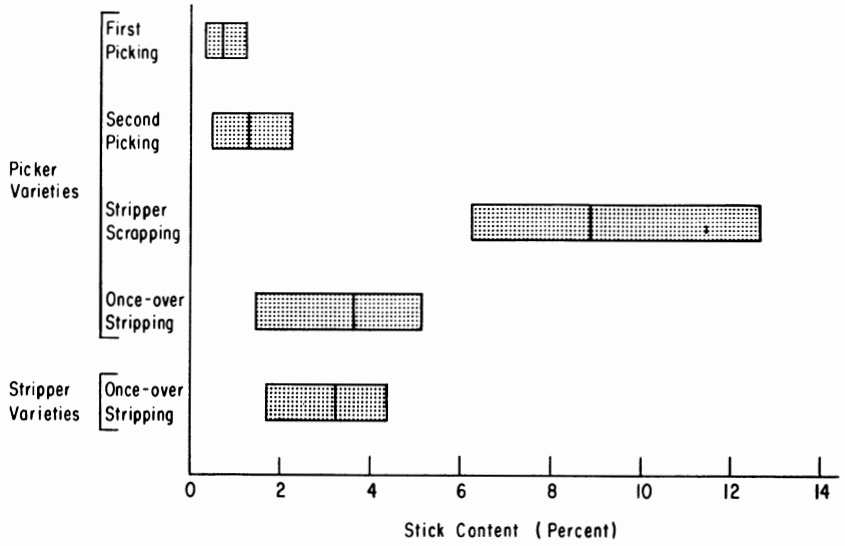

Figure 1. Stick content of harvested material.

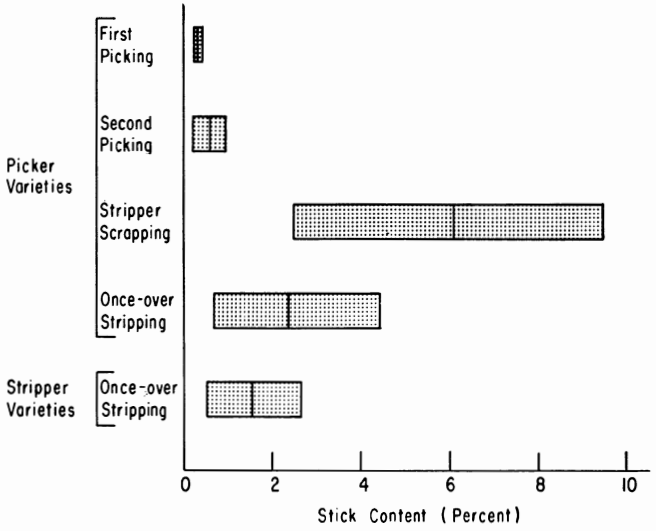

Figure 2. Stick content of material entering gin stand.

or higher grades than picking. Lint grades in these experiments ranged from Low Middling Spot to Middling (Figure 3).

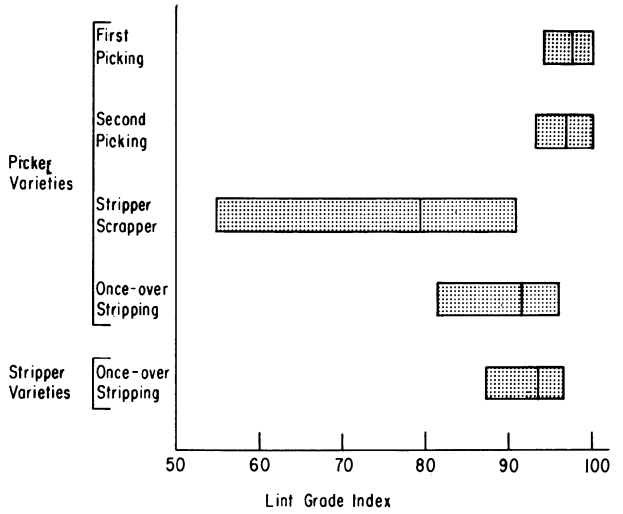

Figure 3. Lint grade.

Harvesting the picker varieties with a stripper, in either the once-over or scrapping operation usually resulted in approximately 1/32-inch staple length reduction compared to harvesting with a picker (Figure 4). This is assumed due to the non-selective harvesting by strippers and the consequent inclusion of short, wasty fibers from immature bolls which would be rejected by the picker spindles. Despite this reduction, the

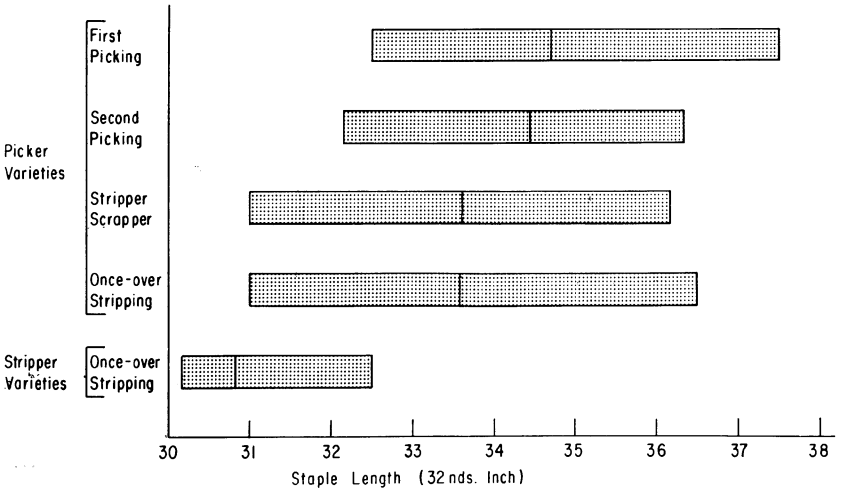

Figure 4. Staple length.

picker varieties harvested by stripping yielded lint approximately 3/32 inch longer in staple than the stripper varieties.

Because of longer staples and frequently higher grades, the government loan value of machine picked lint averaged approximately 3 cents

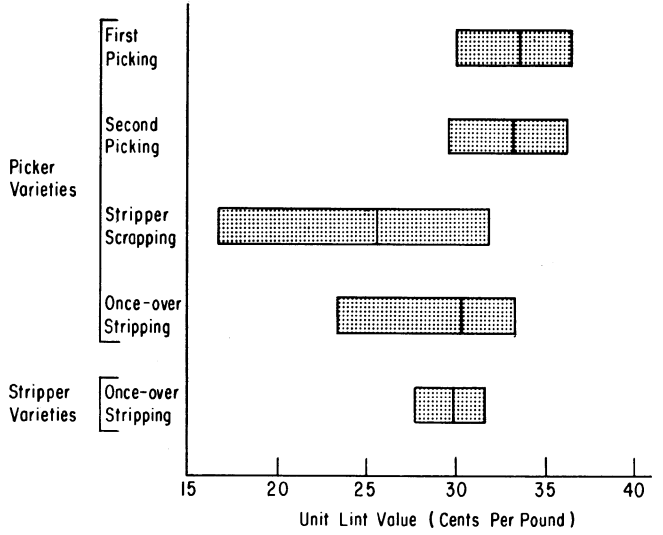

Figure 5. Lint value.

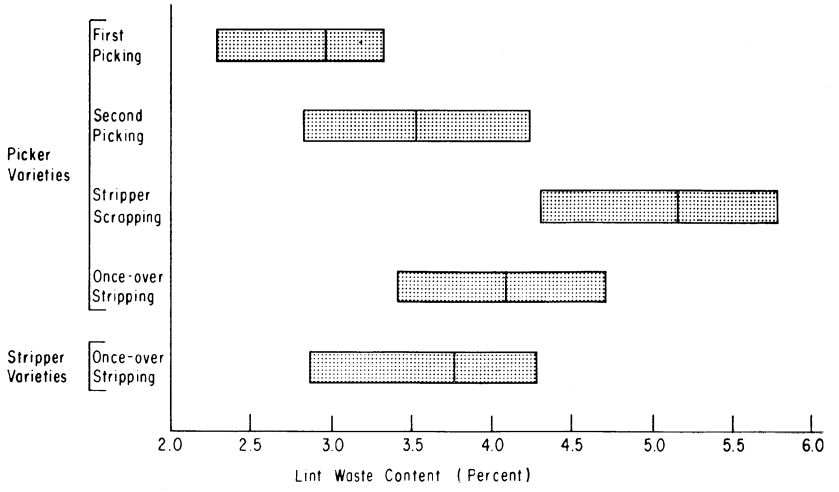

Figure 6. Lint waste.

per pound higher than that of lint harvested by once-over stripping (Figure 5). The value of stripper scrapped lint was severely penalized in some seasons by the presence of bark.

The relative response of lint waste content to harvesting method varied widely from season to season. In general, however, the lowest lint

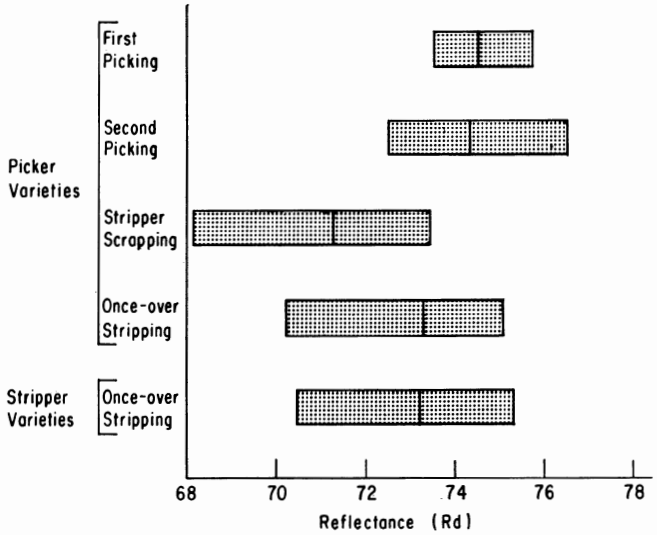

Figure 7. Lint reflectance.

waste contents were from machine picked cotton, and the highest were from stripper scrapped cotton (Figure 6).

As would be expected, the pattern of lint reflectance (Figure 7) among harvesting methods was similar to that of lint grade. The relatively high degree of lint yellowness associated with stripper scrapping is believed due to the high proportion of immature bolls normally harvested by this method (Figure 8). The high lint yellowness associated with the initial machine picking is probably due in part to a lint discoloration in 1963 arising from a high moisture content in the harvested material, and over-night trailer storage prior to ginning.

Fiber coarseness was apparently related to the relative proportions of mature and immature bolls available for harvest by each method (Figure 9). Once-over stripping resulted in intermediate fiber coarseness because bolls of all degrees of maturity were harvested. A similar response to harvest method is indicated for measures of fiber strength and length

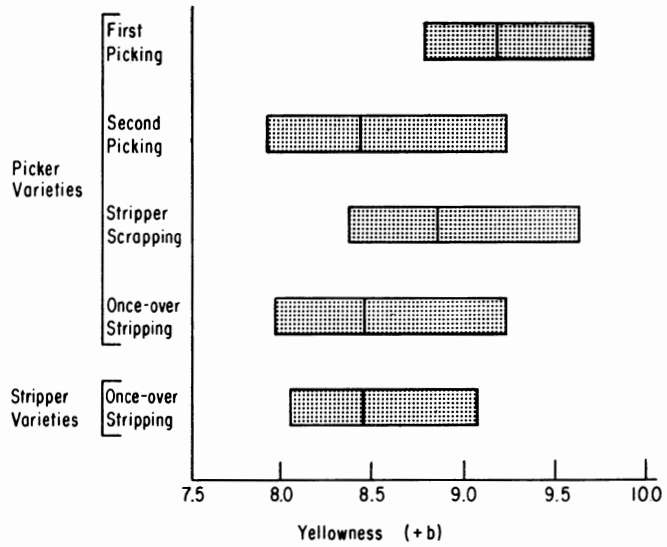

Figure 8. Lint yellowness.

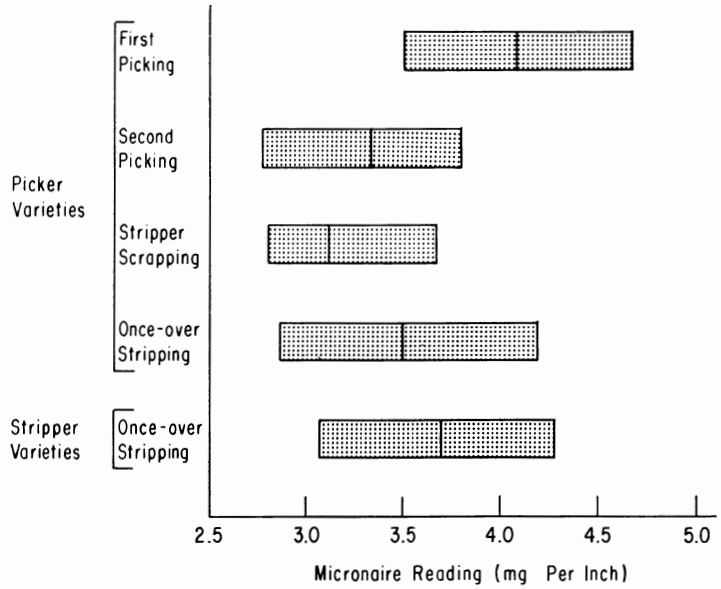

Figure 9. Fiber coarseness.

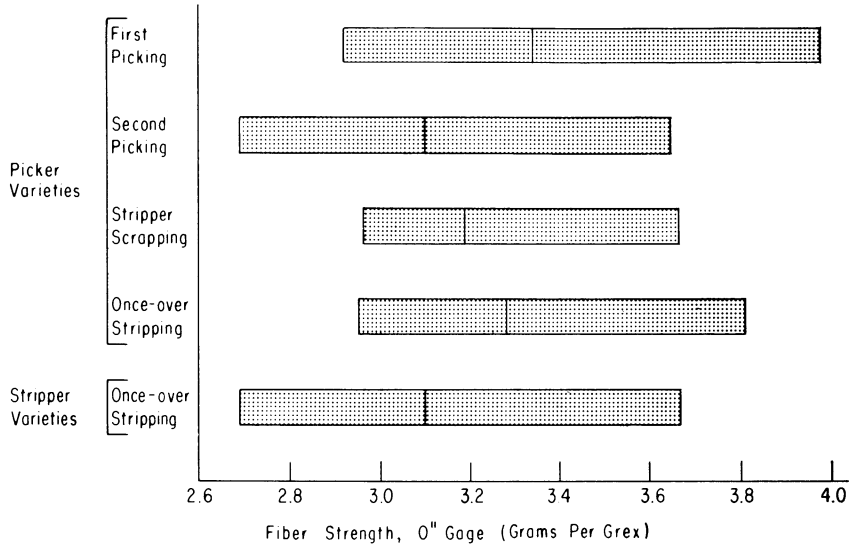

Figure 10. Fiber strength.

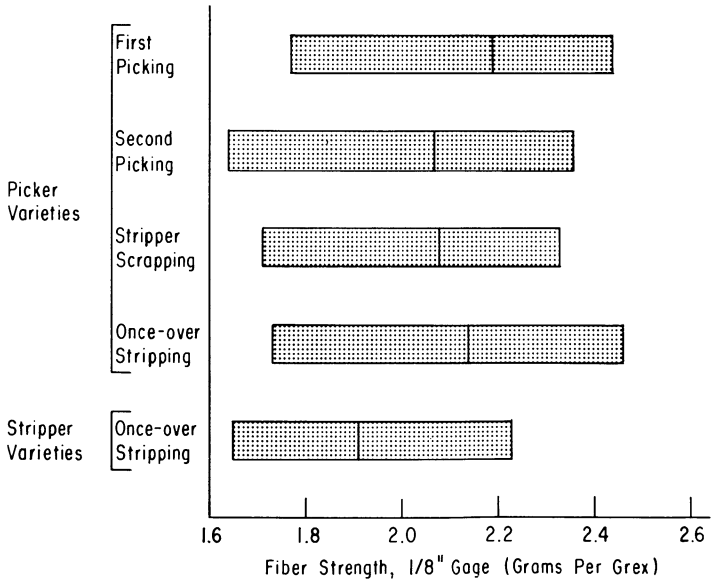

Figure 11. Fiber strength.

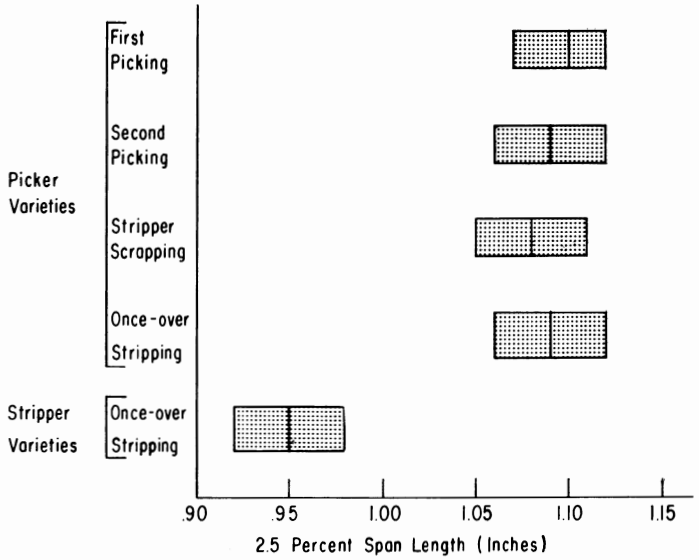

Figure 12. Span length.

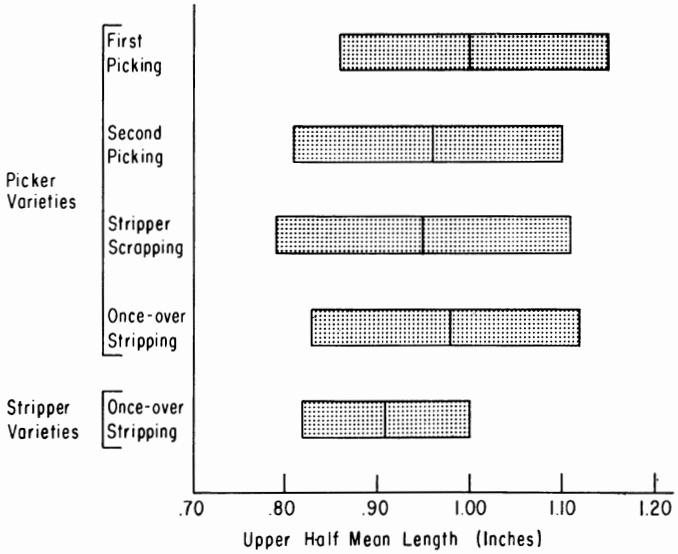

Figure 13. Upper half mean length.

for picker varieties (Figures 10 through 13). The relatively low performance of the stripper varieties in fiber strength and length is believed to be due primarily to varietal characteristics.

The relation between harvesting method and ginned lint yield followed three general patterns. In the years of favorable growing conditions, once-over stripping of a picker variety out-yielded the double picking method and the combination picking-stripping method by 135 and 54 pounds per acre respectively. This was due to the higher harvesting efficiency normally expected with strippers. Lower efficiencies for pickers accrue from green boll damage or loss at the first picking, failure to harvest seedcotton from inadequately opened bolls and higher ground and plant losses from mature bolls. Once-over stripping of stripper varieties also yielded more lint than any picker method of harvesting a picker variety.

In 1960, the season which favored the early-maturing stripper variety because of late spring and autumn hailstorms, once-over stripping of the stripper variety yielded almost double the lint obtained from any method of harvesting the picker variety. This unusual combination ot climatic factors and varietal characteristics would be expected to occur only rarely.

In 1960, the combination picking-stripping method of harvesting a picker variety yielded almost 100 more pounds of lint per acre than once-

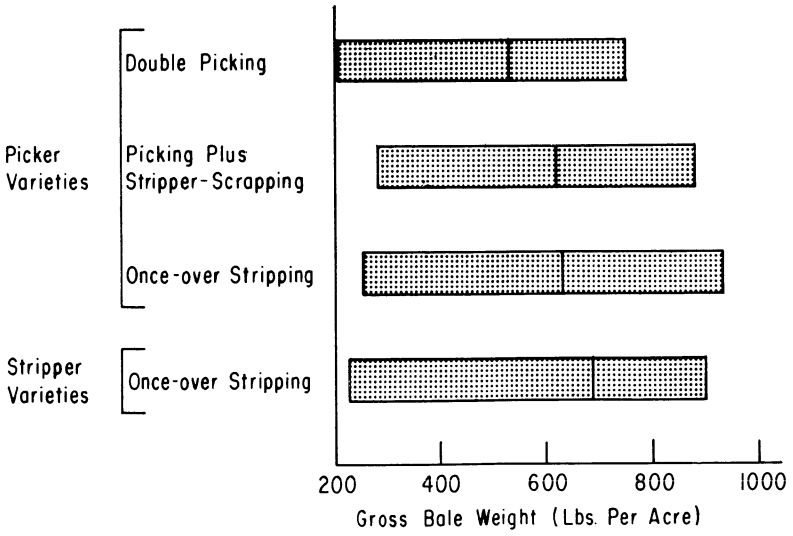

Figure 14. Lint yield.

over stripping. In 1962, another year of low yields, the combination picking-stripping method of harvesting a picker variety yielded more lint than any other method of harvesting either variety.

Average yields for the 5-year period are shown in Figure 14.

The yield of ginned seed was assumed a constant percentage of ginned lint and would therefore parallel the yields of lint for the various seasons and harvest methods.

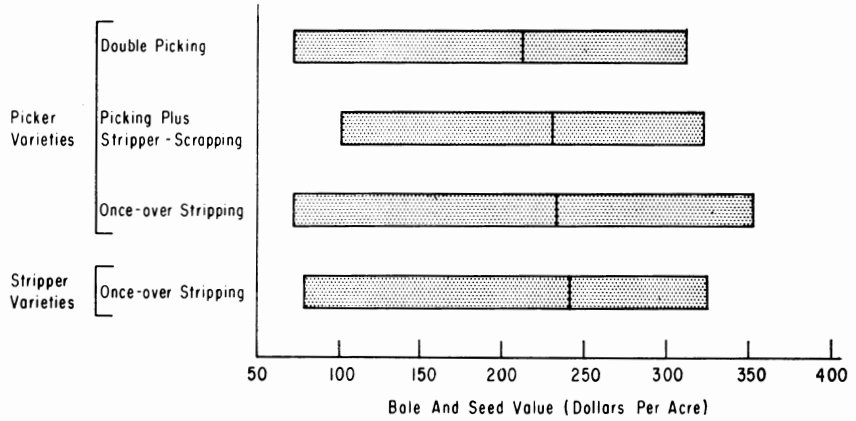

Figure 15. Gross sales.

The gross acre value of lint and seed (Figure 15) appears to be primarily a function of ginned lint yield, even though grade and staple variations somewhat modified this relationship.

Acre returns (gross value of lint and seed, less harvesting, ginning and bagging fees) were also closely related to ginned lint yields for the various harvest methods. In the seasons of normal yields, the advantages of longer staple lengths, frequently higher grades, and lower ginning and bagging fees associated with picker harvesting were over-ridden by the higher acre yields and lower harvesting fees of once-over stripping. In those seasons, the financial advantage of once-over stripping a picker variety over the double picking or combination picking-stripping method averaged 42 and 38 dollars per acre respectively. Once-over stripping of a picker variety was 27 dollars per acre more profitable than stripping a stripper variety.

In the seasons of low yields, harvesting a picker variety by the combination picking-stripping method averaged 10 dollars per acre more

profitable than double picking, and 6 dollars more profitable than once-over stripping. Once-over stripping of a stripper variety averaged 50 dollars per acre more profitable than picking-stripping a picker variety.

Many cotton producers may not be in a position or may not wish to devise each season a variety-harvest scheme which would be most likely to yield the highest return for that season. Further, the grower may be irrevocably committed to a certain scheme before it becomes apparent that yields will be low and that another scheme would have been more appropriate. This would be particularly true of the producer who owns a picker or stripper, but not both, or who cannot depend on obtaining the type of custom harvesting indicated. These producers might prefer to choose the scheme which provided the highest average return over all seasons.

To the extent that the 5-year period embraced by these experiments is representative of any 5-year period, the producer could expect the highest average acre returns from growing a stripper variety and stripping it in a once-over operation (Figure 16). This scheme averaged 6.5 dollars

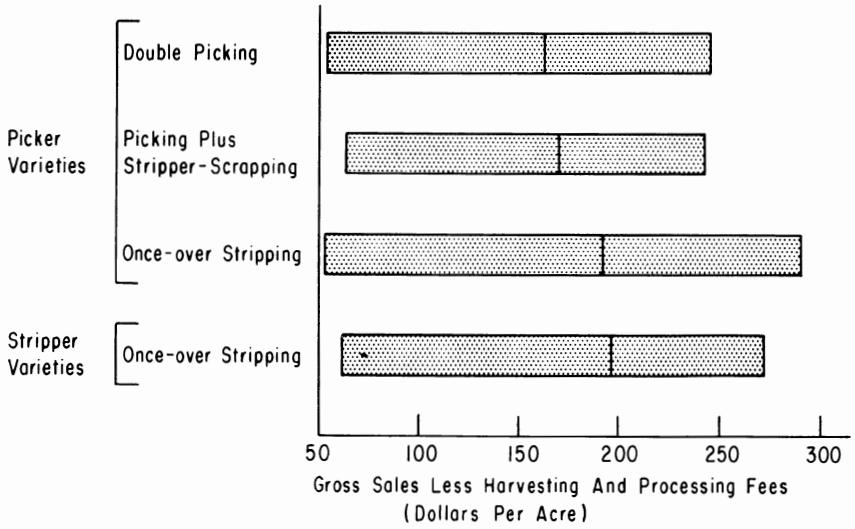

Figure 16. Returns above production costs.

per acre more profitable than once-over stripping of a picker variety, and 27 to 34 dollars more profitable than either scheme involving picker harvesting a picker variety.

However, if the results of the 1960 season were ignored on the assumption that a season so peculiarly favorable to stripper varieties

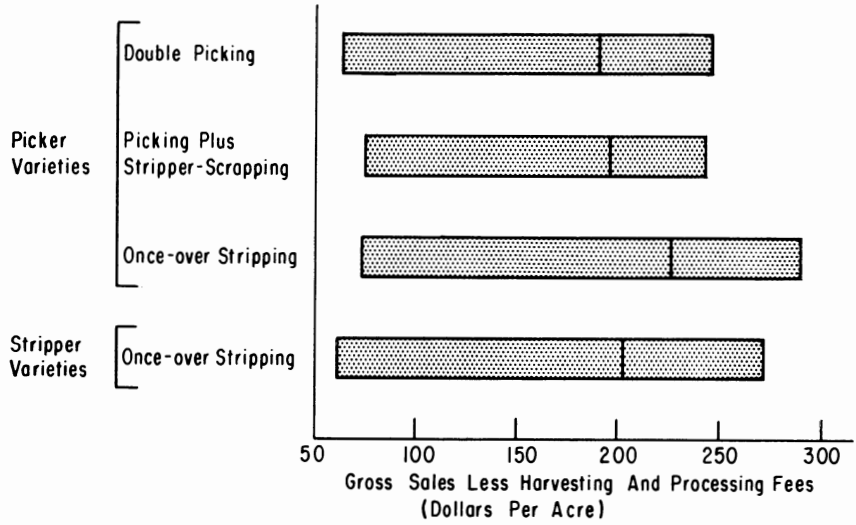

Figure 17. Returns above production costs, 1959, '61, '62, and '63.

would occur at much less than a 5-year frequency, acre returns would favor once-over stripping of a picker variety by 23 dollars over any other harvest method (Figure 17).

No attempt was made in these experiments to assess the value of the reduced amount of time required to harvest by once-over stripping compared to the double picking or picking-stripping methods. This might be of little consequence when custom harvesting is employed, but would become more important if the producer owned and operated his own equipment.

Also, no assessment was made of the cost of preparing the cotton plants for harvest. If cotton to be picked is defoliated, and if once-over stripping is performed after frost with no plant preparation, an additional 2.5 to 3 dollars per acre advantage in net returns might accrue to the once-over stripping schemes. On the other hand, no account was taken of the fact that once-over stripping schemes may require additional labor to distribute cotton in the trailer. This labor is not normally required with pickers or with basket-equipped strippers.

Summary

Three methods for harvesting picker varieties and one method for harvesting a stripper variety were compared on the basis of lint and

fiber quality and returns during a 5-year series of experiments with irrigated cotton. The harvest methods were picking and/or stripping in various combinations.

In general, the highest fiber quality (length, strength, and coarseness) from picker varieties was obtained from the first machine picking. Once-over stripping of picker varieties usually produced fiber equal or superior in quality to that from the second machine picking or stripper scrapping.

Machine picked lint was usually higher in grade, staple, and value than that from once-over stripping, while lint from stripper scrapping was often reduced in grade and value because of bark. Stripping picker varieties resulted in an average reduction in staple length of 1/32 inch, compared to picking these varieties. This was still about 3/32 inches longer staple than for the stripper varieties.

Returns to the producer varied widely among seasons and among harvest methods. Much of the variation in returns among harvest methods was attributed to variations in the amount of lint and seed harvested and ginned. In seasons of high yields, once-over stripping of picker varieties was more profitable than any other combination of variety and harvest method. But in seasons of low yields, once-over stripping of a stripper variety was far more profitable than any method of harvesting a picker variety.

The results of these experiments suggest that the producer of irrigated cotton in Southwest Oklahoma could expect the highest average annual returns by growing a stripper variety and harvesting it in a once-over stripping operation. The second highest average returns could be expected from once-over stripping a picker variety if it possessed storm resistance approaching that of stripper varieties.

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