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MANAGING HARVEST AID AND APPLICATION COSTS

Carl G. Anderson and James R. Supak
Texas Cooperative Extension
Texas A&M University
College Station, TX

Abstract

Cotton growers are seeking cost-effective production practices that increase income. Because cotton harvesting operations account for almost one-third of production costs, growers are closely evaluating the costs associated with harvest aid treatments, harvest operations and ginning. With intense international competition and low prices, managing harvest aid applications to allow timely harvest and maintain fiber quality is a valuable contribution to having a more marketable crop that enhances income. Price discounts for reductions in quality due to delayed harvest and field weathering can be substantial. Also, excessive expenditures for harvest aids can increase costs and provide little or no improvement in economic returns. By considering the crop yield potential, expected prices for cotton, harvest method, treatment efficacy and cost and potential treatment effects on fiber quality, the economically optimal expenditures for harvest aid programs can be estimated. This can be done prior to harvest and for specific farms or fields in a given crop year. The end results can be more effective use of harvest aid treatments that result in earlier, structured harvest and better quality cotton that can more than offset the cost of a well managed crop termination program.

Introduction

Cotton harvest aids are valuable management tools and, when properly used, enable timely and structured harvest, contribute to maintaining crop yield and quality and to expanded marketing alternatives. As crops approach maturity, harvest aids may be used to effectively schedule harvesting equipment and labor. A critical factor in the value of the crop is the condition and quality of the cotton. Good quality cotton makes for a more marketable crop worldwide and also provides a fiber that is more competitive against the array of synthetics on the market. Selecting and planting varieties with the genetic potential to produce high quality cotton provides strong advantages to textile manufacturers in that the fibers are better suited for use with high speed fiber processing technology and for utilization in the manufacture of higher quality end products. Harvesting cotton soon after all mature bolls are open ensures that the inherent yield and quality of the crop will be maintained over cotton that remains in the field and is subjected to weather-related deterioration. Early harvest can contribute to a substantial improvement in color grade and possibly other quality parameters, such as a reduction of leaf content in the fiber. The result is an improvement in crop value and, typically, a greater demand for the fiber in the market place.

Because of low prices for cotton, growers are carefully evaluating all inputs to determine which production costs can be reduced or eliminated. Cotton harvesting operations (crop termination with harvest aids, harvesting and ginning) account for approximately 30% of total production costs and, therefore, significantly impact profitability. The costs associated with harvesting and ginning are largely fixed, but harvest aid inputs can vary substantially by year, production region and harvest method. Results from a recent survey (Anderson and Supak, 2001) indicate that the selection of harvest aids is based largely on efficacy and cost, that growers are tank mixing products to minimize sequential applications, and that they are placing increasing emphasis on once over harvest.

Objectives

The primary objective of this project was to develop guidelines for producers, Extension personnel, consultants and others for use in estimating the economically optimal expenditures for cotton harvest aid programs (products, and treatment applications) for a given crop in a given year. To the extent possible, the guidelines take into account:

- projected (lint and seed) yields
- cotton (lint and seed) prices
- harvest method (picker or stripper)
- treatment efficacy and cost
- treatment effects on fiber quality
- other relevant factors

Discussion

During the last ten years, the U.S. cotton acreage has ranged from just over 13 million acres in 1992 to more than 16 million acres in 2001. Prices paid to U.S. producers for cotton during the last decade have ranged from $.77 in 1995 to $.45 in 1999 on a seasonal basis. Market prices received by producers tend to average in the $.55 to $.70 level most of the time (Table 1). When the farm price for cotton is on the lower end of the range, the cost and effectiveness of harvest aid treatments become even more significant to producer income.

Traditionally, cotton prices are the strongest during the planting season and weakest at harvest (Figure 1). Since 1990, the spot price for base grade 41/34 West Texas cotton shows the strongest average seasonal prices for the months of March, April, May and June. The seasonal spot price increase following harvest (Figure 1) is largely due to storage costs. The price averages slightly higher in September and October than in November following peak harvest activity. In January, the price level increases slightly before rising steadily in the February to May period. The seasonal spot price changes for 42/34 quality cotton follows the same pattern as that for 41/34.

Overall, the weakest spot prices occur in the months of September, October, November, December, and January. This is due in part to a more abundant supply of new cotton but also to lower quality of cotton that is harvested later in the season. Delayed harvest increases exposure of open cotton to the elements and results in yield losses and quality deterioration (Minton and Ray, 1973; Parvin and Smith, 1982; Williams, 1984). Dulak (1999) examined the relationship between ginning period and the proportion of Texas cotton that was classed as white. Her analysis determined that a much higher percentage of the bales harvested and ginned earlier in the season were classed as white cotton (Figure 2).

Crop Yield

The crop yield per acre is a key factor in determining the economically optimal inputs for harvest aid treatments. Expenditures for harvest aids are most frequently reported as the total cost per acre, but it is often more meaningful to view these expenditures as a cost per pound of lint produced. For example, a $15 per acre treatment costs (including application) translates into a cost of $.05 per pound of lint for a crop yielding 300 pounds per acre, but only $.025 per pound of lint for a crop yielding 600 pounds per acre (Table 2). Likewise, a $20 per acre treatment costs only $.025 per pound of lint in a field that produces 800 pounds per acre.

Crop Price and Yield

The price of cotton and yield are critical factors in determining the returns over harvest costs. A farm price received of $.70 per pound and a 500-pound per acre yield with a $25 per acre harvest aid treatment generates $288 per acre returns over harvest costs to pay for remaining operating and overhead costs (Table 3). But, at $.50 per pound, the returns drop to $188 per acre, a reduction in income of $100 per acre. Thus, when prices are low, good yields contribute more to total revenues than do moderate reductions in harvest aid treatment costs.

Harvest Method

Harvest method (picking or stripping) is another important consideration that impacts both harvest costs and overall profitability. Some advantages and disadvantages of spindle picking and stripping are listed in Figure 3. Generally, the purchase price and operating costs for strippers are lower than for pickers. Additionally, strippers typically have a higher harvesting efficiency than pickers. Thus, when yields and fiber quality are comparable, the returns over harvest costs tend to be higher for stripper harvesters. However, the effectiveness of the stripper harvester is limited in the Southeast, Mid-south, and West by high humidity and the taller and ranker plants that are typically produced in those regions. Also, the market place typically pays about two cents per pound more for picked cotton. Additionally, some areas, such as the Coastal Bend of Texas, are producing a large acreage of high quality cotton. Buyers and mills are requiring this cotton to be spindle picked to reduce problems with over ginning and neps.

Tables 4 and 5 summarize the economic impacts of harvest aid treatments for spindle picked cotton versus stripper cotton. The alternative income levels are intended to be used mainly as a guideline to indicate that yield and price contribute significantly to returns over harvest costs. Custom harvest rates were assumed. However, equipment ownership is usually desirable and may reduce costs slightly when used to harvest large amounts of cotton. There are several factors that must be considered in deciding the harvest method. In most cotton regions, the decision to pick or strip cotton is determined by plant size, yield, the ability to produce consistently good yields and quality (i.e. irrigated vs. dryland growing conditions), contract stipulations concerning marketing arrangements and other factors. Typically, most cotton acreage in Texas and Oklahoma is stripped. However, the longer fiber cotton varieties and some irrigated cotton can and probably should be spindle picked to maintain top fiber quality and to obtain the highest prices offered. Textile manufacturers producing the higher valued end-products prefer picked cotton. Picked cotton is usually cleaner (less trash than stripped cotton) and spins with fewer problems.

For picked cotton, ginning costs may be less, and problems in drying and cleaning the fiber tend to be fewer, but harvest costs are higher than for stripped cotton. Typically, yields must be around a bale per acre or higher for spindle picking to be economically feasible (Anderson, 1994, Anderson, 1995). Many spindle picking operators place a minimum cost of $40 per acre for harvesting the lower yielding fields.

Although picked cotton usually brings a premium over stripped cotton, field losses tend to be higher for spindle picked than for stripped cotton. High harvest losses can result in significant yield and economic losses (Table 6). Frequently, the quality of picked cotton, depending on varieties and growing and harvesting conditions, is slightly better than that of stripped cotton. In some regions, harvest operations can often be completed a little earlier with picking than stripping, thereby reducing the exposure to adverse weather to some extent.

Treatment Efficacy and Cost

In 1992, a Beltwide effort was launched to uniformly evaluate the performance of cotton harvest aids and on their effects on fiber quality (Snipes, 1996). Results from the field trials conducted over five years in 12 to 14 states showed that when used properly, none of the harvest aids tested adversely affected fiber quality. The study also showed that although the performance levels varied by treatment, the effects on fiber quality tended to be minimal, (Anonymous, 1999). Difference in year or location accounted for more of the variation in fiber quality than did the treatments being evaluated. The results suggest that costly treatments that result "perfect" defoliation, boll opening and/or desiccation, are not always warranted from an economic standpoint.

Treatments Effects on Lint Quality

A major advantage provided by the use of harvest aids is the ability to harvest the crop before weathering results in yield and quality losses. Cotton quality enhancement using timely and cost-effective harvest aid treatments may easily add $10 to $25 to the value of a cotton bale. Price discounts for qualities below the base grade of 41 color, 34 staple, and 4 leaf cotton are substantial. For example, a 5 leaf grade drops the cotton price per pound 330 points below base grade (Table 7). Even a 4 leaf quality decreases price by 50 or more points on some grades. When 41 color is compared to 42, the CCC loan discount amounts to 360 points per pound or $18 on a 500 pound bale. Delays in harvest, especially when coupled with rain and other adverse weather events, can cause substantial reductions in color grade and more lint contamination with extraneous plant materials (Figures 2 and 4).

Summary

Harvest aid treatments that are used efficiently can add value to cotton lint. An early harvest of clean, white cotton contributes to overall profitability by increasing the spinning quality attributes. However, improved yields and higher market prices are dominant factors in the profitable growing of cotton. When per acre production and price are favorable, a $5 to $10 per acre higher cost to make harvest aid treatments effective is often financially justifiable.

An early harvest that makes the difference in producing a slightly better cotton quality can increase the value of cotton $10 to $25 per bale, and sometimes much more. Modern textile spinning technology requires good quality and uniformity in cotton fiber. Quality of fiber is the foundation of textile manufacturing.

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Table 1. Average Prices Received by U.S. and Texas Upland Cotton Producers

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
					- - - - - Cents/Lb. - - - - -						
U.S.	68.2	58.1	54.9	58.4	72.0	76.5	70.5	66.2	61.7	45.0	50.4
Texas	63.2	53.6	49.1	53.5	69.6	74.6	65.6	60.1	56.5	41.0	51.4

Source: USDA/NASS

Table 2. Harvest-Aid Treatment Costs Per Pound

Treatment	Yield Per Acre (Lbs.)						
Cost/Acre	300	400	500	600	700	800	900
			- - - - - - - Cents Per Pound - - - - - - -				
$25	8.3	6.3	5.0	4.2	3.6	3.1	2.8
$20	6.7	5.0	4.0	3.3	2.9	2.5	2.2
$15	5.0	3.8	3.0	2.5	2.1	1.9	1.7
$10	3.3	2.5	2.0	1.7	1.4	1.3	1.1

Table 3. Economic Impact of Alternative Harvest-Aid Treatment Costs [1/]

		Cotton Price in Cents Per Pound				
Treatment	Yield/Ac	80¢	70¢	60¢	50¢	40¢
Cost/Acre	(Lbs.)	Returns Over Harvest Costs for Stripped Cotton				
$25	500	$338	$288	$238	$188	$138
$20	400	$270	$230	$190	$150	$110
$15	300	$203	$173	$143	$113	$83
$10	300	$208	$178	$148	$118	$88

[1/] Estimated harvest costs for stripped cotton: stripping 7¢/lb.; ginning 9¢/lb.; seed value 5¢/lb.

Total harvest costs = total harvest-aid treatment costs + harvesting costs + ginning costs - seed value (Seed yield = 1.7 x lint yield was used to estimate seed weight).

Returns over harvest costs = yield x price - harvest costs.

Returns over harvest costs must pay for remaining operating and overhead costs. In 1997, the USDA production costs survey indicated U.S. cotton farmers averaged 38 cents in operating costs per pound and another 35 cents in overhead costs for a total, including harvest costs, of 73 cents per pound.

Table 4. Economic Impact of Harvest-Aid Treatments for Spindle Picked Cotton [1/]

	Cotton Price in Cents Per Pound				
Yield/Ac (Lbs.)	**80¢**	**70¢**	**60¢**	**50¢**	**40¢**
	Returns Over Harvest Costs				
900	$610	$520	$430	$340	$250
800	$539	$459	$379	$299	$219
700	$469	$399	$329	$259	$189
600	$398	$338	$278	$218	$158
500	$328	$278	$228	$178	$128
400	$257	$217	$177	$137	$97
300	$177	$147	$117	$87	$57

[1/] Treatment cost at $25 per acre. For lower cost harvest-aid treatments, deduct from $25 per acre the actual treatment cost (*i.e.* $25 - $15 = $10 less cost per acre can be added to returns over harvest costs).
Estimated harvest costs for spindle picked cotton: 10¢/lb. with $40 per acre minimum; ginning costs 8¢/lb.; seed value 5¢/lb. (seed yield = 1.7 x lint yield was used to estimate seed weight).
Total harvest costs = total harvest-aid treatment costs + harvesting costs +ginning costs - seed value
Returns over harvest costs = yield x price - harvest costs.

Table 5. Economic Impact of Harvest-Aid Treatments for Stripping Cotton Per Acre [1/]

	Cotton Price in Cents Per Pound				
Yield/Ac (Lbs.)	**80¢**	**70¢**	**60¢**	**50¢**	**40¢**
	Returns Over Harvest Costs				
900	$628	$538	$448	$358	$268
800	$555	$475	$395	$315	$235
700	$483	$413	$343	$273	$203
600	$410	$350	$290	$230	$170
500	$338	$288	$238	$188	$138
400	$265	$225	$185	$145	$105
300	$193	$163	$133	$103	$73

[1/] Treatment cost at $25 per acre. For lower cost harvest-aid treatments, deduct from $25 per acre the actual treatment cost (*i.e* $25 - $15 = $10 less cost per acre can be added to returns over harvest costs).
Estimated harvest costs for stripped cotton: stripping 7¢/lb.; ginning 9¢/lb.; seed value 5¢/lb.
Total harvest costs = total harvest-aid treatment costs + harvesting costs + ginning costs - seed value.
Returns over harvest costs = yield x price - harvest costs.

Table 6. Potential Yield Reductions Due to Harvest Losses

	Percent Loss					
Yield Per Acre (Lbs.)	**2**	**4**	**6**	**8**	**10**	**12**
	Pounds Per Acre					
900	18	36	54	72	90	108
800	16	32	48	64	80	96
700	14	28	42	56	70	84
600	12	24	36	48	60	72
500	10	20	30	40	50	60
400	8	16	24	32	40	48
300	6	12	18	24	30	36

Table 7. Commodity Credit Corporation Loan Premium and Discount Schedule for Selected Cotton Qualities, 2001

		Staple			
Color	**Leaf**	**32**	**33**	**34**	**35**
11 & 21	1-2	-485	-205	165	305
	3	-505	-215	160	300
	4	-555	-280	60	190
	5	-655	-425	-195	-80
31	1-2	-505	-225	145	290
	3	-525	-230	140	285
	4	-575	-300	55	185
	5	-685	-435	-220	-110
41	1-2	-595	-315	40	160
	3	-600	-320	30	155
	4	-630	-350	Base	125
	5	-755	-525	-330	-245
51	1-2	-755	-540	-330	-250
	3	-755	-545	-330	-255
	4	-805	-585	-380	-305
	5	-895	-670	-510	-445
41	1-2	-595	-315	40	160
	3	-600	-320	30	155
	4	-630	-350	Base	125
	5	-755	-525	-330	-245
42	1-2	-705	-505	-285	-205
	3	-715	-515	-300	-225
	4	-770	-565	-360	-285
	5	-890	-695	-540	-490
43	1-2	-955	-805	-765	-750
	3	-995	-845	-810	-790
	4	-1040	-890	-860	-840
	5	-1185	-1035	-1015	-990

Source: USDA 2001 CCC Loan Schedule

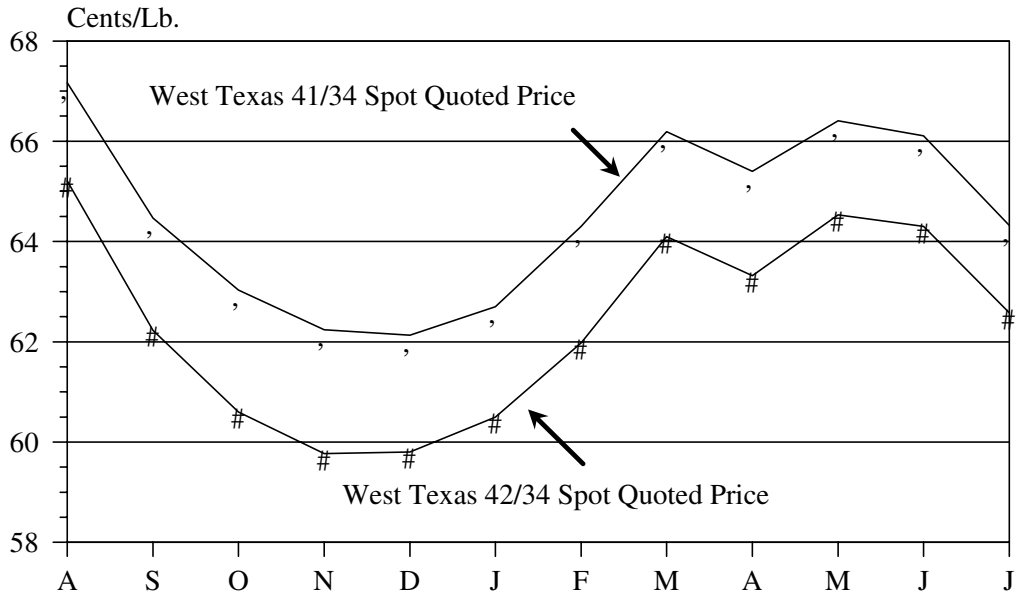

Figure 1. Seasonal Average Spot Quoted Price, Grades 41 & 42, Staples 34, Monthly Average, 1990 - 2000, Lubbock.

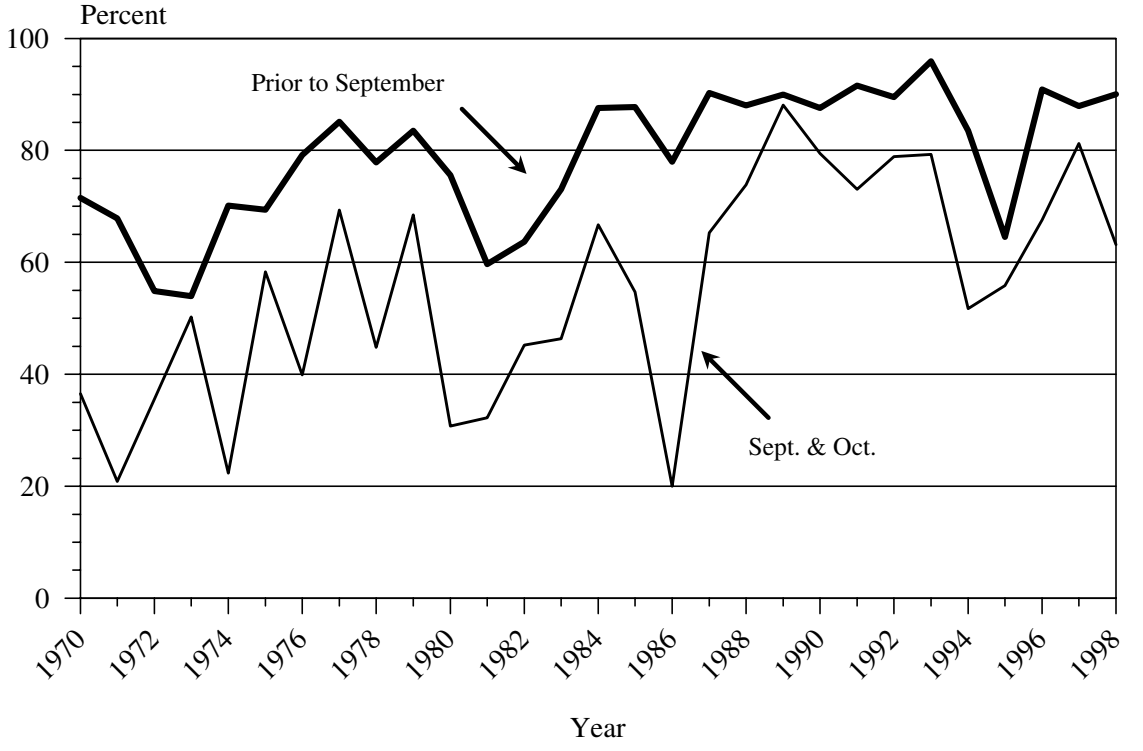

Figure 2. Proportion of Texas cotton classed as white by ginning period, 1970 - 1998 (Dulak, 1999).

Picking	
Advantages	**Disadvantages**
1 Start harvesting earlier	1. Low yields - high costs
1. Cleaner cotton	2. Relatively expensive to harvest
2. Less seed cotton to gin	3. May leave some cotton
3. Works best in high yields	4. Higher level of expertise to operate machine
4. May use less harvest-aid chemicals	5. In Southwest, may not be feasible every year
5. Better quality possible	

Stripping	
Advantages	**Disadvantages**
1. Fast	1. Wait until open
2. All cotton on stalk removed	2. More burs and trash
3. Lower yields okay	3. More weight to gin
4. Relatively less expensive to harvest	4. May use more harvest-aid chemicals
5. High harvest efficiency	5. Lower quality possible
	6. Green bolls may be problem

Figure 3. Advantages and Disadvantages of Cotton Picking vs. Stripping

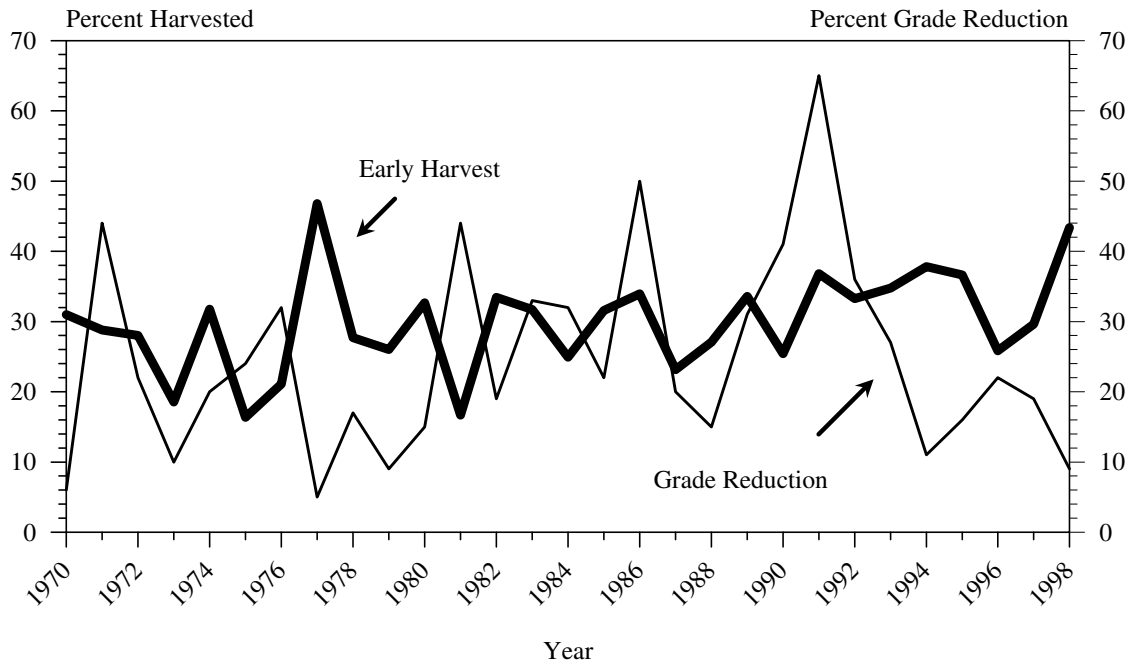

Figure 4. Texas cotton proportion harvested early and percent of grade reduced for bark and grass (Dulak, 1999).