COOPERATIVE EXTENSION SERVICE
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A Cost Comparison of Three 10-Acre Tobacco Transplant Production Systems

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Introduction

Tobacco production in Kentucky has undergone numerous changes in recent years. Perhaps the most dramatic of these changes has been the introduction of float plants. Since its inception, the float system has grown rapidly in both technology and acceptance by producers. Today, tobacco float plants are produced across the state under a variety of conditions in greenhouses and outdoor float systems. New practices, technologies, and problems are continuing to develop in float plant production. Tobacco producers have responded to these changes by altering the way they select and use transplant systems. As farmers consider these new methods of plant production, the need for economic evaluation arises.

This publication compares the cost of three transplant production systems used by small- to moderate-sized tobacco operations. These systems include *conventional plant beds, outdoor plug and transfer, and outdoor direct seeding.* All costs necessary to prepare plants for field transplanting are evaluated in this publication. Specific annual costs are categorized as operating costs, labor costs, and capital costs.

Operating Costs

Supplies or inputs that must be purchased each year for transplant production.

Labor Costs

The value associated with all labor tasks whether provided by hired or unpaid operator/family labor. Labor costs include all tasks required to prepare transplants for field setting.

Capital Costs

The annual ownership costs assigned to land, buildings, and machinery. Capital costs include depreciation, interest, insurance, and storage costs for all assets used in plant production.

Cost Comparison

For this analysis, a 10-acre transplant production level was established as a baseline for comparison. However, the costs represented in this publication are valid for a wide range of small- to moderate-sized tobacco producers. The three 10-acre transplant systems evaluated are listed below.

- Six 12'x100' conventional plant beds.
- Three 9'-1"x 29'-10" outdoor plug and transfer beds.
- Three 9'-1"x 32'-1" outdoor direct seedbeds.

Note: *Float system dimensions are inside measurements of beds.*

Input requirements and production practices for each of the three transplant systems are described in Table 1. The inputs used for each system are separated into the three cost categories specified earlier: operating, labor, and capital.

Assumptions

In order to provide a fair and consistent evaluation of each transplant system, certain prices and assumptions are required. For this study, the following assumptions are noted:

- The wage rate is $6.00 per hour for both hired and family/operator labor.
- A 253-cell tray is used for the direct seed system and a 242-cell tray is used for the plug and transfer system. The cost for float trays is $1.80 per tray.
- Miniplugs are $15.00 per thousand and the plugging rate is 1,000 plugs per worker-hour for the plug and transfer system.
- The seeding rate for the direct seed system is 50 trays per hour with two workers (includes filling trays, dibbling, and seeding).
- The usable plant rate is 95 percent for the plug and transfer system, 85 percent for the direct seed system, and 12,000 plants per plant bed for the conventional system.
- Conventional transplant costs include the labor costs associated with plant pulling. The plant pulling rate is 800 plants per worker-hour.
- Most burley tobacco producers currently use a population that ranges from 6,000 to 8,000 plants per acre. For this publication, a field population of 7,000 plants per acre (about 22" x 40" row spacing) is used to calculate the cost per acre of all transplant systems.
- Seeding equipment for the direct seed system often varies widely in complexity and cost among producers.

Table 1. Description of Three 10-Acre Burley Transplant Systems

	Six 12'x100 Plantbeds	Three 9'1"x29'10" Plug & Transfer Float System	Three 9'1"x32'1" Direct Seeding Float System
ANNUAL OPERATING EXPENSES			
Supplies	Bed covers, straw	Plastic liner, Bed cover	Plastic liner, Bed cover
Seed/Miniplugs	6 -1/6th oz. pks. conventional seed	73,000 mini-plugs	9-10,000 pks. of primed pelleted seed
Fertilizer/Chemicals	10-10-10 fertilizer, fumigant, fungicide, pesticide	pesticide, fungicide	20-10-20 water soluble fertilizer, pesticide, fungicide
Soiless Media	----------	18 3-cu.-ft. bags fortified media	20 3-cu.-ft. bags unfortified media
Machinery/Utilities	Repairs, maintenance, fuel, oil	Repairs, maintenance, fuel, oil, electricity for heat source	Repairs, maintenance, fuel, oil, electricity for heat source
ANNUAL LABOR TASKS			
Bed Site Preparation	Plow and disk beds	Install heat source and plastic liner, fill with water	Install heat source and plastic liner, fill with water
Establishing Plant System	Fumigate, seed, straw, and cover beds	Fill trays, transfer mini-plugs (1,000/hr), and place trays in bed	Add fertilizer to beds, fill dibble and seed trays (50/hr.), place trays in bed
Irrigation	4 times w/tank and pump	----------	----------
Clipping	Twice w/weed clipper	Twice w/lawnmower and frame	Three times w/lawnmower and frame
Observation/Spraying	Observe weekly, spray 1 time	Observe weekly, spray 2 times	Observe weekly, spray 3 times
Plant Pulling	Pull plants and load	Load plants	Load plants
Clean Up/Bed Destruction	Disk beds	Clean trays and sanitize with 10% chlorine bleach solution, remove liner	Clean trays and sanitize with 10% chlorine bleach solution, remove liner
ANNUAL CAPITAL EXPENSES			
Land	Beds and access, 0.33 ac	Beds and access, 0.038 ac	Beds and access, 0.042 ac
Tractor	60 hp	----------	----------
Plow	3-16" moldboard	----------	----------
Disk	8' disk harrow	----------	----------
Water Tank (for irrigation)	500 gallon	----------	----------
Transfer Pump (for irrigation)	2 hp gas powered	----------	----------
Wagon (for irrigation)	16', 8 ton running gear	----------	----------
Fumigation Equipment	Manual applicators	----------	----------
Seeding System	Drop type spreader	----------	Air seeder, dibble board, and vacuum unit
Irrigation System	Manual w/tank and pump	----------	----------
Water Bed Frame	----------	179 ft. treated lumber, 3/4" PVC pipe, etc.	186 ft. treated lumber, 3/4" PVC pipe, etc.
Float Trays	----------	312 242-float trays	336 253-float trays
Supplemental Heat	----------	2 100-watt bulbs/acre of plants	2 100-watt bulbs/acre of plants
Clipping Equipment	Weed clipper	Lawnmower and frame	Lawnmower and frame
Spraying Equipment	3 gal. hand sprayer	3 gal. hand sprayer	3 gal. hand sprayer

The seeding equipment used in this analysis is assumed to be purchased from a local agribusiness supplier. This equipment includes a dibble board, air seeder, and vacuum unit.

- Direct seeding equipment and float plant structures are depreciated over a useful life of seven years. Fumigation equipment and float trays are depreciated over a useful life of four years (straight-line economic depreciation).
- Additional input costs were determined by an informal survey of Kentucky agribusiness suppliers.

Results

Table 3 (page 4) is a list of the costs per acre for the inputs and production practices specified in Table 1 (page 2). These costs are estimated for the 1997 growing season. Growers are encouraged to adjust values to reflect their own prices and expectations. Direct seed, plug and transfer, and conventional plants vary substantially in cost distribution. Operating costs for outdoor direct seedbeds and conventional plant beds are relatively comparable at $60.22 per acre and $68.10 per acre, respectively. Conventional bed costs are higher due to increased costs of supplies, fertilizer/chemical requirements, and machinery repairs and maintenance. At $152.78 per acre, the operating cost for an outdoor plug and transfer system is more than twice the cost of the other systems. Higher operating costs in the plug and transfer system are mainly attributable to purchased miniplugs, which represent almost 72 percent of total operating expenses.

Labor costs vary dramatically across all three transplant production systems. Both outdoor float systems have substantially lower labor costs per acre than conventional plant beds and are lowest for the outdoor direct seed system. Compared to conventional plant beds, labor costs are reduced by 37 percent in the plug and transfer system and by 68 percent in the direct seed system. Higher labor costs in conventional beds result from pulling plants for field setting. This task accounts for 50 percent of the total labor costs in this system. Labor costs are higher in plug and transfer systems than in direct seed systems due to the plugging and transferring process. This task comprises 70 percent of total labor expenses for this system.

Direct seeding transplant production is more capital intensive than both of the other systems. Annual capital expenses for direct seeding are $40.13 per acre, almost twice as high as conventional plant beds and plug and transfer systems. Higher capital costs in this system are attributable to seeding equipment depreciation and more intensive use of other capital inputs, such as clipping equipment.

Choosing a Transplant System

Choosing a transplant system is not a simple decision. Often a system that fits one farming operation is not suitable for another. Some factors to consider in making a decision include cost, risk, labor and management requirements, and producer preferences.

For most tobacco producers, cost per acre is the primary factor behind their choice of transplant systems. Costs differ not only for each system but also across farm operations. For this reason, producers should consider their own input costs and expectations when evaluating transplant costs. Table 3 provides a separate column for producers to evaluate the costs of their current transplant production system against alternative transplant systems.

Risk is a factor that can dramatically affect transplant cost. Generally, risk increases from plant beds to float systems and is highest in the outdoor direct seed float system. Elevated risks in the float system are attributable to increased disease/insect pressure, management requirements, and the effects of adverse weather on float plants. These risks can potentially affect the usable plant rate and plant quality. Producers should consider that higher levels of management are required to offset the increased risks in float plant production.

Risk management is essential in outdoor direct seeding systems. The success of this system is highly dependent on weather conditions and management within the first 15 days after seeding. If beds are not adequately protected, a hard spring shower can dramatically reduce the usable plant rate by washing away or burying tobacco seeds. Table 2 below presents the cost per thousand in the outdoor direct seeding system under various usable plant rates and tray sizes. Producers who are considering direct seeding in outdoor beds should evaluate not only inputs that will reduce risk, such as various float bed covers, outdoor structure designs, and preventive fungicide applications, but also their ability to manage risk under this system.

Increased risk in direct seeding is a major reason why many tobacco producers choose and continue to use outdoor plug and transfer systems. This system allows producers to employ the labor saving advantages of float

Table 2: Cost For Outdoor Direct Seeding Systems Under Various Tray Sizes and Usable Plant Rates (in dollars per thousand)

Tray Size	Usable Plant Rate					
	65%	70%	75%	80%	85%	90%
200	30.53	28.46	26.66	25.10	23.71	22.48
242	25.50	23.79	22.31	21.01	19.87	18.85
253	24.46	22.82	21.41	20.17	19.08	18.10
288	21.68	20.24	18.99	17.91	16.94	16.09

Table 3. Cost/Acre of Three 10-Acre Burley Transplant Systems

	Conventional Plantbed System ($/Acre)	Plug and Transfer Float System ($/Acre)	Direct Seeding Float System ($/Acre)	Your Farm ($/Acre)
ANNUAL OPERATING EXPENSES				
Supplies	$26.80	$14.26	$15.12	
Seed/Mini-plugs	$4.67	$110.53	$20.18	
Fertilizer/Chemicals	$21.68	$0.14	$1.86	
Soilless Media	----	$19.45	$16.28	
Machinery Repairs & Maintenance/Utilities	$12.65	$3.23	$4.75	
Operating Interest	$2.30	$5.17	$2.03	
SUBTOTAL	**$68.10**	**$152.78**	**$60.22**	
ANNUAL LABOR TASKS				
Bed Site Preparation	$2.63	$3.23	$3.49	
Establishing Plant Bed	$24.50	$47.72	$7.85	
Irrigation	$8.75	----	----	
Clipping	$9.31	$6.09	$9.77	
Observation,Taking Plastic Cover On/Off	$1.75	$1.76	$3.49	
Spraying	$3.50	$1.62	$3.49	
Plant Pulling	$52.50	----	----	
Clean Up/Bed Destruction	$0.88	$4.82	$5.15	
SUBTOTAL	**$103.82**	**$65.24**	**$33.24**	
ANNUAL CAPITAL EXPENSES				
Land	$3.21	$0.37	$0.41	
Tractor	$6.17	----	----	
Plow	$0.19	----	----	
Disk	$0.87	----	----	
Water Tank & Transfer Pump (for irrigation)	$2.30	----	----	
Wagon (for irrigation & bed setup)	$2.64	----	----	
Fumigation Equipment	$2.29	----	----	
Spraying Equipment	$0.16	$0.07	$0.16	
Seeder	$0.42	----	$9.68	
Water Bed Frame	----	$5.35	$5.77	
Float Trays	----	$13.70	$14.65	
Supplemental Heat Source	----	$2.84	$3.06	
Clipping Equipment	$1.70	$1.11	$1.78	
Interest	$1.99	$2.37	$3.55	
Storage & Insurance	$0.60	$0.71	$1.07	
SUBTOTAL	**$22.54**	**$26.52**	**$40.13**	
TOTAL COST/ACRE	***$194.46***	***$244.54***	***$133.59***	
TOTAL COST/THOUSAND	***$27.78***	***$34.93***	***$19.07***	

plants but with lower risk than outdoor direct seeding.

Another factor to consider is the labor requirements for each system. Float plants have lower labor requirements than conventional plant beds. Within float plant systems, outdoor direct seedbeds have lower labor requirements than outdoor plug and transfer beds. Producers who are experiencing labor shortages or time constraints should consider the labor saving advantages of these systems to their farming operation. Many growers cite the inability to find experienced plant pullers as a major advantage of the float system. Float plants also provide greater flexibility to the producer. Tobacco growers can store unused plants back on the waterbed or hold plants until field conditions are suitable for transplanting.

For many producers, the timing of labor is almost as important as the amount of labor required. With plant beds, a majority of the labor requirements occur when producers are pulling plants for transplanting. However, float plants tend to transfer a majority of the labor requirements from planting season in May and June to March and April. This may allow producers to finish transplanting in a more timely fashion or to work on other farm tasks that occur during May, such as hay harvesting. Figure 1 exhibits how labor timing varies across the three transplant systems during the growing season.

Personal preferences of tobacco producers may also affect transplant system choice. Many producers use the plug and transfer system because they want to have some control over the plant production process and do not necessarily want to buy finished plants from transplant dealers. Generally, but not always, the three systems evaluated in this publication follow the descriptions displayed in Table 4. Producers should consider these factors as well as any other pertinent information when comparing alternative transplant systems for their farming operation.

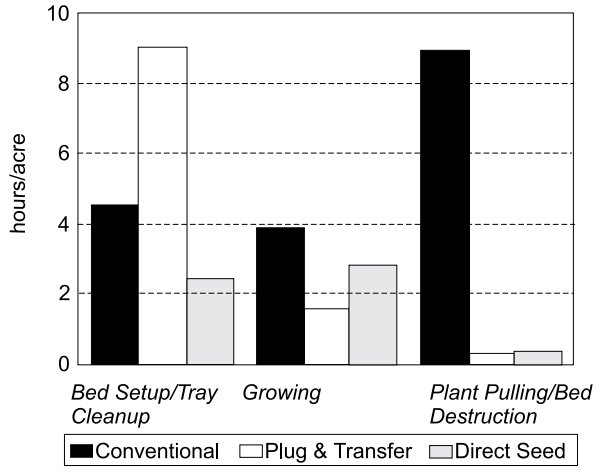

Figure 1: Timing of labor requirements for each transplant system

Table 4: General Characteristics of Outdoor Direct Seed, Outdoor Plug and Transfer, and Conventional Transplant Systems.

System	Cost	Risk	Mgmt.	Labor
Outdoor Direct Seed	Lowest	Highest	Highest	Lowest
Outdoor Plug & Transfer	Highest	Medium	Medium	Medium
Conventional Plantbeds	Medium	Lowest	Lowest	Highest

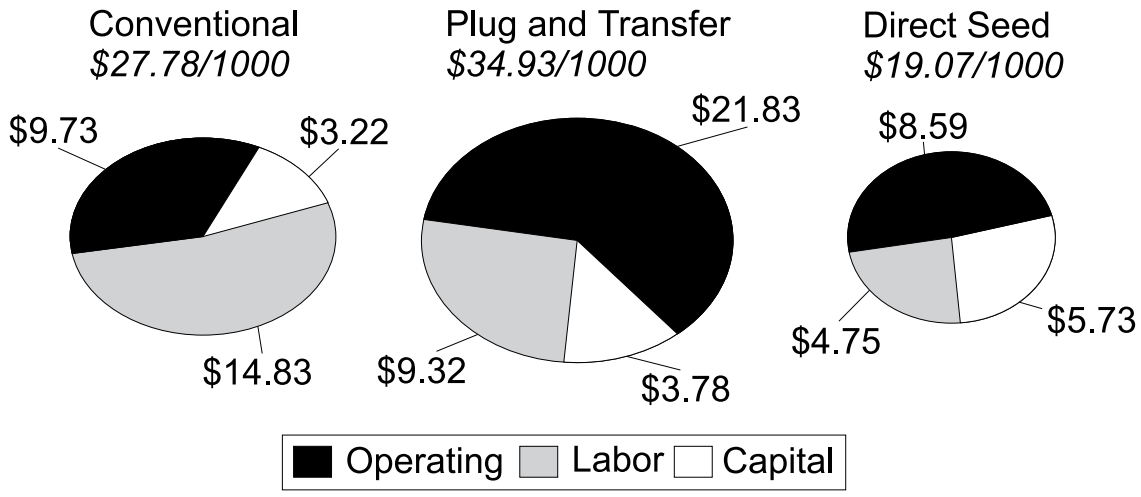

Figure 2: Distribution of costs for each transplant production system (in dollars per 1,000 transplants)

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