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ALTERNATIVE TOBACCO HARVESTING AND CURING SYSTEMS FOR THE NORTH CAROLINA COASTAL PLAINS

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INTRODUCTION

Interest in new techniques for harvesting flue-cured tobacco has been expanding since the middle 1950's when a self-propelled machine was first marketed for harvesting the crop (Chumney and Toussaint, 1957). Since that time new harvesters as well as new curing methods have been developed. Currently there are tractor-drawn and self-propelled priming aides, some of which are used with conventional curing barns while others are designed for bulk curing. In addition, there are self-propelled mechanical harvesters and electric tying machines. Thus the question arises as to the relative costs of the various methods of harvesting tobacco.

This publication reports on one part of a study of flue-cured tobacco harvesting, curing, and marketing practices on tobacco farms in Census Subregion 17, North Carolina.[1] This report is limited to a discussion of alternative tobacco harvesting and curing systems and the presentation of budgets for the systems. A detailed presentation of

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[1]Census Subregion 17 contains the following counties: Edgecombe, Franklin, Green, Harnett, Johnston, Lee, Lenoir, Nash, Pitt, Sampson, Wake, Warren, Wayne, and Wilson.

possible changes in tobacco farm size, organization, and harvesting practices in Census Subregion 17 due to elimination of the acreage control program and implementation of acreage-poundage controls will be reported later. In addition, the effects of increased wage rates on the profitability and adoption of alternative flue-cured tobacco harvesting systems will be the subject of a third report.

Objective

The main objective of this report is to determine the least-cost alternative tobacco harvesting system for each of four sizes of farms. The budget procedure was used to develop information to compare alternative systems. Budgets are presented for four farm sizes and two lengths of run. Length of run was defined for a specific situation--the ownership of conventional tobacco curing barns. In the short run an adequate number of conventional tobacco curing barns were assumed to be on the farms analyzed and therefore no investment costs were necessary for these barns. In the long run no curing facilities were assumed to exist on any farm analyzed. Therefore, investment had to be made for curing barns (bulk or conventional) in the long run. For both lengths of run, investment costs were assumed to be charged for all tobacco harvesting equipment and other machinery used on the farm.

Previous Work

Earlier studies have focused upon the economic evaluation of one particular machine, viz, Ellis et al. (1955), Chumney and Toussaint (1957), and Stone (1959), or the development and field test from an engineering standpoint of a harvester, e.g., Splinter et al. (1960 and 1968), Splinter and Suggs (1966) and Whitaker et al. (1964). Cockroft (1960) in an unpublished thesis presented budgets for several methods of harvesting tobacco and sought to determine the least-cost methods of harvesting, curing, and marketing tobacco. The data used by Cockroft are out of date because of new machines and changes in prices and costs of materials.

Bradford et al. (1963) compared hand harvesting, conventional curing with hand harvesting, bulk curing systems but prices and costs in that study are also out of date.

Chappell and Toussaint (1965) compared hand harvesting, conventional curing, and automatic tying machines with hand harvesting, bulk curing and hand harvesting conventional curing using all hand operations at the barn.

Bradford (1968) indicated the effect of various cultural practices on the net income from tobacco, but he used conventional hand harvesting and curing techniques.

Allgood (1968) compared three harvesting and curing systems for tobacco (hand harvesting, conventional curing vs. hand harvesting with automatic tying machines, conventional curing barn vs. the self-propelled mechanical harvester, bulk curing system). However, he did not consider priming aides or the hand harvesting, bulk curing system. In addition, Allgood was concerned mostly with one size of farm with 30 acres of tobacco, although he did vary tobacco acreage by five acres in one section of his report. The amount of market preparation time for the mechanical harvesting, bulk curing system in the Allgood report seems to be low. Allgood assumed only 74 hours per acre total labor time for the mechanical harvester, including 40 hours for harvesting a 2,000 pound yield. The budgets for this study contain 95.4 hours per acre total labor time for the harvester with essentially the same labor time for harvesting--42.9 hours for 2,010 pounds. Therefore, Allgood appears to have underestimated market preparation time by approximately 18 hours per acre.

Data Sources

About 45 percent of the North Carolina flue-cured tobacco acreage is contained in the 14-county study area in the eastern Piedmont and central Coastal Plains. Farm size is an important variable, and secondary data which contained information on the kinds of harvesting-curing methods in use on farms of various sizes, or which indicated a distribution of farm sizes consistent with the economic definition of a farm,[2] were not available; therefore, primary data were collected.

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[2]Economic definition of a farm is all the land managed by one individual whether he owns it or not. Under this definition sharecroppers are not farmers, although the census of agriculture defines them as such. Instead sharecroppers exchange their labor for a share of the crop and are not different from other farm labor. Therefore, the census was not used as a data source.

A survey of farmers in the 14 counties was taken using a 1 percent area probability sample (Monroe and Finkner, 1959). Information obtained in addition to farm size included tenure, crops grown, age of operator, labor use, wages paid, machinery inventory, the extent of mechanization of tobacco in 1967, an inventory of curing facilities and cultural practices followed on tobacco.

During the summer of 1967 a sample of farmers who were using priming aides in harvesting their crop was taken. The machines were observed in the field and necessary data were recorded on crew size, composition and wages, as well as operational characteristics of the machines.

Also, in the summer of 1967 the operational characteristics of the self-propelled, mechanical harvester were obtained from field trials conducted on a farm near Angier, North Carolina, under the supervision of Splinter and Suggs. Additional information was published about the machine by Splinter et al. (1968).

Chappell observed hand harvesting, bulk curing systems and priming aides used with bulk curing on farms during the summer of 1968 and recorded the necessary data. S. N. Hawks, Extension Agronomy Specialist at N. C. State University, supplied an estimate of the amount of labor required to cure a barn of tobacco. The remaining data necessary to construct the budgets for each harvesting-curing system were obtained from earlier studies. The labor time required for looseleaf market preparation of flue-cured tobacco was taken from Nicholson (1968). Plant bed labor requirements and costs were obtained from North Carolina Agricultural Extension Service (1965) and Bradford (1968). The operational information pertaining to automatic tying machines or loopers came from Chappell and Toussaint (1965).

DESCRIPTION OF SYSTEMS

Eight tobacco harvesting-curing systems were considered for analysis. The systems can be classified according to the method of harvesting and preparation for curing. There are three methods for harvesting tobacco in the field: (1) the conventional hand harvesting method that requires the primers to walk down each row of tobacco and harvest ripe leaves by breaking them off the stalk by hand, (2) the priming aide method that differs from the conventional hand harvesting method only in that the primers are seated on a machine and ride through the field harvesting the tobacco by hand, and (3) the mechanical method that utilizes a machine to mechanically harvest the tobacco from the stalk. Once harvested, the tobacco is transported from the field and cured in either a conventional or a bulk curing barn. There are also several ways of preparing the tobacco for curing: (1) by hand at a conventional curing barn where a barn crew removes harvested tobacco leaves from the trailer and ties them on sticks, (2) with the help of an automatic tying machine or looper at the conventional curing barn, so that the barn crew loads the machine with tobacco and sticks and the looper stitches the tobacco onto the sticks, (3) by hand while riding on a priming aide so that the tobacco is ready to be placed in the barn when the crew leaves the field, (4) by hand at a bulk curing barn by a crew that removes harvested tobacco leaves from the trailer, places them in bulk racks and places the filled racks into the barn, and (5) by a crew of two on the mechanical harvester in the field as the leaves are harvested.

The tobacco systems analyzed in this report that used conventional curing barns were: (1) conventional hand harvesting and barning by hand, (2) conventional hand harvesting and use of an automatic tying machine or looper at the curing barn, (3) harvesting with a tractor-drawn priming aide but barning with an automatic tying machine or looper, (4) harvesting with a tractor-drawn priming aide on which the tobacco is prepared for curing, and (5) harvesting with a self-propelled

priming aide on which the tobacco is prepared for curing. Those systems that required bulk barns were: (1) conventional hand harvesting and barning by hand, (2) harvesting with a tractor-drawn priming aide where the tobacco was prepared in the field for curing, and (3) mechanical harvesting and curing preparation (Table 1).

Crew size for the harvesting and curing systems was assumed to vary from 5 to 20 persons according to the system considered (Table 2).[3] The mechanical harvesting method, of course, used no persons as primers. However, each of the remaining methods was assumed to require four people as primers. The composition of the rest of the crew depends upon the harvesting and curing system.

In addition to varying crew sizes the individual systems employ several kinds of labor for harvesting and curing tobacco. The hand harvesting method requires that primers be able-bodied men or older boys, while women, teenagers and older persons can work as primers on priming aides. The people who tie or rack the tobacco are usually women, although men are employed on the mechanical harvester. However, for the hand harvesting, hand barning system used with conventional curing barns nine of the twelve people in the tying crew can be children who hand the tobacco from the trailer or sled to the persons tying it on sticks.

The four farm sizes considered for analysis were selected by plotting a distribution of farms with 10-acre size intervals using the 1968 farmer survey data for Census Subregion 17. The farm size groups were chosen from the distribution based on number of observations per

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[3]The tobacco harvesting and curing systems are necessarily given short names when they appear in the tables. Thus the system that uses primers to hand harvest the tobacco in the field and a large barn crew to tie the tobacco on sticks by hand and hang it in a conventional curing barn is simply referred to as hand harvesting, conventional curing. Similarly, the other four systems that use conventional curing barns are given short names. Thus, hand harvesting and barning with the help of an automatic tying machine becomes just automatic tying machine, while harvesting with a priming aide drawn by a tractor and barning with an automatic tying machine is referred to as priming aide and automatic tying machine. The two systems that employ priming aides on which the tobacco is harvested and prepared for curing are referred to as priming aide and self-propelled priming aide according to the power source. The bulk curing systems are given similar names.

Table 1. Harvesting and curing systems for flue-cured tobacco selected for analysis

Methods of preparing tobacco for curing	Harvesting methods		
	Conventional hand harvesting	Priming aide method	Mechanical method
Conventional curing barn:			
By hand	x		
By automatic tying machine	x	x	
By priming aide		x[a]	
Bulk curing barn:			
By hand	x		
By priming aide		x	
By mechanical harvester			x

[a]Two of these systems were analyzed. The difference between the systems concerned the power source and hence investment cost. One system was tractor-drawn, the other self-propelled. Both systems required the same crew size.

group, compatibility with size groups defined by the census, and common levels of resource use. The intervals chosen and number of tobacco farms per group in 1968 were as follows: (1) 101 farms with 10-49 acres of cropland, (2) 85 farms with 50-99 acres of cropland, (3) 60 farms with 100-219 acres of cropland, and (4) 17 farms with 220 or more acres of cropland. An arithmetic mean for acres of cropland and acres of tobacco was computed for each of the four farm size groups. The representative farms used in the analysis of the tobacco harvesting and curing systems were: (1) the small farm with 30.1 acres of cropland and 5.28 acres of tobacco, (2) an average farm with 69.6 acres of cropland and 9.27 acres of tobacco, (3) a medium farm with 143.2 acres of cropland and 15.86 acres of tobacco, and (4) a large farm with 369.6 acres of cropland and 32.20 acres of tobacco. Hereafter, the farms will be referred to simply as small, average, medium, and large farms.[4]

[4]This report presents only tobacco budgets for these farms. However, the farms surveyed did produce other crops (Appendix). In no instance did a farmer produce only tobacco. Therefore, the analysis

Table 2. Crew size and composition for selected tobacco harvesting and curing systems, Census Subregion 17, North Carolina

Harvesting system	Crew size	Composition of crew			
		Primers	Drivers	Tying or racking	Other[a]
		(number of workers)			
Bulk curing systems:					
Hand harvesting	10	4	2	4	-
Priming aide	9	4	2	3	-
Mechanical harvester	5	-	2	2	1
Conventional curing systems:					
Hand harvesting	20	4	2	12	2
Tying machine	14	4	2	5	3
Priming aide and tying machine	15	4	2	5	4
Priming aide	11	4	2	4	1
Self-propelled priming aide	11	4	2	4	1

[a]Includes various jobs not easily categorized such as the man to help load at the barn with the mechanical harvester, people hanging tied sticks in the barn when this job is not done by the whole crew, and various strenuous tasks such as moving tobacco in the field from where it is tied or racked to a trailer or pallet so it can be hauled to the barn.

Labor Requirements, Wage Rates, and Management Time

The labor requirements for any system of harvesting flue-cured tobacco can vary considerably depending upon the size, sex and age composition, and efficiency of the crew doing the work as well as the managerial skills of the farm operator. For this study the labor and management coefficients assumed were the averages of those obtained from the farmer surveys and other data. Hence, the labor requirements may not agree exactly with the times required for tasks on a particular farm. However, the figures are presented in sufficient detail to facilitate adjustment of coefficients if the reader cares to do so.

The total labor requirements for each harvesting and curing system do not vary by farm size. However, the operator was assumed to have a fixed number of hours per year and from these could work or supervise hired labor; no family labor was assumed to be available. All hired labor was assumed to require one hour of operator supervisory time for each 20 hours hired.[5] Thus the amount of time the operator spent working as opposed to supervising varied by farm size. (See the Appendix for a detailed labor breakdown by farm size.) The only other assumption made with regard to management was that the operator had enough managerial ability to adequately manage his farm.

Wage rates for hired labor were those paid in the 1967 harvest season. No significant variation in wages paid for any one task by different sizes of farms was evident from the survey data. However, wages varied by task performed by the laborer. Those people priming tobacco received the highest hourly wage along with some persons performing tiresome jobs for a few of the systems, such as the "stick-stackers" on the riding priming aides with conventional systems, the trailer loader on the bulk priming aide system, and all members of the mechanical harvester crew. Those people stringing or racking received the next highest wage with the other crew members receiving lower wages. For simplicity, an average wage was computed for each system weighted

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is presented with the assumption that the farm machinery is also used on other crops when needed. Thus, annual costs of ownership are allocated to tobacco on a pro rata basis of total hours of use annually.

[5] Bradford *et al.* (1963) also used this assumption.

for the percentage of the crew at each individual wage rate. The 1967 weighted wage rates fall in a narrow range from $0.93 - $1.06 per hour (Table 3). After the least-cost system, at 1967 weighted wage rates, is determined, then wage rates will be increased and the relative profitability of the harvesting-curing systems will be explored.

Variable Requirements

The variable resources other than labor used in harvesting, curing, and market preparation of one acre of flue-cured tobacco will be discussed in this section. They fall into two categories--those that vary with farm size and those that do not. Many resources are required in the same amount regardless of farm size because they are related to the quantity of tobacco harvested per acre rather than farm size. For example, the same amounts of curing fuel, electricity, twine, and barn insurance are required per acre for a 2,010 pound yield of tobacco whether it is grown on a small or a large farm.

Other resources such as machinery do vary in cost as farm size changes. For example, a small tractor may be adequate for a small farm, but a larger farm may require two tractors in order to assure timeliness of operations. If the two tractors are of different sizes so that, say, there is a 20-horsepower and a 45-horsepower tractor then the cost per acre for machinery for the small farm and the larger farm will be different.[6] The same is true for trucks required to market tobacco. If one farmer can market his tobacco with a pickup, but another produces so much tobacco that a large truck is required for transportation, their cost per acre for marketing will be different. Thus, when the budgets are presented there will be two kinds of variable expenses.

Capital Considerations

Capital requirements for the harvesting and curing systems vary considerably because of the different levels of investment in harvesting equipment (Table 4). The farmer was assumed to have enough capital to

[6]The reader is reminded that tobacco farmers produce other crops. Hence, the machinery presented in the tobacco budgets is used also on other enterprises and tobacco does not bear all the costs of the equipment.

Table 3. Weighted wage rates for hired labor for harvesting-curing systems for flue-cured tobacco, Census Subregion 17, North Carolina

Item	Weighted wage rate per hour
Conventional curing systems	
Hand harvesting	0.94
Automatic tying machine	0.98
Priming aide and automatic tying machine	0.98
Priming aide	0.97
Self-propelled priming aide	0.93
Bulk curing systems	
Hand harvesting	1.04
Priming aide	1.06
Mechanical harvester	1.06

Table 4. Annual costs for tobacco harvesting equipment

Item	Automatic tying machine	Priming aide	Self-propelled priming aide	Priming aide for use with automatic tying machine	Priming aide and 3 trailers, bulk curing	Mechanical harvester, bulk curing
Investment cost (dols.)	1,550.00	900.00	3,595.00	800.00	2,800.00	12,500.00
Years of life	7	10	10	10	10	7
Annual costs (dols.):						
Depreciation and repairs	267.93	90.00	359.50	80.00	280.00	1,785.71
Interest	46.50	27.00	107.85	24.00	84.00	375.00
Insurance and taxes	31.00	18.00	71.90	16.00	56.00	312.50
Total	345.43	135.00	539.25	120.00	420.00	2,473.21

purchase any harvesting-curing system considered. Once purchased, the farmer must pay all the annual costs associated with the equipment. Therefore, the annual ownership cost is entered in the budget along with the operating costs for fuel, oil, etc. The ownership costs of the machinery are the same for all farms when considered on an annual basis. However, the costs on a per acre basis are different for each size of farm.

The annual costs for tobacco barns were based upon a cost per pound of tobacco, due to the variety of barn sizes.[7] The costs would be the same for all farms. Therefore all systems utilizing bulk curing barns were charged 6.1 cents per pound and all systems with conventional curing barns were charged 2.1 cents per pound annual costs.

Resource Situations by Farm Size

This section presents the budgets for tobacco production and harvesting in detail by kind of harvesting system and by farm size.

Because the emphasis of the report is upon the harvesting-curing phases of tobacco culture, a single production budget was constructed to give the preharvest costs for flue-cured tobacco, regardless of the harvesting-curing system employed (Table 5). The production budget was taken from the unpublished Ph.D. thesis by Bradford (1968) and modified with regard to the costs of machinery and sucker control materials, both of which seemed too low. While the cost categories in the budget are fairly aggregative, a more detailed presentation would require construction of a new budget which would add little to the analysis. As long as the preharvest expenses in the original budget are a good approximation to reality, the production budget has served its purpose.

Labor requirements and machinery usage for the preharvest operations of tobacco production are depicted in Table 6. Table 7 presents a comprehensive breakdown of the equipment schedule for the preharvest operations associated with tobacco production assumed to be representative of tobacco farms in this geographic area of study.

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[7]The conventional tobacco barns on the farms surveyed in 1968 were of 21 sizes, excluding number of tiers which ranged from two to nine. Bulk barns, although not as variable, also cover a range of sizes.

Table 5. Tobacco preharvest budget: One acre, 2,010 pound yield, Census Subregion 17, North Carolina

Item	Costs	
	Per pound[a]	Per acre
	(dollars)	
Variable costs (preharvest):		
Plant bed	.0110	22.11
Field fertilizer	.0209	42.01
Sucker control material[b]	.0073	14.66
Crop insurance	.0147	29.55
Tractor and 1/2 ton truck operating costs[c]		12.77
Other field costs	.0090	18.09
Total		139.19
Annual ownership costs for field machinery and 1/2 ton truck[c]		6.81
Total production costs except labor		146.00

[a]Cost per pound figures obtained from Bradford (1968), Tables 2 to 8 and 19 to 22 except as noted.

[b]Cost computed as follows: 7/8 gal. MH-30 at $16.75/gal. = $14.66. Cost per pound = $14.66/2,010 = .0073.

[c]These costs are calculated in Table 6.

Table 6. Tobacco preharvest operations: Labor and machinery budget for one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Machinery			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Cut stalks and seed cover crop	3.6	31 drawbar hp tractor and specified equipment[a]	3.3	1.65	1.33
Plant bed	16.1	Tractor	1.3	.72	
Land preparation	5.9	Tractor and equipment[a]	5.4	2.70	1.05
Transplanting	11.3	Tractor and transplanter[a]	4.8	2.40	1.03
Transplanting support	27.5	1/2 ton truck	1.4	1.40	2.10
Growing	17.6	Tractor and equipment	7.2	3.60	1.17
Topping and suckering	32.8	Tractor and sprayer[a]	.6	.30	.13
Total	114.8		24.0	12.77	6.81

[a]See Table 7 for detailed listing of machinery used and computation of annual ownership costs. Variable costs were computed at 50 cents per hour for tractor and one dollar per hour for 1/2 ton truck.

Table 7. Tobacco preharvest operations: Equipment and tractor budget for one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Equipment				Tractor	
			Annual ownership costs			
	Type	Use	Per hour	Per acre	Use	Variable costs
		(hours)	(dollars)		(hours)	(dollars)
Cover crop:						
Cut stalks	2-row stalk cutter	0.7	.15	.10	.7	.35
Plow out roots	3-14" moldboard	1.1	.46	.51	1.1	.55
Disk land	7' tandem disk	.7	.30	.21	.7	.35
Harrow	9' section harrow	.4	.09	.04	.4	.20
Drill cover crop	8' drill	.4	1.17	.47	.4	.20
Subtotal		3.3		1.33	3.3	1.65
Plant bed					1.3	.72
Land preparation:						
Break land	3-14" moldboard	1.1	.46	.51	1.1	.55
Disk land	7' tandem disk	.7	.30	.21	.7	.35
Harrow	9' section harrow	.4	.09	.04	.4	.20
Lay off rows and fumigate	2-row plow with applicator	2.0	.11	.22	2.0	1.00
Distribute fertilizer	1-row distributor	1.2	.06	.07	1.2	.60
Subtotal		5.4		1.05	5.4	2.70
Transplanting:						
Transplant	1-row transplanter	3.8	.27	1.03	3.8	1.90
Replant	Hand transplanter				1.0	.50
Subtotal		3.8		1.03	4.8	2.40
Transplanting support:						
Pull plants						
Haul plants and water	1/2 ton truck	1.4	1.50	2.10		
Subtotal		1.4		2.10		

Table 7 (continued)

Operation	Equipment				Tractor	
			Annual ownership costs			
	Type	Use	Per hour	Per acre	Use	Variable costs
		(hours)	(dollars)		(hours)	(dollars)
Growing:						
Cultivate, 3 times	1-row cultivator	4.5	.12	.54	4.5	2.25
Cultivate and side dress	1-row cultivator and fertilizer attachment	1.5	.25	.38	1.5	.75
Poison, 4 times	4-row sprayer	1.2	.21	.25	1.2	.60
Subtotal		7.2		1.17	7.2	3.60
Topping and suckering:						
Apply MH-30	4-row sprayer	.6	.21	.13	.6	.30
Total		21.7		6.81	22.6	11.37

Labor costs were not included in the production budget because the price of labor will be varied and the effect upon total costs discussed later.

The harvesting and curing system budgets present the costs for each size of farm.

The hand harvesting, conventional curing system is a relatively low cost system as long as no charge is made for labor (Table 8). The total costs except labor range from $306 to $310 per acre depending upon farm size when no charge is made for conventional curing barns. (In this section of the report the question of length of planning horizon will be set aside and no charge will be made for conventional curing barns for any system.)

The total labor required is 255.2 hours as shown in the labor and machinery schedule in Table 9. In this report, the times shown for the individual labor tasks such as priming are not varied from one system to another unless a task is performed in a different manner in one instance than in another. For example, priming time when walking through the field is always 44.3 hours per acre. It changes when primers ride instead of walk. Thus the labor times for curing, other market preparation, and marketing are the same for all systems. The labor times for hanging tobacco in the barn and removing to the packhouse are the same for the five conventional curing barn systems, but differ for bulk systems. The remaining tasks have different times for several systems.

The automatic tying machine, conventional curing system saves 72.3 hours of labor (Table 10) when compared to the hand harvesting, conventional curing system budgeted in Table 9. The annual costs of the machine add $65 per acre to the costs of the small farm, $37 to those of the average farm, $22 to medium farm costs and only $11 to those for the large farm (Table 11). Thus, per acre fixed costs decline as the machine is used at higher and higher levels approaching its capacity.

When a tractor-drawn priming aide replaces walking primers in the above system, 6.6 hours are added to total labor hours (Table 12). The extra time is distributed between hauling and priming activities. Although the primers go slower when riding than when walking, the

Table 8. Tobacco budget: Hand system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue:[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs				
Curing fuel	55.27	55.27	55.27	55.27
Twine	4.02	4.02	4.02	4.02
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	9.25	11.19	11.19	9.25
Subtotal	98.49	100.43	100.43	98.49
Post harvest equipment variable costs[b]	9.70	9.70	9.70	11.82
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	293.38	295.32	295.32	295.50
Annual ownership costs, truck and trailer	12.95	12.95	12.95	14.63
Total short-run costs (except labor)	306.33	308.27	308.27	310.13
Annual ownership costs, conventional barn	42.21	42.21	42.21	42.21
Total long-run costs (except labor)	348.54	350.48	350.48	352.34

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 9.

Table 9. Hand system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming	44.3				
Hauling	18.5	31 drawbar hp tractors and trailers[a]	18.5	9.25	1.48
Handing and stringing	109.0				
Hanging in barn	18.3				
Removing to packhouse	11.6	31 drawbar hp tractor and trailer	4.6	2.30	.37
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Looseleaf preparation	39.2				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	255.2		30.5	18.95	12.95

[a]For the two middle sized farms, one of the 31 drawbar hp tractors was replaced by a larger 42 drawbar hp tractor with variable costs of $6.57. Therefore, variable costs for these farm sizes are $11.19 rather than the $9.25 shown above.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 figures shown above.

Table 10. Tying system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming	44.3				
Hauling	18.5	31 drawbar hp tractors and trailers[a]	18.5	9.25	1.48
Tying	43.7				
Hanging in barn	18.3				
Removing to packhouse	11.6	31 drawbar hp tractor and trailer	4.6	2.30	.37
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Looseleaf preparation	32.2				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	182.9		30.5	18.95	12.95

[a]For the two middle sized farms one of the 31 drawbar hp tractors was replaced by a larger 42 drawbar hp tractor with variable costs of $6.57. Therefore variable costs for these farms are $11.19 rather than the $9.25 shown above.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 figures shown above.

Table 11. Tobacco budget: Tying system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs				
Curing fuel	55.27	55.27	55.27	55.27
Twine	4.02	4.02	4.02	4.02
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	9.25	11.19	11.19	9.25
Subtotal	98.49	100.43	100.43	98.49
Postharvest equipment variable costs[b]	9.70	9.70	9.70	11.82
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	293.38	295.32	295.32	295.50
Annual ownership costs truck and trailer	12.95	12.95	12.95	14.63
Annual ownership costs automatic tying machine	65.42	37.26	21.79	10.73
Total short-run costs (except labor)	371.75	345.53	330.06	320.86
Annual ownership costs, conventional barn	42.21	42.21	42.21	42.21
Total long-run costs (except labor)	413.96	387.74	372.27	363.07

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 10.

Table 12. Aide-tying system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming	59.5	Tractor, trailer and priming aide	9.9	4.95	.79
Hauling	9.9	Tractor and trailer[a]	9.9	4.95	.79
Tying	43.7				
Hanging in barn	18.3				
Removing to packhouse	11.6	Tractor and trailer	4.6	2.30	.37
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Looseleaf preparation	32.2				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	189.5		31.8	19.60	13.05

[a]For the two middle sized farms a larger tractor was used in hauling than the one figured above. The variable costs of this tractor are $7.03 which replaces the $4.95 figure above.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 entries above.

operator can use a different kind of labor with the priming aide than he can without one. The fixed costs of the priming aide add $23 per acre to the costs for the small farm, but only $4 per acre to the costs of the large farm. Also the machinery costs per acre for all farm sizes increase because of the longer priming and hauling times for this system (Table 13).

The tractor-drawn priming aide, conventional curing barn system requires 197.0 hours of labor per acre (Table 14) or 7.5 hours more than the priming aide and tying machine system; but 58.2 hours less than the hand harvesting, conventional curing system of Table 9. The annual costs of this priming aide are very close to those recorded for the priming aide used in the previous system. As with the previous system, the machinery costs are higher because of the relatively slow priming and hauling times. Tractor operating expense for the small farm is $10.30 compared to $9.25 for the hand harvesting, conventional curing system (Table 15). However, total costs for the priming aide, conventional curing system are low because of the low annual costs of the priming aide and the relatively low labor requirements.

The last harvesting and curing system discussed that requires conventional curing barns is the self-propelled priming aide. It is similar to the tractor-drawn priming aide, conventional curing system just discussed in that both systems require an 11-man crew, 10 of whom work in the field. The self-propelled priming aide, conventional curing system requires 184.8 hours of labor per acre (Table 16) as compared to 197.0 hours for the tractor-drawn priming aide, conventional curing system (Table 14), and 255.2 hours for the hand harvesting, conventional curing method (Table 9). The self-propelled priming aide system requires more capital investment than any system yet discussed. As a result, the annual costs are $102 per acre for the small farm, $58 for the average farm, $34 for the medium farm, and $17 for the large farm (Table 17). However, only one tractor is needed with this system so farmers considering the purchase of an extra tractor might find it to be a good investment.

The hand harvesting, bulk curing system saves 123.7 hours of labor per acre (Table 18) when compared to the hand harvesting, conventional curing system of Table 9 and 51.4 hours when compared to the automatic

Table 13. Tobacco budget: Aide-tying system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs				
Curing fuel	55.27	55.27	55.27	55.27
Twine	4.02	4.02	4.02	4.02
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	9.90	11.98	11.98	9.90
Subtotal	99.14	101.22	101.22	99.14
Postharvest equipment variable costs[b]	9.70	9.70	9.70	11.82
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	294.03	296.11	296.11	296.15
Annual ownership costs, truck and trailer	13.05	13.05	13.05	14.73
Annual ownership costs, priming aide	22.73	12.95	7.57	3.72
Annual ownership costs, automatic tying machine	65.42	37.26	21.79	10.73
Total short-run costs (except labor)	395.23	359.37	338.52	325.33
Annual ownership costs, conventional barn	42.21	42.21	42.21	42.21
Total long-run costs (except labor)	437.44	401.58	380.73	367.54

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 12.

Table 14. Aide system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming and stringing	103.3	Tractor and priming aide	10.3	5.15	.82
Hauling	10.3	Tractor and trailer[a]	10.3	5.15	.82
Hanging in barn	18.3				
Removing to packhouse	11.6	Tractor and trailer	4.6	2.30	.37
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Looseleaf preparation	39.2				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	197.0		32.6	20.00	13.11

[a]For the two middle sized farms, a larger tractor was used in hauling than the one figured above. The variable costs of the larger tractor are $7.31 which replaces the $5.15 figure above.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 entries above.

Table 15. Tobacco budget: Aide system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs:				
Curing fuel	55.27	55.27	55.27	55.27
Twine	4.02	4.02	4.02	4.02
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	10.30	12.46	12.46	10.30
Subtotal	99.54	101.70	101.70	99.54
Postharvest equipment variable costs[b]	9.70	9.70	9.70	11.82
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	294.43	296.59	296.59	296.55
Annual ownership costs, truck and trailer	13.11	13.11	13.11	14.79
Annual ownership costs, priming aide	25.57	14.56	8.52	4.19
Total short-run costs (except labor)	333.11	324.26	318.22	315.53
Annual ownership costs, conventional barn	42.21	42.21	42.21	42.21
Total long-run costs (except labor)	375.32	366.47	360.43	357.74

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 14.

Table 16. Self-propelled aide system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming and stringing	92.2	Self-propelled priming aide[a]	9.2	4.23	
Hauling	9.2	Tractor and pallet	9.2	4.60	
Hanging in barn	18.3				
Removing to packhouse	11.6	Tractor and trailer	4.6	2.30	.37
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Looseleaf preparation	39.2				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	184.8		30.4	18.53	11.47

[a]Variable costs for the priming aide were calculated as follows: Fuel - 2 gal./hour at $.20/gal. for 9.2 hours = $3.68; grease, oil and filters - 15 percent of fuel or $.55. Total variable cost is thus $3.68 + .55 = $4.23.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 entries above.

Table 17. Tobacco budget: Self-propelled aide system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs:				
Curing fuel	55.27	55.27	55.27	55.27
Twine	4.02	4.02	4.02	4.02
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	4.60	4.60	4.60	4.60
Priming aide operating costs[b]	4.23	4.23	4.23	4.23
Subtotal	98.07	98.07	98.07	98.07
Postharvest equipment variable costs[b]	9.70	9.70	9.70	11.82
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	292.96	292.96	292.96	295.08
Annual ownership costs, truck and trailer	11.47	11.47	11.47	13.15
Annual ownership costs, self-propelled priming aide	102.13	58.17	34.02	16.75
Total short-run costs (except labor)	406.56	362.60	338.45	324.98
Annual ownership costs, conventional barn	42.21	42.21	42.21	42.21
Total long-run costs (except labor)	448.77	404.81	380.66	367.19

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 16.

Table 18. Hand-bulk system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming	44.3				
Hauling	18.5	Tractors and trailers[a]	18.5	9.25	1.48
Barning	31.0				
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Removing to packhouse	11.3	Tractor and trailer	4.5	2.25	.36
Looseleaf preparation	12.1				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	131.5		30.4	18.90	12.94

[a]For the two middle sized farms, a larger tractor than 31 drawbar hp was used for hauling. One 42 drawbar hp tractor and one 31 drawbar hp tractor were used. The larger tractor had variable costs of $6.57 which makes total variable costs for the two farms for hauling = $11.19.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 entries above.

tying machine, conventional curing system (Table 10). The labor saving occurs for the barning and looseleaf market preparation tasks with the bulk system. As far as costs are concerned, the bulk barn has annual costs of 6.1 cents per pound of tobacco for each size of farm. The barn also requires electricity to run the blower but does not need twine (Table 19).

The priming aide, bulk curing system reduced total labor 3.2 hours per acre when compared to hand harvesting and bulk curing (Table 20). The bulk racking and barning times for the priming aide were less than for the hand harvesting, bulk curing system and were enough to offset the higher priming time with the priming aide. In the operation of the priming aide, harvested leaves are placed between belts which carry the tobacco to bins on either side of a racking turntable. The tobacco is taken from the bins by hand and placed in the racking turntable. There it is racked and the bulk rack removed and placed in a special trailer towed behind the priming aide.

The annual cost of the priming aide varies from $80 to $13 according to size of farm (Table 21). Also, with this system machinery operating costs are slightly greater than with the hand harvesting, bulk curing system. For the small farm, total costs excluding labor are $516.51 compared to $306.33 for the hand harvesting, conventional curing system.

The last bulk curing system analyzed uses the least labor (Table 22). It requires 95.4 hours of labor per acre. In the operation of the one-row, mechanical harvester, leaves are harvested and placed in the bulk rack turntable mechanically. However, the bulk racks are fastened and removed from the turntable by hand. The leaves of tobacco are randomly oriented when racked and are cured in this condition. Thus, the looseleaf market preparation time is higher for the mechanical harvester than for any other bulk curing system because the leaves are assumed to be oriented with the butts in one direction for marketing.

The annual costs of the mechanical harvester are high because of the large capital investment required. For example, annual costs per acre for the harvester on the small farm are $468 (Table 23). When the annual costs of the bulk curing barns are added to the costs of the harvester, and variable and other costs except labor are considered,

Table 19. Tobacco budget: Hand-bulk system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs:				
Curing fuel	54.87	54.87	54.87	54.87
Electricity	13.50	13.50	13.50	13.50
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	9.25	11.19	11.19	9.25
Subtotal	107.57	109.51	109.51	107.57
Postharvest equipment variable costs[b]	9.65	9.65	9.65	11.77
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	302.41	304.35	304.35	304.53
Annual ownership costs, truck and trailer	12.94	12.94	12.94	14.62
Annual ownership costs, bulk barn	122.61	122.61	122.61	122.61
Total costs (except labor)	437.96	439.90	439.90	441.76

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 18.

Table 20. Aide-bulk system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Priming and bulk racking	80.5	Tractor, priming aide, and bulk trailer	10.1	5.05	
Hauling and putting in barn	10.1	Tractor and bulk trailer[a]	10.1	5.05	
Removing to packhouse	11.3	Tractor and bulk trailer	4.5	2.25	
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Looseleaf preparation	12.1				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	128.3		32.1	19.75	11.10

[a]For the two middle sized farms a larger tractor than the 31 drawbar hp tractor used above was used for hauling. Therefore, the variable costs change from $5.05 to $7.17 for hauling for these two farms.

[b]For the largest farm a 1 1/2 ton truck was used in marketing tobacco. The costs are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 entries above.

Table 21. Tobacco budget: Aide-bulk system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs:				
Curing fuel	54.87	54.87	54.87	54.87
Electricity	13.50	13.50	13.50	13.50
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	10.10	12.22	12.22	10.10
Subtotal	108.42	110.54	110.54	108.42
Postharvest equipment variable costs[b]	9.65	9.65	9.65	11.77
Marketing, warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	303.26	305.38	305.38	305.38
Annual ownership costs, truck	11.10	11.10	11.10	12.78
Annual ownership costs, priming aide and bulk trailers	79.54	45.29	26.49	13.04
Annual ownership costs, bulk barn	122.61	122.61	122.61	122.61
Total costs (except labor)	516.51	484.38	465.58	453.81

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 20.

Table 22. Mechanical harvester system: Labor and machinery budget for harvesting and postharvest operations, one acre, 2,010 pound yield, Census Subregion 17, North Carolina

Operation	Labor	Equipment			
		Description	Use	Costs	
				Variable	Annual ownership
	(hours)		(hours)	(dollars)	
Harvesting and barning	42.9	Harvester, tractor and pallet[a]	8.6	12.21	
Curing	6.7	1/2 ton truck	3.4	3.40	5.10
Removing to packhouse	11.3	31 drawbar hp tractor and trailer	4.5	2.25	.36
Looseleaf preparation	26.9				
Other market preparation	2.0				
Marketing	5.6	1/2 ton truck[b]	4.0	4.00	6.00
Total	95.4		20.5	21.86	11.46

[a]Calculation of variable costs: 31 drawbar hp tractor, 8.6 hours at $.50 = $4.30; harvester, 8.6 hours at 4 gal./hour at $.20/gal. = $6.88 for fuel; grease oil and filters for harvester = 15 percent of fuel cost = $1.03. Total variable costs = $4.30 + $6.88 + $1.03 = $12.21.

[b]For the largest farm, a 1 1/2 ton truck was used in marketing tobacco. The costs of the 1 1/2 ton truck are as follows: Variable costs = $6.12, annual ownership costs = $7.68. These figures replace the $4.00 and $6.00 entries above.

Table 23. Tobacco budget: Mechanical harvester system, one acre, 2,010 pound yield, four farm sizes, Census Subregion 17, North Carolina

Item	Farm size			
	Small	Average	Medium	Large
	(dollars)			
Total revenue:[a]	1,306.50	1,306.50	1,306.50	1,306.50
Preharvest variable costs	146.00	146.00	146.00	146.00
Harvest variable costs:				
Electricity	13.50	13.50	13.50	13.50
Curing fuel	54.87	54.87	54.87	54.87
Barn insurance	29.95	29.95	29.95	29.95
Tractor operating costs[b]	4.30	4.30	4.30	4.30
Harvester operating costs[b]	7.91	7.91	7.91	7.91
Subtotal	110.53	110.53	110.53	110.53
Postharvest equipment variable costs[b]	9.65	9.65	9.65	11.77
Marketing warehouse costs	39.19	39.19	39.19	39.19
Total variable costs (except labor)	305.37	305.37	305.37	307.49
Annual ownership costs, truck and trailer	11.46	11.46	11.46	13.14
Annual ownership costs, harvester	468.41	266.80	156.04	76.81
Annual ownership costs, bulk barn	122.61	122.61	122.61	122.61
Total costs (except labor)	907.85	706.24	595.48	520.05

[a]Computed using 65 cents per pound sales price.

[b]Source: Table 22.

the total for the small farm becomes $907.85, which is nearly three times the cost for the hand harvesting, conventional curing system first discussed. However, annual costs per acre for the harvester are $76.81 for the large farm, which lower total costs to $520.05 when labor is excluded. Thus for the large farm, the laborsaving could possibly offset the added costs of the machine.

SHORT-RUN DECISIONS AND FARM SIZE

One decision facing farmers is whether to invest in a harvesting system that will make use of existing conventional curing barns or to invest in one that requires abandonment of existing curing facilities in favor of bulk barns.

Total receipts are assumed to be equal for all harvesting and curing systems. Therefore, the system which is least-cost will also be most profitable. Thus, to determine the least-cost harvesting and curing system in the short run, total costs including labor expenses calculated from the 1967 weighted wages of Table 3 and nonlabor costs of Tables 8-23 were calculated for each system for each of the four sizes of farms (Table 24). The total costs per acre for the least-cost systems are underlined in the table. Thus, the least-cost system for small farms in the short run was the priming aide, conventional curing system. The priming aide costs $22.02 less per acre than the hand harvesting, conventional curing system and $26.79 less than the automatic tying machine, conventional curing system. On a per acre basis such cost reductions are substantial, but for the whole farm allotment of 5.28 acres of tobacco the cost savings per year from using the priming aide in preference to the hand harvesting, conventional curing system on the farm are $116.27. Such an amount could be too small to persuade some farmers to abandon hand harvesting, especially if they were old enough to retire in a few years. On the other hand, if labor were scarce, the farmer could use the priming aide, conventional curing system as a means to reduce the quantity of labor used and reduce costs at the same time.

The priming aide, conventional curing system was also the least-cost method for harvesting and curing tobacco on average farms. The automatic tying machine, conventional curing system would increase costs by $9.42 per acre, while the self-propelled priming aide, conventional curing system would cost $19.11 more per acre if used in preference to the least-cost method. The average farm has 9.27 acres of tobacco;

Table 24. Short-run costs per acre for selected flue-cured tobacco harvesting and curing systems for each of four sizes of farms, Census Subregion 17, North Carolina, 1967

Item	Conventional curing systems					Bulk curing systems		
	Hand harvesting	Automatic tying machine	Priming aide and tying machine	Priming aide	Self-propelled priming aide	Hand harvesting	Priming aide	Mechanical harvester
	(dollars)							
Labor costs for producing tobacco with weighted wages of $0.88 per hour	101.02	101.02	101.02	101.02	101.02	101.02	101.02	101.02
Weighted harvesting-curing wages per hour	.94	.98	.98	.97	.93	1.04	1.06	1.06
Labor costs for harvesting-curing tobacco	239.89	179.24	185.71	191.09	171.86	136.76	136.00	101.12
Total labor costs	340.91	280.26	286.73	292.11	272.88	237.78	237.02	202.14
Total costs by size of farm:								
Small farms	647.24	652.01	681.96	625.22	679.44	675.74	753.53	1109.99
Average farms	649.18	625.79	646.10	616.37	635.48	677.68	721.40	908.38
Medium farms	649.18	610.32	625.25	610.33	611.33	677.68	702.60	797.62
Large farms	651.04	601.12	612.06	607.64	597.86	679.54	690.83	722.19

therefore it would cost the farmer $87.32 or $177.15 per year extra to use the automatic tying machine or self-propelled priming aide in preference to the priming aide, conventional curing system.

For medium farms there is very little difference in costs for three systems. The least-cost system, the automatic tying machine, conventional curing system, costs only one cent per acre less than the priming aide, conventional curing system (Table 24). The third system, the self-propelled priming aide, increases costs $1.01 per acre more than the tying machine. Thus, for practical purposes, any one of the three systems would be a good choice for medium farms with 15.86 acres of tobacco in the short run. The exact choice would depend upon non-monetary considerations such as personal preference of the farmer.

For large farms, the least-cost harvesting and curing system is the self-propelled priming aide. However, the automatic tying machine, conventional curing system would increase costs only $3.26 per acre. In addition, the priming aide, conventional curing system would cost $9.78 per acre more than the self-propelled priming aide. When converted to an annual basis, the automatic tying machine would increase costs $104.97 and the priming aide, conventional curing system would cause costs to rise $314.92 if employed on the 32.20 acres of tobacco on the large farm in preference to the self-propelled priming aide.

For each farm size, three of the eight harvesting and curing systems were consistently least-cost except for the small farm. Hand harvesting, conventional curing appeared as one of the three least-cost systems for that size of farm. Tentative conclusions from the results are first, that with 1967 labor wages, when all labor must be hired for tobacco production, harvesting, and marketing, those systems that substitute some capital for labor are least-cost. The most capital intensive of the three systems mentioned was also most profitable on the large farm. Second, in the short run it pays to use existing conventional curing barns rather than build bulk barns. The capital cost of the bulk barns outweighs the laborsaving at 1967 wage rates. Third, of the conventional harvesting-curing systems studied, three are about equal in total costs, so the preference of the operator should probably dictate the choice of systems in the short run.

Fourth, if a range in costs of one cent per pound of tobacco produced per acre were selected as an interval within which the farmer would be indifferent among alternative systems, then for the small farm, the farmer would choose between the priming aide and hand harvesting, conventional curing. For average farms he would choose between the priming aide and the automatic tying machine. However, for medium and large farms all the conventional curing systems except hand harvesting would be equal cost alternatives.

LONG-RUN DECISIONS AND FARM SIZE

In the long run the farmer must consider replacement of his conventional curing barns. If he chooses to obtain new conventional curing barns, the annual costs of the barns will be about 2.1 cents per pound of tobacco, or $42.21 per acre for the 2,010 pound yield used in the report. Bulk curing barns have annual costs of 6.1 cents per pound, as stated earlier.

For discussion of the long-run situation it was necessary to add the $42.21 annual costs to the figures in Table 24 for each conventional curing barn system. Because a constant annual cost was added to those systems, it did not change the relative profitability among conventional systems. However, it did change the relative profitability of bulk systems versus conventional systems. The question now becomes whether any bulk harvesting and curing system is among the three least-cost systems once annual costs are charged for conventional curing barns.

For small farms in the long run the least-cost system is the priming aide and conventional curing (underlined in Table 25). However, the hand harvesting, bulk curing system is next with costs of $675.74 per acre or $8.31 more than the priming aide, conventional curing system. In third place is hand harvesting and conventional curing with costs of $22.02 per acre more than the least-cost system.

For the average farm, the least-cost system of the priming aide and conventional curing is $9.42 per acre less than the costs of the automatic tying machine. Third place is for practical purposes a tie between the hand harvesting, bulk curing system and the self-propelled priming aide, conventional curing system because they differ in cost by only one cent per acre (Table 25).

For the medium and large farms, the same three conventional systems are least-cost as for the short-run situation; their per acre costs are increased by the amount of the annual costs for the conventional barns. The hand harvesting, bulk curing barn system is fifth lowest in costs, one place lower than the hand harvesting, conventional barn system.

Table 25. Long-run costs per acre for selected flue-cured tobacco harvesting and curing systems for each of four sizes of farms, Census Subregion 17, North Carolina, 1967

Item	Conventional curing systems					Bulk curing systems		
	Hand harvesting	Automatic tying machine	Priming aide and tying machine	Priming aide	Self-propelled priming aide	Hand harvesting	Priming aide	Mechanical harvester
	(dollars)							
Total labor costs at 1967 wages	340.91	280.26	286.73	292.11	272.88	237.78	237.02	202.14
Total costs by size of farm:								
Small farms (30.1 ac.)	689.45	694.22	724.17	667.43	721.65	675.74	753.53	1109.99
Average farms (69.6 ac.)	691.39	668.00	688.31	658.58	677.69	677.68	721.40	908.38
Medium farms (143.2 ac.)	691.39	652.53	667.46	652.54	653.54	677.68	702.60	797.62
Large farms (369.6 ac.)	693.25	643.33	654.27	649.85	640.07	679.54	690.83	722.19

Perhaps the reason the hand harvesting, bulk system is among the top three systems for the smaller farms is that the annual costs of the bulk barn are more than offset by the combination of annual costs for other machines for competing systems and the reduction in labor costs realized with the bulk system. However, as farm size increases, the annual costs for harvesting machines for the competing systems decline.

The initial cost of the mechanical harvester assumed in these tables was $12,500. Would mechanical harvesting of tobacco become feasible with a reduction in initial cost of the harvester? If a substantial price reduction of, say, nearly one-third were to occur so that the price of the harvester was $8,500, annual costs would total $1,681.78 as contrasted to the estimated $2,473.21 for the $12,500 machine. Annual costs of harvester and total costs per acre would be decreased ($149.90, $85.38, $49.94, and $24.59) for the small, average, medium, and large size farms, respectively. At 1967 wage rates, this system is still the most expensive system (Tables 24 and 25).

1969 WAGE RATES

If wage rates for the harvesting-curing systems were recalculated so that average wages were set at $1.30 per hour, the 1969 minimum wage for qualifying farms, then one would expect those systems that use relatively little labor to be most profitable.

To determine relative profitability of the harvesting and curing systems, labor costs were recalculated by multiplying total hours required for each system by the new wage rate. This was done in two steps. First, production labor costs were calculated and then harvesting and curing labor costs were computed. The sum of the two components was called total labor costs. To obtain short-run total costs for each system, the newly calculated labor costs were added to the costs of the other factors as presented in Tables 8-23. For the long-run estimates of total costs, it was necessary to add annual charges for conventional curing barns to short-run total costs for the five conventional harvesting and curing systems. The costs figures just discussed are presented in Table 26 for each size of farm.

Short-Run Implications

For small farms in the short run, the least-cost system at 1969 minimum wage level is the same as at 1967 wages--priming aide, conventional curing system, which costs $738.45 per acre (Table 26). The system in second place is hand harvesting, bulk curing which was also the system that occupied second position for small farms under the long-run analysis (Table 25). So either a rise in wages or the addition of annual costs for conventional curing barns is significant enough to change the relative position of the harvesting and curing system. However, total costs are more for the $1.30 wage rates than for 1967 wages.

The third most profitable system is the automatic tying machine, conventional curing system. This particular order of harvesting and curing systems was not encountered at 1967 wages for either length of

Table 26. Costs per acre for selected flue-cured tobacco harvesting and curing systems for each of four sizes of farms with average wage rates of $1.30 per hour, Census Subregion 17, North Carolina

Item	Conventional curing systems					Bulk curing systems		
	Hand harvesting	Automatic tying machine	Priming aide and tying machine	Priming aide	Self-propelled priming aide	Hand harvesting	Priming aide	Mechanical harvester
	(dollars)							
Labor costs for producing tobacco	149.24	149.24	149.24	149.24	149.24	149.24	149.24	149.24
Labor costs for harvesting-curing tobacco	331.76	237.77	246.35	256.10	240.24	170.95	166.79	124.02
Total labor costs	481.00	387.01	395.59	405.34	389.48	320.19	316.03	273.26
Total costs by size of farm:								
Short run								
Small farms (30.1 ac.)	787.33	758.76	790.82	738.45	796.04	758.15	832.54	1181.11
Average farms (69.6 ac.)	789.27	732.54	754.96	729.60	752.08	760.09	800.41	979.50
Medium farms (143.2 ac.)	789.27	717.07	734.11	723.56	727.93	760.09	781.61	868.74
Large farms (369.6 ac.)	791.13	707.87	720.92	720.87	714.46	761.95	769.84	793.31
Long run								
Small farms (30.1 ac.)	829.54	800.97	833.03	780.66	838.25	758.15	832.54	1181.11
Average farms (69.6 ac.)	831.48	774.75	797.17	771.81	794.29	760.09	800.41	979.50
Medium farms (143.2 ac.)	831.48	759.28	776.32	765.77	770.14	760.09	781.61	868.74
Large farms (369.6 ac.)	833.34	750.08	763.13	763.08	756.67	761.95	769.84	793.31

run; thus, a change in wages has a different impact on costs than a change in annual costs for curing barns.

The cost differential between the first and second system is $19.70 per acre while that between the first and third is $20.31. On this basis, use of the hand harvesting, bulk curing system on the small farm in preference to the priming aide, conventional curing system would reduce "net" income by $104.02 annually, while employment of the tying machine system would reduce profits by $107.24 per year.

For average farms, the least-cost system is also the priming aide, conventional curing method. In addition, the second and third most profitable systems are the same as those for 1967 wages. For the average farm the only changes made in the first three harvesting systems are the differentials in total costs among the systems, not their order of rank.

Thus, the costs of the priming aide, conventional curing system of $729.60 are increased to $732.54 per acre when the automatic tying machine, conventional curing system is used in its place. The use of a self-propelled priming aide, conventional curing system further increases costs to $752.08 per acre.

For medium farms, again the same three machines are most profitable with 1969 wage rates as with 1967 wages in the short run. However, the per acre increase in costs resulting from the use of the second or third most profitable system is considerably larger at 1969 wages.

For the large farms, the automatic tying machine, conventional curing system became the least-cost system when 1969 wages were considered. The self-propelled priming aide and conventional curing dropped from most profitable at 1967 wages to second most profitable at 1969 wages. The increase in costs per acre resulting from the use of the self-propelled system at 1969 wages is $6.59 which is $212.20 annually for the large farm. The third most profitable system is still the priming aide and conventional curing with total costs per acre of $720.87. However, the fourth most profitable system is so close to the third as to be tied with it for practical purposes. The costs of the fourth system are $720.92 per acre or 5 cents more than the third system.

Long-Run Considerations

For small farms as well as for average farms the hand harvesting, bulk curing system was least-cost (Table 26). For both sizes of farms, the second and third most profitable systems were the priming aide and automatic tying machine, respectively.

For medium farms the least-cost system is the automatic tying machine, conventional curing method which has total costs of $759.28 per acre. The second most profitable system is hand harvesting, bulk curing with total costs of $760.09 per acre which is only 81 cents more than the tying machine. The third most profitable system is the priming aide, conventional curing system.

For large farms, the automatic tying machine, conventional curing system is least-cost. The second most profitable system, however, is the self-propelled priming aide and conventional curing. The third least-cost system is hand harvesting, bulk curing, but it is only $1.13-$1.18 per acre lower in cost than the two tractor-drawn priming aide systems with conventional curing.

Again, the reduction in initial cost of the mechanical harvester to $8,500 would not change the relative rankings of the most profitable system for either the small or average size farms in either the short run or long run at wage rates of $1.30 per hour. On the medium-sized farms, however, the mechanical harvester at this lower initial cost would be $12.68 per acre cheaper than the hand conventional system in the long run, but some $30 per acre more expensive in the short run. On the large farms with 32.20 acres of tobacco, the lower initial cost of the harvester results in lower short-run total costs per acre than the priming aide, bulk curing system and the hand harvesting, conventional system, and only $7 per acre more expensive than the hand harvesting, bulk curing system. In the long-run situation at $1.30 wage rates, the mechanical harvester system is $65 per acre cheaper than the hand harvesting, conventional curing system and $1.12 per acre cheaper than the priming aide, bulk curing system, and only $18.64 per acre more expensive than the least-cost system of the automatic tying machine with conventional curing.

Implications

Those farmers who have adequate conventional curing facilities but prefer to use the hand harvesting system will find it less profitable as wages rise. Also it is less profitable for large farms than for small farms (refer to Table 26 for a comparison of the hand harvesting system with the others at 1969 wages).

Those who prefer to use hand harvesting and conventional curing would find an automatic tying machine to be profitable, especially on farms with 15 acres of tobacco or more. If conventional barns are in need of replacement, bulk curing barns would be profitable if used in conjunction with hand harvesting.

Farmers who like to use priming aides with conventional barns will find them to be profitable, especially on small and average farms. However, if wage rates continue to rise, priming aides will be less profitable. The factor which continues to make priming aides attractive is that they employ a different kind of labor than is necessary with hand harvesting. With migration of able-bodied men to nonagricultural employment, those farmers with harvesting aides would still have a source of labor--one not open to farmers who use hand harvesting systems.

An initial cost of the mechanical harvester of $8,500 allows the large farm to use the mechanical harvester system with costs per acre comparable to the hand harvesting, bulk curing and priming aide, bulk curing systems and also at lower costs per acre than the hand harvesting, conventional curing system.

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APPENDIX

Farm Organization, Labor Operations, and Calculation of Weighted Wages

The organization of the farms sampled in the 14-county study area in terms of acres of land and major crops grown is presented in Table 1, while the tobacco poundage quotas are presented in Table 2. The tobacco acreages used for model farms in this study were obtained by dividing the 2,010 pound yield assumed for the study into the tobacco poundage quotas reported in Table 2. The yield was the average for all farms in the area for the years 1965-67 as reported by ASCS.

The most common tobacco machinery and the number of farms reporting ownership of such machinery as well as its age and amount of use are reported in Table 3.

The number of various sizes of conventional tobacco barns on farms in 1967 is given in Table 4.

Table 5 contains the average crew sizes found on the survey farms. The figures given, of course, are averages for several tobacco harvesting and curing systems. However, the information does show the source of the farm labor.

There are many assumptions that could be made concerning the division of labor among the farm operator, his family, and hired labor for purposes of tobacco production. As can be seen in Table 5, some farm families exchange labor with their neighbors. On other farms all labor is hired. Finally, some farms have sharecroppers who supply the labor in return for a portion of the crop. However, in this study all labor except 2,818 hours per year allotted to the farm operator was hired. In defense of the hired labor assumption, none of the labor supplied by farm family members, exchange workers, or sharecroppers is free. In the case of family members and exchange workers, the higher income from tobacco is no different than if they had received cash wages at the going wage rate for the tasks they performed. Thus, the income from tobacco now has at least two components--regular profits plus the

Appendix Table 1. Acres of total land, cropland and selected crops, and percent rented in for all sample farms and by farm size and type, Census Subregion 17, North Carolina, 1967

Item	Whole sample	Farm size, acres of cropland				
		<10	10-49	50-99	100-219	>220
Number of farms, 1967	311	17	120	95	61	18
Acres of total land	131.6[a]	10.2	52.0	111.7	205.6	654.3
	(181.1)	(7.9)	(28.1)	(54.9)	(86.7)	(428.5)
Percent rented in	39.3	22.0	32.7	41.3	45.8	34.9
Acres of cropland	81.6	5.4	30.1	69.6	143.2	369.6
	(94.9)	(1.8)	(10.7)	(14.1)	(31.0)	(181.0)
Percent rented in	53.5	37.0	47.4	53.8	57.0	52.3
Acres of tobacco	9.09	1.28	4.53	8.45	15.21	31.50
	(9.35)	(1.64)	(3.63)	(4.98)	(6.67)	(18.17)
Percent rented in	62.2	83.3	69.1	65.5	62.1	50.1
Acres of corn	33.4	1.6	11.0	26.9	61.2	159.9
	(50.8)	(1.6)	(9.3)	(18.4)	(30.9)	(130.7)
Percent rented in	60.4	21.4	54.4	66.5	57.3	62.0
Acres of soybeans	15.0	0.2	3.5	11.6	26.7	85.4
	(30.4)	(0.7)	(4.9)	(13.4)	(22.6)	(84.0)
Percent rented in	60.9	100.0	52.4	58.4	72.6	52.5
Acres of cotton	1.6	0.1	0.9	1.6	1.8	8.2
	(4.9)	(0.4)	(1.5)	(3.4)	(4.2)	(15.7)
Percent rented in	40.3	0	31.2	38.0	39.9	49.9

[a]These are weighted means in that farms with none of the item under consideration were omitted from the calculations. The figures in parentheses below are standard deviations.

Appendix Table 2. Tobacco poundage quota, feed grain base, and tobacco obtained under lease and transfer for the whole sample, by farm size and type, Census Subregion 17, North Carolina, 1967

Item	Whole sample	Farm size, acres of cropland				
		<10	10-49	50-99	100-219	>220
Number of observations	275	8	101	88	60	18
Tobacco poundage quota, 1967[a]	21203.9[b]	5152.2	10614.4	18640.7	31872.3	64726.4
	(19274.9)	(2579.4)	(6363.2)	(9790.7)	(14502.5)	(36025.2)
Feed grain base, 1967 acres	29.7	1.4	9.7	23.2	48.6	121.6
	(43.8)	(2.5)	(10.3)	(17.9)	(43.0)	(95.2)
Lease and transfer of tobacco, 1967						
Pounds	1162.5	0	717.6	1565.9	1523.5	1000.0
	(2594.9)	-	(1755.6)	(3131.1)	(2865.2)	(2930.6)
Acres	0.59	0	0.38	0.75	0.78	0.67
	(1.33)	-	(0.92)	(1.49)	(1.47)	(1.97)
Lease and transfer of tobacco, 1968						
Pounds	1726.2	0	889.8	2019.1	2016.4	4787.8
	(3905.9)	-	(1744.3)	(3925.5)	(4516.8)	(7880.3)
Acres	0.85	0	0.46	0.95	1.04	2.19
	(1.88)	-	(0.92)	(1.84)	(2.32)	(3.58)

[a]For the 270 farms reporting a poundage quota in 1967, the weighted average yield per acre was 1958.9 pounds.

[b]These are mean values for those farms that reported information. The figures in parentheses below are standard deviations.

Appendix Table 3. Farm machines used on tobacco by ownership of machine and acres of use, whole sample, Census Subregion 17, North Carolina, 1967

Item	Number of farms with machine	Average number of machines per farm	Machine owned by farmer				Machine used, not owned	
				Tobacco acreage on which it was			Tobacco acreage on which it was	
			Age	Used on own farm	Hired out	Exchanged	Hired in	Exchanged
Ferris wheel transplanter, 1-row	160	1.02	3.45[a]	10.66		0.67	0.81	0.80
			(3.45)	(12.86)		(3.19)	(3.10)	(2.28)
Ferris wheel transplanter, 2-row	32	1.00	2.66	18.51		2.09	0.10	1.32
			(2.77)	(19.76)		(7.71)	(0.56)	(3.39)
Hand placement transplanter, 1-row	99	1.02	9.66	8.96	0.30	0.42	0.38	0.73
			(6.93)	(7.92)	(2.22)	(2.25)	(1.73)	(2.82)
Hand placement transplanter, 2-row	17	1.00	8.29	11.26				0.68
			(9.14)	(10.97)				(2.78)
Hand transplanter	137	2.10	0.64	0.27				
			(2.68)	(1.38)				
One-plow tractor	47	1.08	12.50	9.65		1.43	0.02	0.06
			(5.89)	(8.02)		(5.67)	(1.42)	(0.43)
Two-plow tractor	273	1.05	10.08	13.32	0.05	0.33	0.26	0.04
			(5.76)	(11.74)	(0.66)	(3.00)	(1.36)	(0.47)
Three-plow tractor	190	1.05	6.24	15.52		0.20	0.06	0.38
			(5.02)	(13.42)		(8.73)	(0.55)	(4.42)
Four-plow tractor	26	1.04	3.22	21.10		0.44	0.15	0.22
			(2.49)	(20.37)		(2.35)	(0.78)	(0.65)
Five-plow tractor	10	1.00	2.30	25.72				
			(1.70)	(17.73)				

One-row cultivator	219	1.06	10.35	13.49		0.06	0.08	0.04
			(5.23)	(11.83)		(0.53)	(0.74)	(0.47)
Two-row cultivator	125	1.08	6.00	16.31		0.15		
			(4.78)	(10.77)		(1.74)		
Four-row cultivator	2	1.00	5.00					
			(7.07)					
Silent Flame-type harvester	51	1.04	6.06	10.57		0.75		1.30
			(4.75)	(7.82)		(2.57)		(8.38)
Roanoke-Page-type priming aide	16	1.00	1.81	6.28		0.31		0.74
			(2.19)	(13.71)		(1.25)		(2.06)
Henry Vann-type priming aide	5	1.00	0.60	20.22				0.61
			(0.54)	(23.39)				(1.36)
Other type priming aide	9	1.00	2.78	7.52				0.54
			(3.45)	(10.49)				(1.61)
Variable speed looper	36	1.00	1.03	9.12	0.22	0.30		0.48
			(1.66)	(13.37)	(1.33)	(1.83)		(1.79)
Tobacco trailers or trucks	62	3.50	5.71	11.34			0.14	0.26
			(3.02)	(4.81)			(0.72)	(0.97)

[a]These figures are weighted mean values calculated for all farmers using the machines listed. The numbers in parentheses below are standard deviations.

Appendix Table 4. Number of regular tobacco curing barns by size, number of tiers and type of fuel for the whole sample, Census Subregion 17, North Carolina, 1967

Size of barn, feet	One tier oil	Two tiers gas	Three tiers oil	Four tiers oil	Five tiers			Six tiers			
					Gas	Oil	Kero-sene	Gas	Oil	Kero-sene	Jet fired oil burners
8x8									1		
14x16											
16x16					3	4	4	36	106	9	3
16x17											
16x18							1	6	6		
16x20	1	1			1			12	40	1	7
16x24									1		
16x28											
16x32									1		
17x17								2	21		
17x18											
17x20									2		
17x21									2		
18x18								10	13	4	
18x20								2	8	1	
18x22						1					
20x20					3			5	15		1
20x21									1		
20x22											
22x22								1			
Semibulk			1	3		1			1		
Total	1	1	1	3	7	6	5	74	218	15	11

Appendix Table 4 (continued)

Size of barn, feet	Seven tiers				Eight tiers			Nine tiers	
	Gas	Oil	Kero-sene	Jet fired oil burners	Gas	Oil	Kero-sene	Gas	Oil
8x8									
14x16	1	1							
16x16	60	77	3	4	9	10	2	1	
16x17		1							
16x18		2							
16x20	30	38	1	4	12	2			
16x24		2		2					
16x28				1					
16x32									
17x17	4	13		1		2			
17x18	1				2				
17x20	2	3							
17x21	2	1							
18x18	2	5			2				
18x20	6	7			2	1			1
18x22									
20x20	8	19		1	4	3			
20x21	1					1			
20x22		2							
22x22									
Semibulk									
Total	117	171	4	13	31	19	2	1	1

Appendix Table 5. Tobacco transplanting and harvesting crew sizes and composition for the whole sample, by farm size and by type of farm, Census Subregion 17, North Carolina, 1967

Item	Whole sample	Farm size, acres of cropland				
		<10	10-49	50-99	100-219	>220
Number of observations	268	8	101	85	58	16
Transplanting crew						
Total crew size	7.08[a]	4.88	6.23	7.03	8.09	9.94
	(2.41)	(2.43)	(1.94)	(2.17)	(2.46)	(2.74)
Number of family workers	2.18	2.00	2.48	2.21	1.83	1.50
	(1.40)	(0.53)	(1.65)	(1.16)	(1.30)	(1.21)
Number of croppers	0.62	0	0.08	0.38	1.66	1.88
	(1.81)	--	(0.48)	(1.44)	(2.83)	(2.47)
Number of regular hired workers	0.27	0	0.02	0.20	0.43	1.75
	(0.76)	--	(0.20)	(0.51)	(0.86)	(1.69)
Number of seasonal workers	3.62	2.88	3.04	3.96	3.98	4.56
	(2.71)	(2.75)	(2.44)	(2.66)	(2.87)	(3.44)
Number of exchange workers	0.39	0	0.61	0.28	0.19	0.25
	(0.63)	--	(0.77)	(0.59)	(0.33)	(0.21)
Harvesting crew						
Total crew size	13.77	13.13	12.82	13.82	14.17	18.19
	(4.48)	(4.75)	(3.37)	(3.87)	(5.29)	(7.24)
Number of family workers	2.73	2.38	2.84	2.86	2.48	2.44
	(1.62)	(0.74)	(1.73)	(1.42)	(1.70)	(1.96)
Number of croppers	0.89	0	0.13	0.60	2.26	2.75
	(2.74)	--	(0.82)	(2.37)	(4.17)	(3.99)
Number of regular hired workers	0.27	--	0.02	0.20	0.43	1.75
	(0.76)	--	(0.20)	(0.51)	(0.86)	(1.69)
Number of seasonal workers	9.65	10.75	9.44	10.00	8.98	10.94
	(5.14)	(4.46)	(4.36)	(4.75)	(5.97)	(8.24)
Number of exchange workers	0.23	0	0.39	0.16	0.02	0.31
	(0.74)	--	(0.89)	(0.80)	(0.12)	(0.55)

[a]These figures are mean values calculated for the number of observations stated on the first line of the table. The figures in parentheses below are standard deviations.

income accrued to family and exchange labor. So farmers who use these laborers can simply take the hired labor costs and add them to their tobacco income, but that does not eliminate the costs. Sharecroppers receive wages in the form of a share of the tobacco rather than as cash. Otherwise there is no difference between regular hired laborers and sharecroppers.

The following tables present the hours worked by hired labor and by the operator for each harvesting-curing system, by farm size.

Also, one table is presented showing computation of weighted wage rates for 1967.

Appendix Table 6. Labor operations for each harvesting and curing system divided according to hired and operator labor, small and average farms, Census Subregion 17, North Carolina, 1967

Item	Conventional curing systems					Bulk curing systems		
	Hand harvesting	Automatic tying machine	Priming aide and tying machine	Priming aide	Self-propelled priming aide	Hand harvesting	Priming aide	Mechanical harvester
	(hours per acre)							
Priming - all hired	44.3	44.3	49.6[a]	93.0[b]	83.0[b]	44.3	70.4[c]	25.7[d]
Field driver - hired	9.2	9.2	9.9	10.3	9.2	9.2	10.1	8.6
Driver to barn - operator	9.3	9.3	9.9	10.3	9.2	9.3	10.1[e]	8.6
Tying or racking - hired	109.0	43.7	43.7	-	-	31.0[f]	-	-
Hanging in barn - hired	18.3	18.3	18.3	18.3	18.3	-	-	-
Curing - operator	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Removing to packhouse - hired	7.8	7.8	7.8	7.8	7.8	7.6	7.6	7.6
- operator	3.8	3.8	3.8	3.8	3.8	3.7	3.7	3.7
Looseleaf preparation - hired	39.2	32.2	32.2	39.2	39.2	12.1	12.1	26.9
Other market preparation - hired	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
- operator	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Marketing - operator	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Total hired labor	228.8	156.5	162.5	169.6	158.5	105.2	101.2	69.8
Total operator labor	26.4	26.4	27.0	27.4	26.3	26.3	27.1	25.6
Total labor	255.2	182.9	189.5	197.0	184.8	131.5	128.3	95.4
Operator supervisory labor per acre	11.4	7.8	8.1	8.5	7.9	5.3	5.1	3.5

Appendix Table 6 (continued)

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[a]Includes 4 primers and a leaf mover.

[b]Includes 4 primers, 4 stringers, and a stick stacker.

[c]Includes 4 primers, 2 bulk rack loaders, and a trailer loader.

[d]Includes 2 men on top of machine racking and a man at the barn loading racks into barn. With this system the tractor driver helps barn. No time is shown under barning.

[e]Driver also unloads trailer into barn - no separate barning operation.

[f]Includes loading racks into barn.

Appendix Table 7. Labor operations for each harvesting and curing system divided according to hired and operator labor, medium and large farms, Census Subregion 17, North Carolina, 1967

Item	Conventional curing systems					Bulk curing systems		
	Hand harvesting	Automatic tying machine	Priming aide and tying machine	Priming aide	Self-propelled priming aide	Hand harvesting	Priming aide	Mechanical harvester
	(hours per acre)							
Hired labor tasks								
Priming	44.3	44.3	49.6[a]	93.0[b]	83.0[b]	44.3	70.4[c]	25.7[d]
Driving	18.5	18.5	19.8	20.6	18.4	18.5[f]	20.2[e]	17.2
Tying or racking	109.0	43.7	43.7	-	-	31.0[f]	-	-
Hanging in barn	18.3	18.3	18.3	18.3	18.3	-	-	-
Removing to packhouse	11.6	11.6	11.6	11.6	11.6	11.3	11.3	11.3
Looseleaf preparation	39.2	32.2	32.2	39.2	39.2	12.1	12.1	26.9
Other market preparation	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total	241.9	169.6	176.2	183.7	171.5	118.2	115.0	82.1
Operator labor tasks								
Curing	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Other market preparation	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Marketing	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Total	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Total labor	255.2	182.9	189.5	197.0	184.8	131.5	128.3	95.4
Operator supervisory labor per acre	12.1	8.5	8.8	9.2	8.6	5.9	5.8	4.1

[a]Includes 4 primers and a leaf mover.

[b]Includes 4 primers, 4 stringers, and a stick stacker.

[c]Includes 4 primers, 2 bulk rack loaders, and a trailer loader.

[d]Includes 2 men on top of machine racking and a man at the barn loading racks into the barn. With this system the tractor driver helps barn. No time is shown under barning.

[e]The driver who goes from the field to barn also unloads trailer into barn. There is no separate barning operation.

[f]Includes loading racks into barn.

Appendix Table 8. Labor operations for tobacco production budget divided according to hired and operator labor for each of four sizes of farms, Census Subregion 17, North Carolina, 1967

Labor operation	Small farms	Average farms	Medium farms	Large farms
Cut stalks and seed cover crop				
Operator	3.6	3.6	3.6	-
Hired	-	-	-	3.6
Plant bed				
Operator	8.1	8.1	-	-
Hired	8.0	8.0	16.1	16.1
Land preparation				
Operator	5.9	5.9	5.9	-
Hired	-	-	-	5.9
Transplanting				
Operator	-	-	-	-
Hired	11.3	11.3	11.3	11.3
Transplanting support				
Operator	-	-	-	-
Hired	27.5	27.5	27.5	27.5
Growing				
Operator	17.6	17.6	8.0	-
Hired	-	-	9.6	17.6
Topping and suckering				
Operator	3.3	3.3	.6	-
Hired	29.5	29.5	32.2	32.8
Total operator labor	38.5	38.5	18.1	-
Total hired labor	76.3	76.3	96.7	114.8
Total labor	114.8	114.8	114.8	114.8
Operator supervisory labor per acre	3.8	3.8	4.8	5.7

Appendix Table 9. Computation of weighted wage rates for 1967--an example: Hand harvesting, conventional curing, hand barning, small farm, Census Subregion 17, North Carolina

Operation[a]	1967 wages from farm sample[b]	Hours of labor hired	Proportion of total hours hired[c]	1967 weighted wage[d]
Priming	1.22	44.3	0.1936	0.236
Tractor driving	.93	9.2	.0402	.037
Handing and stringing	.89	109.0	.4764	.424
Hanging in barn	.89	18.3	.0800	.071
Removing to packhouse	.84	7.8	.0341	.029
Looseleaf preparation	.84	39.2	.1713	.144
Other market preparation	.89	1.0	.0044	.004
Total		228.8	1.0000	.945 = .94

[a]Only those operations where labor was hired are specified.

[b]The wage rates per hour shown here are average wages paid for the tasks indicated by all farms surveyed in 1968.

[c]To obtain the proportion of total hours hired divide 44.3 by 228.8, for example, to see what proportion priming labor is of total hired labor. The answer is 0.1936.

[d]To calculate the weighted wage multiply 1967 wages by proportion of total hours hired and add the result. The total is the figure of interest.

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