ECONOMIC ANALYSIS OF HARVEST-AIDS IN THE DELTA REGION

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Abstract

This study analyzed the costs and returns to alternative harvest-aid treatments from a 5-year study in the Delta States of Arkansas, Louisiana, Mississippi, Missouri, and Tennessee. Results from this study indicate that harvest-aid treatments using Prep improved net revenues in northern growing areas but did not improve net revenues in southern growing areas. In southern growing areas, the increased costs from diminished harvest efficiency and delays in harvesting from un-defoliated cotton may improve the profitability of harvest-aids.

Introduction

Economic tradeoffs influence producers' decisions in applying a harvest-aid before harvest for cotton (*Gossypium hirsutum* L.). This decision may be affected by the responses of lint yield and fiber quality to the harvest-aid, materials and application costs for the harvest-aid, changes in harvest equipment efficiency due to the harvest-aid and its subsequent effects on harvesting and handling costs, scheduling of harvest activities, how long cotton is stored before ginning (if moduled), weather, and cotton prices. The objective of this study was to evaluate the costs and returns to alternative harvest-aid treatments from a 5-year study in the Delta States of Arkansas, Louisiana , Mississippi, Missouri, and Tennessee. Results from this study should provide useful information to cotton farmers who are considering alternative harvest-aids as a part of their crop management plan.

Materials and Methods

Enterprise budgeting methods were used estimate net revenues for alternative harvest-aid treatments using yield and quality data from the 5-year harvest-aid study. The yield and price data entered into the budgets are presented first followed by a description of how the costs of production and net revenues were estimated and analyzed.

Cotton Yield Data

Lint yield and fiber quality data were from a harvest-aid study conducted from 1992 through 1996 at experiment stations in Arkansas, Louisiana, Mississippi, Missouri, and Tennessee. Commercial harvest-aid chemicals approved for use on cotton were evaluated in the study: Folex, Dropp, Harvade, Defol, and Prep. The combinations and rates used to formulate the 12 treatments, including an untreated check, are in Table 1. Each treatment was replicated four times using a randomized complete block design. Readiness for chemical termination at maturity (approximately 55-60% open bolls) was determined through daily field inspection. The two middle rows were harvested approximately 10 to 14 days after treatment in each plot to determine yields and obtain seed cotton samples. Treatment and harvest dates varied depending on the site and the year. Each year, samples of seed cotton were air-dried and ginned to determine lint percentages and obtain lint samples. Lint fiber from the samples were used to determine fiber characteristics for each treatment using High Volume Instrument (HVI) testing (U.S. Department of Agriculture, Agricultural Marketing Service Staff, 1993).

Cotton Price Data

The only published source of producer price data for the study area that reports premiums and discounts from a base quality are quotations collected by the U.S. Department of Agriculture, Agricultural Marketing Service. These spot price quotations are compiled daily by market reporters for seven major market areas (Larson and Meyer, 1996). Relevant quotations for the study area are from the North Delta and South Delta market areas. The area market reporter determines daily prices by interviewing market participants and collecting sales information (Kuehlers, 1993). Prices reported by the Agricultural Marketing Service are not weighted by trading volume, are not based on a statistical sampling procedure, and are not reproducible (Hudson et al., 1996). Moreover, in the absence of actual trading in a market, quotations are determined by prices paid for other qualities or prices paid for the same quality in other markets. Consequently, the price differences actually received in a market may deviate from those reported in the quotations. Irrespective of these data limitations, we assume spot quotes reflect price differences for farmers in the Delta.

The reported base quotation price is for Strict Low Middling (color 41, leaf 4, staple 34, micronaire 35-36 and 43-49, and strength 23.5-25.4 cotton). Price differences from the base for the various quality attributes are also reported. The price discount for leaf grade is reported for each color grade and staple length. Quoted price differences for micronaire and strength are also included in the data. The season-average August 1996 through July 1997 base price of $0.72/lb and the premiums and discounts from the base quality were used in the analysis of harvest-aids.

Budgeting Methods and Data

Net revenues were obtained by estimating variable costs, fixed equipment and labor costs, and overhead costs for each harvest-aid treatment at each location, and subtracting

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the total cost from estimated total receipts (Boehlje and Eidman, 1984). This residual is the estimated return to a farmer for land, management, and risk. To estimate costs of production, cotton budgets for the North Delta and South Delta areas were obtained by using the APAC budget generator developed by the Agricultural Policy Analysis Center (Slinsky, 1996).

Cotton budgets obtained from each states' extension service were used as a baseline for estimating costs with the budget generator. The budgets were modified to reflect typical machinery optimum, to include the different harvest-aid chemicals (defoliants, desiccants, growth regulators, and adjuvants) used, and to reflect a large scale cotton farm employing conventional tillage and non-irrigated land. The base extension budget modified for Arkansas was for solid planted cotton grown on Loamy soils south of Interstate I-40 in eastern Arkansas (Extension Economics-Management Economic and Community Development Section, University of Arkansas). The Louisiana extension budget was for an owner operated farm in the northeast part of the state with sandy soils and producing solid planted cotton (Department of Agricultural Economics and Agribusiness, Louisiana State University, 1997). The Mississippi extension base budget was for production on non-irrigated Sandy soils and utilized solid planted cotton (Mississippi Cooperative Extension Service, 1996). Because Missouri does not have extension cotton budgets, the Missouri base budget was developed using the Arkansas extension budget for north of Interstate I-40 in eastern Arkansas (Extension Economics-Management Economic and Community Development Section, University of Arkansas). The base budget assumed solid planted cotton grown on non-irrigated Loamy soils. The base extension budget for Tennessee assumed cotton produced with 8-row equipment in west Tennessee (Gerloff, 1997).

It was assumed that the harvest aids treatments were applied by an aerial applicator. The harvest-aid treatment costs (materials and aerial application costs) used for the analysis are presented in Table 1. Besides harvest-aid treatment costs, the other costs that varied by treatment in the budgets were for ginning and handling as a function of harvested lint yields. The enterprise budgets were estimated on a per acre basis. The budgets are representative of larger farms (1,400 acres) and assume an equipment compliment that includes a boll buggy and module builder when calculating labor and equipment costs for harvesting. All the input prices used to estimate costs of production are those that reflect 1996 purchases.

Results and Discussion

Lint Yields

Lint yield means for each treatment from the 1992 through 1996 harvest-aid study are in Table 2. Dunnett's two-tailed t-test (a = 0.05, 0.10) for comparing treatments to a single control was used to evaluate which treatments produced lint yields that were significantly different from the untreated check (SAS, Institute, Inc., 1996). The only locations where one or more of the harvest-aid treatment lint yields were significantly different from the untreated check occurred in Louisiana and Tennessee. In Louisiana, treatment 12 using Dropp (0.0625 lb a.i./A) and Prep (0.25 lb a.i./A) produced lint yields that were significantly lower than the untreated check. In Tennessee, three treatments using Prep to open bolls in combination with a defoliant produced lint yields that were significantly higher than the untreated check: treatment 5 using Harvade (0.25 lb a.i./A) and Prep (1.0 lb a.i./A), treatment 7 using Dropp (0.05 lb a.i./A) and Prep (1.0 lb a.i./A), and treatment 11 using Folex (0.75 lb a.i./A) and Prep (1.5 lb a.i./A).

Analysis of lint yields in Arkansas, Mississippi, and Missouri indicated no statistical differences in lint yield for any of the harvest aid treatments when compared to the untreated plots. However, in numerical terms, treatment 6 using Folex (0.56 lb a.i./A) and Prep (1.0 lb a.i./A) produced the largest lint yields among the treatments at the Arkansas location. Treatment 7 using Dropp and Prep produced the largest lint yields among the treatments at the Mississippi and Missouri locations.

In a comparison of all treatments containing Prep (boll opener) and non-Prep (defoliants and desiccants) treatments, harvest-aid combinations containing Prep produced significantly (a = 0.05) higher yields in Arkansas, Missouri, and Tennessee. By contrast, the lint yields for all Prep treatments in Louisiana were significantly less than the lint yields all non-Prep treatments. Lint yields for Prep versus non-Prep treatments in Mississippi were not significantly different from each other.

Effective Lint Prices

Effective lint price means (base quality price adjusted for premiums and discounts) for each treatment from the 1992 through 1996's harvest-aid study are in Table 3. None of the harvest-aid treatments produced effective lint prices that were significantly different from the untreated check at any location.

Net Revenues

The estimated net revenues for each treatment are presented in Table 4. Analysis of net revenues indicates that none of the harvest-aid treatments were significantly different from the untreated check at the Arkansas, Mississippi, and Missouri locations. In Arkansas, treatment 6 using Folex and Prep produced the highest net revenue among the treatments of $606/ac. By contrast, treatment 7 using Dropp and Prep produced the highest net revenue of $519/A at the Tennessee location, which was significantly higher than the $431/a produced by the untreated check. Treatment 7 also produced the largest net revenue among treatments at the Missouri location ($426/ac).

In Louisiana, five of the harvest-aid treatments produced net revenues that were significantly less than the untreated check: treatments 5,6, 11, and 12.
Lower yields compared with the check and the costs of the harvest-aids contributed to lower net revenues. None of the harvest-aid treatment net revenues were significantly different from the untreated check at the Mississippi location.

In the comparison of all Prep treatments and non-Prep treatments, harvest-aid combinations containing Prep produced significantly (a = 0.05) higher net revenues in Arkansas, Missouri, and Tennessee. By contrast, treatments containing Prep produced significantly less net revenue at the Louisiana location. Net revenues for Prep versus non-Prep treatments in Mississippi were not significantly different from each other. Analysis of all treatments containing Prep and all non-Prep treatments indicated significantly higher net returns from Prep in the northern locations (Missouri and Tennessee). The study locations in Arkansas, Louisiana, and Missisippi are approximately 100 miles apart with Arkansas being the northern most location and Louisiana being the southern most location. Net returns in the more southern growing areas (Louisiana and Mississippi) did not improve with the use of Prep. In southern growing areas, the increased costs from diminished harvest efficiency and delays in harvesting from un-defoliated cotton may improve the relative profitability of harvest-aids. These costs were not documented in the 5-year study.

Summary

This study analyzed the costs and returns to alternative harvest-aid treatments from a 5-year study in the Delta States of Arkansas, Louisiana, Mississippi, Missouri, and Tennessee. Results from this study are mixed. Analysis of harvest-aid treatments using Prep indicates more improved net revenues in northern growing areas but did not improve net revenues in southern growing areas. Treatments using the boll opener Prep in combination with the defoliants Dropp or Folex may have the greatest potential to improve net revenues in northern areas. Net returns in the more southern growing areas did not improve with the use of Prep. In southern growing areas, the increased costs from diminished harvest efficiency and delays in harvesting from un-defoliated cotton may improve the relative profitability of harvest-aids.

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References

AGCHEMPRICE. Current U.S.A. Prices of Non-Fertilizer Agricultural Chemicals. DPRA Incorporated. Manhattan-Kansas, September 1996.

Boehlje, M. D, and V. R. Eidman. 1984. Farm management. John Wiley & Sons, New York.

Department of Agricultural Economics and Agribusiness, 1997. Projected Costs and Returns - Cotton, Soybeans, Corn, Milo, and Wheat, Northeast Louisiana, 1997, Louisiana State University. A.E.A. Information Series No. 151.

Extension Economics-Management Economic and Community Development Section, University of Arkansas. Estimating Production Costs in Arkansas, University of Arkansas Cooperative Extension Service. Extension Bulletin No. 239.

Extension Economics-Management Economic and Community Development Section. Estimating Production Costs in Arkansas, University of Arkansas Cooperative Extension Service. Extension Bulletin No. 242.

Gerloff, D.C. 1995. Field crop budgets for 1995: A supplement to the guide to farm planning. The Univ. of Tennessee Agric. Econ. Resour. Dev. Info. Series 32.

Hudson, D., D. Ethridge, and J. Brown. 1996. Producer prices in cotton markets: An evaluation of reported price information accuracy. Agribusiness: An International Journal. 12:353-62.

Kuehlers, T. 1994. 1993 crop spot quotations. p. 457. *In* D.J. Herber (ed.), 1994 Proc. Beltwide Cotton Prod. Res. Conf., San Diego, CA, Jan. 4-8, 1994. National Cotton Council of America, Memphis, TN.

Larson, J.A. and L.A. Meyer. 1996. Chapter 1-Supply, demand, and prices. p. 1-32. *In* E.H. Glade, L.A. Meyer, and H. Stults (ed), The U.S. Cotton Industry in the United States. USDA-ERS Rep. 739. Econ. Res. Serv., Washington D.C.

Mississippi Cooperative Extension Service, 1996. Cotton 1997 Planning Budgets, Mississippi State University. Agricultural Economics Report 77, December, 1996.

SAS, Institute, Inc. 1996. SAS/STAT user's guide, release 6.11 edition. SAS, Institute, Inc., Cary, NC.

U.S. Department of Agriculture, Agricultural Marketing Service Staff. 1993. The classification of cotton. USDA-AMS Agric. Information Bull. 566. U.S. Gov. Print. Office, Washington, D.C.

U.S. Department of Agriculture, Agricultural Marketing Service Staff. August 1997. Cotton price statistics 1996-1997. USDA-AMS, Cotton Division, Market News Branch, Memphis, TN.

Table 1. Harvest-aid treatments and costs.

Treatment Number	Treatment Name	Rate†	Treatment Cost/Ac‡
1	Control	NA	0.00
2	Folex	1.1250	11.01
3	Dropp	0.1000	14.06
4	Harvade	0.3000	10.49
5	Harvade	0.2500	17.18
	Prep	1.0000	
6	Folex	0.5600	15.19
	Prep	1.0000	
7	Dropp	0.0500	16.72
	Prep	1.0000	
8	Harvade 5F	0.2500	15.52
	Dropp	0.0625	
9	Dropp	0.0500	12.54
	Folex	0.5600	
10	Defol 6	4.5000	7.18
11	Folex	0.7500	20.20
	Prep	1.5000	
	Dropp	0.0625	12.23
12	Prep	0.2500	

† Pounds of active ingredient applied per acre.
‡ Treatment chemical and applications costs are based the chemical application rate and prices obtained from "AGCHEMPRICE."

Table 2. Lint yields for alternative harvest-aid treatments.

Treatment	Arkansas	Louisiana	Mississippi	Missouri	Tennessee
			lb/ac		
1	1,173	1,167	903	863	885
2	1,141	1,179	893	846	905
3	1,185	1,149	913	879	916
4	1,165	1,140	905	925	878
5	1,164	1,129	920	925	1,000**
6	1,219	1,083	883	887	984
7	1,160	1,021	924	930	1,012**
8	1,152	1,131	914	881	933
9	1,134	1,140	894	894	938
10	1,133	1,154	884	842	951
11	1,215	1,082 **	907	924	1,010**
12	1,158	1,069**	897	890	976

**, * indicates significantly different from the untreated check at the 5% and 10% probability levels, respectively, for the Dunnett two-tailed, t-test in which comparisons are made between harvest-aid treatments and the untreated control (treatment 1).

Table 3. Effective lint prices for alternative harvest-aid treatments, 1996-97 marketing season.

Treatment	Arkansas	Louisiana	Mississippi	Missouri	Tennessee
			$/lb		
1	0.7186	0.7221	0.6867	0.7044	0.6977
2	0.7211	0.7108	0.6942	0.7192	0.7012
3	0.7209	0.7174	0.6867	0.7113	0.7080
4	0.7144	0.7116	0.6819	0.7114	0.7072
5	0.7154	0.7066	0.6867	0.7159	0.6953
6	0.7200	0.7158	0.6953	0.7214	0.6979
7	0.7201	0.7193	0.6716	0.7214	0.7221
8	0.7209	0.7041	0.6799	0.7204	0.7031
9	0.7199	0.7172	0.6866	0.7109	0.6979
10	0.7199	0.7154	0.6799	0.7114	0.6989
11	0.7196	0.7140	0.6870	0.7114	0.6837
12	0.7196	0.7119	0.6869	0.7203	0.7072

**, * indicates significantly different from the untreated check at the 5% and 10% probability levels, respectively, for the Dunnett two-tailed, t-test in which comparisons are made between harvest-aid treatments and the untreated control (treatment 1).

Table 4. Net returns to land, management and risk for alternative harvest-aid treatments, 1996-97 marketing season.

Treatment	Arkansas	Louisiana	Mississippi	Missouri	Tennessee
			$/ac		
1	586	523	271	383	431
2	554	508	258	368	438
3	583	489	263	382	446
4	564	481	259	419	425
5	558	460*	267	415	487
6	606	441**	254	396	479
7	561	470	254	426	519**
8	557	460**	259	390	450
9	547	484	252	392	449
10	551	498	247	366	465
11	597	432*	253	408	470
12	563	429*	257	400	486

**, * indicates significantly different from the untreated check at the 5% and 10% probability levels, respectively, for the Dunnett two-tailed, t-test in which comparisons are made between harvest-aid treatments and the untreated control (treatment 1).