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COST OF SEED COTTON HANDLING SYSTEMS

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SUMMARY:

Seed cotton handling systems cost were determined using 1985 equipment and labor cost. These data are presented for various usage levels for conventional trailer systems, and module systems both with and without pallets.

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COST OF SEED COTTON HANDLING SYSTEMS

Introduction

Handling, storing, and transporting seed cotton from the field to the gin has taken many forms since the early days of the cotton industry. Hand harvested seed cotton was often stored in the cotton house and hauled to the gin in a mule-drawn wagon. Farms became mechanized and one bale wagons gave way to trucks and larger trailers. Mechanical harvesters required even larger trailers to handle the flow of cotton from the field to the gin. As picking capacity increased, backlogs of harvested cotton awaiting ginning became commonplace throughout the cottonbelt.

The Arkansas Cotton Caddy, the rick compactor, and the module builder offered ways to eliminate the producers dependency on the gin to provide empty trailers so that the harvest could go un-interrupted.

In 1972, 18 of the 22 module builders in existence were located in the Mississippi Delta. In late 1974, the self-loading palletless module mover truck was successfully demonstrated in Mississippi. Yet, Mississippi growers have been slow in adapting this technology in their harvesting operations. In 1983, almost no cotton was moduled in Mississippi. During our best recent harvest years, only ten to fifteen percent of the crop was handled with the module system in Mississippi, compared to as high as fifty percent of the crop for some western states. Due to a rapid decline in the number of gins in the state, increased average annual gin volume, and larger more expensive harvesters, there is renewed interest in using the module system of handling seed cotton. Growers still view the module system as an overflow system to handle picker capacity in excess of gin capacity.

Cost of the various systems have changed drastically, due to inflation and machinery designs and capacities since the introduction of this equipment in the early 1970's. A review of the economic feasibility of each seed cotton handling system was needed in order to correctly advise growers how to best solve the transportation and storage requirements created by todays high capacity harvesters serving fewer gins.

Procedure

Cost and capacity data were collected from manufacturers representatives in early 1985, for each piece of equipment used in five seed cotton handling systems (See Appendix I). Conventional seed cotton trailers being purchased in Mississippi are now 10' wide X 40' long X 6' deep (10 bale capacity). These provide transportation from the field to the gin and temporary storage, making an average of 14 to 18 trips per year to the gin.

The predominant towing vehicle is a 100+ horsepower farm tractor operated by minimum wage labor. For the purpose of this study, an eight mile average haul distance was assumed. Four module systems were analyzed with transportation method being the differentiating factor in each system.

A module made on a metal or wood pallet, and hauled by a tilt-bed trailer with roller bed and winch for loading, was included for growers who must transport cotton longer distances, are not large enough or do not have palletless module transporting equipment at their disposal or for those who are reluctant to put seed cotton directly on the ground without some protection.

The three palletless systems differ mainly in the prime mover and represent a wide range in capital expenditures. The most expensive is a heavy-duty tandem axle, long wheel base cab and chassis mounted self-loading bed capable of moving both 24' and 32' modules.

The intermediate system is a fifth-wheel self-loading trailer arrangement which can utilize an existing road-truck tractor for a power source. This offers lower capital outlay if a road truck-tractor is available.

The third system utilizes an even lower cost farm tractor drawn self-loading trailer and is generally suitable for short distance hauls and moving modules on the gin yard.

Per module and per bale costs for each system were determined using capital recovery formulas for a five year system cost in order to provide growers and ginners better information in determining actual cash flows. In some cases, cost are also presented for a 15 year life. Cost of each component in the systems were determined and are provided as basic building blocks so that users can "design" a system that fits their needs and determine an overall cost usage level.

Results

Table 1 shows costs associated with handling seed cotton in trailers. These costs include all cost from the turn-row to the gin. For example, if a 10 bale trailer makes 16 trips per year to the gin, it costs about $10.20 per bale for a 5 year capital recovery life and $7.35 per bale for a 15 year capital recovery life. Tarp cost are relatively minor or about .30¢ per bale for 16 trailer trips per year. (see Tables 1 and 3).

Table 2 contains the cost of forming modules at different usage levels for five and fifteen year capital recovery lives. Conventional trailers do not provide storage capability. The grower is dependent on the gin to keep trailers empty in order to keep harvesting.

The cost of using tarps and pallets is shown in Tables 3 & 4 respectively. Mississippi growers have accepted synthetic tarp materials for module covers during the 1985 harvest season. Cotton tarp cost shown in Table 3 are about twice the cost for synthetic tarps. Tarps for trailers and modules are essential for Mississippi growers. Cost of cotton tarps are included for a true comparison of both the module and conventional trailer systems.

Table 5 shows the various cost for the module transportation systems used.

Use levels above 300 modules per year are not recommended for a single pallet trailer or a farm tractor drawn self-loading palletless trailer, because of time limitations.

Overall field to gin system cost and comparisons are presented in Table 6 for the five systems.

Table 7 contrasts the cost of forming modules without pallets to the equivalent handling capacity in cotton trailers. The costs of transporting modules to the gin are not included. Module forming and tarp cost alone (for handling 1,000 bales) of $10.11 per bale approaches the $10.50 per bale cost of trailers used, an average of 16 trips per year.

CONCLUSIONS AND OBSERVATIONS

1. Cotton trailer pulled by truck or farm tractor is still cheapest seed cotton transportation system, but a very expensive seed cotton storage system.

2. Cost of forming modules is about equal to total cost of handling in trailers when both systems are fully utilized. Module transportation costs must be justified by advantages realized from seed cotton storage.

3. Pallet costs make the pallet moduling system more expensive than trailers or the palletless systems, but many producers and ginners feel that extra cost is justified to keep the cotton off the soil.

4. Gin yard trailers, pulled by a farm tractor can be efficiently used for small moduled volumes and short hauling distances if highway regulations allow them to be used.

5. Palletless module movers, both the mounted chassis/cab and the 5th-wheel truck/tractor type, can be economically efficient for high volumes. The 5th-wheel trailer allows utilization of existing or leased truck/tractors and could reduce capital expenditure.

TABLE 1. COST OF HANDLING SEED COTTON IN TRAILERS

FIXED COST	
10' X 40' 10 Bale Trailer (New)	$3,500
Life (Years)	5
Salvage	0
Deprec. & Interest (12%)	$969.00
Insurance .26¢/$100	$9.10/yr.
*Repairs, Maint. & Tires	$350/yr.
VARIABLE COST	
Labor - 1 man $4/hr.	$4/trip
**Tractor - $15/hr.	$15/trip

TRIPS/YEAR	TOTAL COST/BALE*** (10'X40' - 10 Bale $3500 @ 12%)
6	$24.04
8	18.51
10	15.19
12	12.97
14	11.39
16	10.20
18	9.28
20	8.54
22	7.94
24	7.44

FIXED COST	
10' X 40' 10 Bale Trailer	$3,500
Life (Years)	15
Salvage	0
Deprec. & Interest (12%)	$513.80
Insurance .26¢/$100	9.10/yr.
*Repairs, Maint. & Tires	$350/yr
VARIABLE COST	
Labor - 1 man $4/hr.	$4/trip
**Tractor - $15/hr.	$15/trip

TRIPS/YEAR	TOTAL COST/BALE*** (10'X40' - 10 Bale $3500 @ 12%)
6	$16.45
8	12.81
10	10.63
12	9.17
14	8.14
16	7.35
18	6.75
20	6.26
22	5.87
24	5.54

* Average estimated repair cost reported by gins for 1984 season in Mississippi

** Assume that 1 trailer per hour is towed or cost of $19.00 per trailer trip.

*** Does not include tarp cost. To determine tarp cost for trailers, divide the per bale cost for 12 bales annual useage in Table 3 and the tarp life you expect by the average trailer trips per year. Example for a 3 year life at 16 trailer trips tarp cost would be $4.85 ÷ 16 = .30¢ per bale.

TABLE 2. ESTIMATED COST OF MODULING SEED COTTON

FIXED ANNUAL COST	5 YEAR LIFE	15 YEAR LIFE
Cost of Module Builder	$19,000	$19,000
Life (years)	5	15
Salvage Value	0	0
Depreciation & Interest (12%)	$5,263	$2,790
VARIABLE COST/MODULE		
Module Builder Repairs	$2.00	$2.00
Labor	4.00	4.00
Tractor	15.00	15.00
Total Variable Cost/Module	$21.00	$21.00

$/MODULE COST AT VARIOUS USE LEVELS PER YEAR

Modules Built Per Year	5 YEAR LIFE $/Module	5 YEAR LIFE $/Bale	15 YEAR LIFE $/Module	15 YEAR LIFE $/Bale
50	126.26	10.52	76.80	6.40
100	73.63	6.13	48.90	4.07
150	56.09	4.67	39.60	3.30
200	47.31	3.94	34.95	2.91

TABLE 3. COST OF USING COTTON TARPS

ANNUAL USAGE (Bales)	TARP LIFE (Years)					
	Three		Four		Five	
	$/Module	$/Bale	$/Module	$/Bale	$/Module	$/Bale
12	58.24	4.85	46.06	3.83	38.78	3.23
18	38.83	3.23	30.71	2.55	25.85	2.15
24	29.12	2.42	23.03	1.91	19.39	1.61
30	23.30	1.94	18.42	1.53	15.51	1.29

Based on 11' X 37'4" (finished size), 10 oz. S. F. Cotton Duct at $140 each, 12% interest, no salvage value.

Does not include cost of drying, cleaning, storing or retreating.

Form fitted synthetic tarps cost approximately 1/2 the cost of cotton tarps. For cost of synthetic tarps, take 1/2 of cotton tarp cost for your estimated life and use levels.

TABLE 4. COST OF OWNING STEEL PALLETS

ANNUAL USAGE (Bales)	PALLET LIFE (Years)					
	Three		Five		Seven	
	$/Module	$/Bale	$/Module	$/Bale	$/Module	$/Bale
12	168.08	14.00	115.26	9.60	93.22	7.77
18	115.38	9.62	80.17	6.68	65.48	5.46
24	89.04	7.42	62.63	5.22	51.61	4.30
30	73.23	6.10	52.10	4.34	43.29	3.61

Based on initial cost of $380 each, 12% interest and $10/use repair cost.

TABLE 5:

ESTIMATED COST OF MOVING MODULES TO GIN

FIXED COST	NEW SELF-LOADING TRUCK		5th WHEEL TRAILER		FARM TRACTOR GIN YARD TRAILER		PALLET TRAILER
Cost	$89,000.00	$89,000.00	$55,000.00	$55,000.00	$36,500.00	$36,500.00	$10,000.00
Life	5 yr.	10 yr.	5 yr.	10 yr.	5 yr.	10 yr.	5 yr.
Salvage	0	0	0	0	0	0	0
Deprec. & Int.	24,653.00	15,753.00	15,235.00	9,735.00	10,110.00	6,460.50	2,770.00
Tax (part yr. tax)	400.00	400.00	200.00	200.00	--	--	200.00
Insurance (part yr.)	150.00	150.00	143.00	143.00	94.90	94.90	26.00
*Truck Dep. & Int.	--	--	7,756.00	4,956.00	--	--	--
TOTAL FIXED COST/MODULE							
$/Module-300 mod.	84.01	54.34	77.78	50.11	34.01	21.85	9.98
$/Module-500 mod.	50.40	32.60	46.66	30.07	----------Not Possible----------		
$/Module-700 mod.	36.00	23.29	33.33	21.47			
**VARIABLE COST/MODULE							
Repairs	8.00	8.00	6.00	6.00	4.00	4.00	3.00
Fuel & Oil	6.00	6.00	6.00	6.00	--	--	
Labor	4.50	4.50	5.50	5.50	6.00	6.00	6.00
***Tractor	--	--	--	--	22.50	22.50	22.50
Total Variable Cost	18.50	18.50	17.50	17.50	32.50	32.50	31.50
TOTAL COST							
$/Module-300 Mod/yr.	102.51	72.84	95.28	67.61	66.52	54.35	41.48
$/Bale	8.54	6.07	7.94	5.63	5.54	4.53	3.46
$/Module-500 Mod/yr.	68.90	51.10	64.16	47.57	--	--	--
$/Bale	5.74	4.26	5.35	3.96	--	--	--
$/Module-700 Mod/yr.	54.50	41.79	50.83	38.97			
$/Bale	4.54	3.48	4.24	3.25			

*Truck cost for 1½ ton single axle tractor with fifth wheel and air brakes $28,000 at 12% and 10 year life.
**Assumes 1 module/hr. Repair cost based on $4000 annual and 500 modules. All costs based on 10 year life, 12% interest; no salvage value.
***$15 per hour includes tractor repairs, maintenance, oil and fuel. Takes approximately 1.5 times as long to haul a module on an 8-mile one way haul as with a truck.

TABLE 6. TOTAL PER BALE SEED COTTON HANDLING SYSTEM COST FOR 5 YEAR PAYBACK

	Conventional Trailers 16 Trips/year	Pallet Type Module System	Palletless Module System with Cab & Chassis Transporter			Palletless Mod. System with Farm Tractor-Drawn Trans.	Palletless Module System with Road Tractor-Drawn 5th-Wheel Transporter		
Capacity	160 Bales/yr.	3600 Bales/yr.	3600 Bales/yr.	6000 Bales/yr.	8400 Bales/yr.	3600 Bales/yr.	3600 Bales/yr.	6000 Bales/yr.	8400 Bales/yr.
COST									
*Module Forming		6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13
COTTON TARPS 3 yrs Life 1.5 uses/yr	0.63	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23
PALLETS 5 yrs Life 1.5 uses/yr		6.68	---	---	---	---	---	---	---
TRANSPORTATION	10.20	3.46	8.54	5.74	4.54	5.54	7.94	5.35	4.24
TOTAL Cost/Bale	10.83	19.50	17.90	15.10	13.90	14.90	17.30	14.71	13.60

* 1200 Bales per year/Per Module Builder

TABLE 7. ESTIMATED COST FOR HANDLING 1,000 BALES OF SEED COTTON IN TRAILERS & MODULES

COST	6 TRAILERS	1 MODULE BUILDER
Principal & Interest (12%)	$5814	$5263
Insurance,Repair & Maint.	$2154	$400
Labor	$1200	$400
Tractor	$1500	$1500
Tarps	$630	$2550
	$11,289	$10,113
COST/BALE	$11.29	$10.11

Five Year Life. 100 Modules/year, 1 Module/hour X $4 = $400
Tractor $15/hour X 100 hours = $1500

References

Lalor, W. F., J. K. Jones, G. A. Slator. March 1977, Palletless Module Movers. Agro Industrial Report, Volume 4, Number 3. Cotton Incorporated, Raleigh, NC

Kepner, R. A. and Curley, R. G. March 1976. Comparison of Palletless and Pallet Module Systems for Handling Seed Cotton in California. Summary Proceedings of Seed Cotton Handling Seminar, March 1976, Memphis,TN - Sponsored by, Cotton Incorporated, Raleigh, NC

Taylor, Warren E., January 1972. Seed Cotton Handling and Storage, A Researchers Report. Proceedings of 1972 Beltwide Cotton Production - Mechanization Conference. Sponsored by, National Cotton Council, Memphis,TN.

Gary, F. H., January 1973. The Module Builder System. Proceedings of 1973 Beltwide Cotton Production - Mechanization Conference, Phoenix, Arizona, January 11-12, 1973. Sponsored by, National Cotton Council, Memphis, TN.

Paxton, K. W., January 1973. Economics and Efficiency of Module Stacked Seed Cotton Handling. Proceedings of Seed Cotton Handling and Storage Seminar, Phoenix, Arizona, January 8, 1973.

APPENDIX I: COST OF EQUIPMENT AND ASSUMPTIONS MADE

General - All costs were determined using price quotes from Manufacturers Representatives. No adjustments for income tax investment credit was made. All interest rates were at 12% and capital recovered with interest in five and fifteen years life. A zero salvage value was used for all equipment even for five year life computations, in order to avoid disagreement on used equipment values. Each user's equipment will have a different salvage value at the end of its capital recovery life and that value will depend on use, maintenance, operator care and economic conditions of the locale where that machine will be salvaged. An average round-trip from field to the gin of eight miles was assumed, for all systems.

Conventional Trailers -

Producers in Mississippi who buy new cotton trailers, generally buy larger trailers. The most popular size is 10' wide X 40' long X 6' deep and easily handles 10 bales of seed cotton. Cost ranged from $3,200 to $3,800 with delivery distance and tire options accounting for most of the differences in prices. An average of $3,500 per trailer was used. A one through a five year life was used. A fifteen or twenty year average life would not be unreasonable for most Mississippi cotton trailers. Repairs and maintenance cost of $350 per year were based on limited phone survey of ginners. This cost allows for replacing tires, wheels, bearings and hubs, welding of the body as needed and completely repainting every 3 to 4 years of service. No turnrow labor was included for packing trailers.

Tarps -

Tarps 4ft. wider and 6 ft. longer than Modules were recommended. An 11' wide X 37' 4" long 10 oz. single filled cotton duct (before treatment) tarp costs $140.00. A useful life of 3 to 5 years is expected if this tarp is well cared for. It is possible to retreat cotton tarps and perform repairs as needed. Each owner's care and use will determine the repair cost and tarp life. A three year life with no repair cost was assumed as an average.

Form fitted synthetic tarps cost about 1/2 that of cotton tarps. Most users of synthetic tarps consider the possible quality loss due to condensation under a synthetic tarp to be offset by the dangers of a cotton tarp leaking. Trailer tarps were the same tarp used for modules. Since each tarp stays with the trailer throughout the season, useage is greatly increased. Labor involved to tarp trailers and modules assumed to be equal.

Pallets -

Thirty two foot (32') Steel Pallets were available for $380.00 f.o.b. the manufacturer early in 1985. An estimated $10.00 average repair cost per use was assumed with an average life of 5 years.

Module Builder -

Cost for 32' picker model module builders ranged from $17,000.00 - $24,000.00. An average price of $19,000.00 was assumed. Each Module Builder builds one module (twelve bales) per hour, and requires one operator at $4.00 per hour and one 60+ horsepower farm tractor to operate it. Only tractor time for the actual module forming operation was charged. No taxes or insurance were included. An average $500.00 maintenance and repair cost per year was assumed, and an average use of 250 modules/year unless otherwise noted, for a $2.00 per module cost. No turnrow labor was included other than the builder operator.

Farm Tractor -

All tractor costs were charged at $15.00 per hour, regardless of use for pulling trailers or operating the module builder. Fuel, oil, repairs and recovery of investment are assumed to be included in this figure. This reduced tractor cost was arrived at by calculating only the cost of operating at reduced load for the additional hours each season plus difference in per hour capital recovery for the lower and higher use levels.

Palletless Cab and Chassis Transporter -

Cost $89,000.00 for 32' module hauler, heavy duty tandem axle chassis with diesel engine. Average haul distance of 8 miles was assumed and one round-trip made per hour. Labor cost of $4.50 per hour. Repair cost based on estimated $4,000.00 annual repair cost and 500 modules/year or $8.00 per module trip. Insurance and taxes are cost reported for part year coverage by gins. Fuel and oil estimated at 37½ cents per mile.

Palletless Gin Yard Trailer -

Cost of $36,500.00 for a straight tongue farm tractor powered unit was reported. Round-trip time was assumed to be 1½ hours for an average 8 mile trip. Repair cost of $4.00 per module was assumed.

Palletless Fifth-Wheel Road Tractor Transporter -

Cost $55,000.00 for self-loading trailer and $28,000.00 for light to medium duty single axle road tractor. More skilled labor at $5.50 per hour will be required to back the trailer in loading. Fuel and oil cost estimated at 37½ cents per mile.

Pallet Trailer -

Cost $10,000.00 for straight-tongue farm tractor powered pallet trailer in 1985, and may be discontinued before 1986. Repairs to trailer, rollers and winch of $2.00 per module assumed. Requires 1½ hours per round-trip.

APPENDIX II: CAPITAL RECOVERY FACTORS USED TO COMPUTE DEPRECIATION & INTEREST (D & I) FOR EQUIPMENT

Capital Recovery Factors

Machine Life (Years)	Interest Rate (%)							
	9	10	11	12	13	14	15	16
2	.568	.576	.584	.592	.599	.607	.615	.623
3	.395	.402	.409	.416	.424	.431	.438	.445
4	.309	.315	.322	.329	.336	.343	.350	.357
5	.257	.264	.271	.277	.284	.291	.298	.305
6	.223	.230	.236	.243	.250	.257	.264	.271
7	.199	.205	.212	.219	.226	.233	.240	.248
8	.181	.187	.194	.201	.208	.216	.223	.230
9	.167	.174	.181	.188	.195	.202	.210	.217
10	.156	.163	.170	.177	.184	.192	.199	.207
11	.147	.154	.161	.168	.176	.183	.191	.199
12	.140	.147	.154	.161	.169	.177	.184	.192

D & I = (First Cost) X CRF Where no salvage value is used.