COSTS AND RETURNS OF MARYLAND SOD PRODUCTION

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This is the final in a series of three articles dealing with the structure and costs and returns for sod production and marketing in Maryland. The first article introduced the Maryland sod industry's characteristics for the 1976 crop year and the second provided costs and returns per acre for sod produced and marketed on an unharvested basis. The purpose of this article is to describe, develop and present costs and returns for the various vertically integrated options observed for the Maryland turfgrass industry in 1976. These options include different harvest techniques employed to lift the sod and different transportation methods used to deliver the harvested product. Production costs for this analysis were reported in the second article and are shown in Table 1. All data are based on a research project conducted through the Maryland Agricultural Experiment Station.[3]

Thirty-four of the 56 producers who cooperated in the study performed integrated services such as cutting, cutting and loading, delivery, and/or installing Maryland turfgrass. Of these 34, 23 reported delivering and/or installing turfgrass. In general, those individuals who harvested also delivered and installed the turfgrass. These individuals were producers or were a part of a landscape company who had contracted the acreage. A few producers cut only, or cut and loaded sod for other contractors. Generally, landscapers and sod installation companies possessed their own equipment and manpower to harvest the turfgrass and did not desire to pay a premium price for the sod if the producer wished to harvest it himself.

Totally vertical integrated operations were the exception rather than the general rule for several reasons. First, since sod is a highly perishable product once it is lifted (cut) and loaded, har-

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[3] An Experiment Station publication giving more detailed information will be available for distribution in late fall or early winter.

[4] Harvest equipment cost based on an average harvest of 70.6, 15.8 and 42.5 acres for the palletizer, hand-directed and tractor-powered methods of harvest, respectively.

Table 1. Average Total Costs of Production for Various Sizes of Turfgrass Farms, Maryland, 1976

Item	Farm Size				
	Less Than 100 Acres	100-150 Acres	151-300 Acres	Greater Than 300 Acres	All Growers
	— Dollars Per Acre, Two-Year Production Period —				
Fixed Costs					
Machinery and Equipment					
Depreciation	68.12	48.10	37.64	35.55	41.29
Repairs	34.06	24.05	18.82	17.78	20.65
Insurance	4.08	2.89	2.26	2.13	2.48
Permanent Structures					
Depreciation	19.26	14.56	10.78	10.18	14.70
Repairs	3.86	2.92	2.16	2.04	2.94
Insurance	3.86	2.92	2.16	2.04	2.94
Supervisory Services	7.21	6.70	15.14	26.05	13.65
Real Estate Tax	9.00	9.28	9.24	9.38	9.28
Interest on Fixed Capital	52.50	38.26	30.44	29.78	35.52
Land Rental Rate	70.00	70.00	70.00	70.00	70.00
Average Fixed Cost	271.95	219.68	198.64	204.93	213.45
Variable Costs					
Seed	78.40	60.80	69.00	84.32	76.13
Fertilizer	32.96	33.40	29.12	37.06	33.54
Top-dressing	84.12	79.26	72.52	77.64	80.80
Herbicides	11.07	11.91	15.25	20.85	14.31
Lime	17.59	13.25	19.25	14.83	16.59
Fuel and Oil	32.27	30.36	26.77	31.55	31.11
Production Labor	63.65	60.39	45.44	59.58	59.61
Interest on Variable Capital	28.11	25.47	24.40	28.65	27.43
Average Variable Cost	348.17	314.84	301.75	354.48	339.52
Average Total Cost	620.12	534.52	500.39	559.41	552.97

vesters must be guaranteed a final market prior to harvest. This is especially difficult for producers who do not possess the resources or desire to search out and transact key sales or who do not choose to be involved with managing a harvest-delivery-installation operation.

A second factor contributing to limited vertical integration in the industry is the constraint imposed by the capital outlay for equipment necessary to harvest, deliver and install turfgrass. The high capital costs of this specialized equipment, coupled with the high annual costs of operation, are too expensive to be considered economically feasible by many Maryland turfgrass producers.

There were three methods of harvest observed on Maryland turfgrass farms. These varied widely in the degree of mechanization and, subsequently, labor use. The first method, used mostly by small-scale harvesters, involved using a hand-directed machine which cut the sod in segments 15 inches wide and three to four feet long. The sod was then rolled into balls and hand loaded onto trucks. The second method involved using a tractor-powered sod cutter which lifted the sod. The sod was then rolled and hand loaded onto trucks. The final method, observed on turfgrass farms where large acreages were harvested, was characterized by use of a palletizer mounted and secured on a tractor. The palletizer lifted the sod and transferred it up a conveyor belt while rolling it into a ball. At the end of the conveyor, and stationed on the back of the tractor, one or two men received the rolled ball and loaded it on a pallet. The pallet was dropped at the rear of the tractor when it became full. Extra pallets were carried on the side of the palletizer so very little time was spent waiting for extra pallets. Full pallets were then loaded on waiting trucks by a forklift.

Costs and returns for harvested turfgrass are presented on both an acre and a square yard basis. Cost and return figures developed on a per acre basis were converted to a square yard figure by using a harvest rate of 95 percent, or 4,600 square yards per acre.

Twenty-three harvesters supplied detailed information concerning the varied methods of harvesting turfgrass. Labor costs for the three methods are reported in Table 2. These costs include labor for lifting, rolling and loading turfgrass. As shown in Table 2, total labor hours and total labor cost decreased as the degree of mechanization increased.

Total labor cost for the hand-directed, hand rolled method was $288.11 per acre, 16 percent greater than the labor cost of $247.32 for the tractor-powered, hand-rolled method. Use of the palletized system cut labor cost by 38 and 46 percent, respectively, when compared to the tractor-powered and the hand-directed, hand-rolled systems of harvesting turfgrass (Table 2). However, the advantages of labor savings and decreased harvest time associated with the palletizer method were partially offset by increased equipment investment (palletizer, replacement pallets, tractor, forklift) and associated annual fixed and variable costs for the more sophisticated system of harvesting and loading turfgrass.

Table 2. Average Labor Requirements, Wage Rate and Labor Cost for Harvesting Turfgrass by Various Methods, Maryland, 1976

	Method of Harvest		
	Hand-Directed Hand Rolled	Tractor-Powered Hand Rolled	Palletizer Palletized Handling
Total Labor	$288.11 /acre	$247.32 /acre	$154.47 /acre
Total Labor	6.26 cents/yd²	5.37 cents/yd²	3.36 cents/yd²
Labor Required To Harvest One Acre (Hours)	95.4	84.7	45.3
Average Hourly Wage	$3.02	$2.92	$3.41

Table 3. Average Cost of Harvest Machinery and Equipment by Various Methods of Harvest, Maryland, 1976

Item	Method of Harvest					
	Hand Directed Hand Rolled		Tractor Powered, Hand Rolled		Palletizer, Palletized Handling	
	$/acre	cents/yd²	$/acre	cents/yd²	$/acre	cents/yd²
Depreciation	49.41	1.074	48.69	1.058	60.19	1.308
Repairs	15.44	0.336	15.21	0.331	18.81	0.409
Insurance	1.85	0.040	1.83	0.040	2.26	0.049
Interest	15.75	0.342	15.52	0.337	19.18	0.417
Average Fixed Cost	82.45	1.792	81.25	1.766	100.44	2.183
Gas and Oil	6.20	0.135	25.54	0.555	40.74	0.886
Blades	27.50	0.598	27.50	0.598	27.50	0.598
Replacement Pallets	—		—		42.27	0.919
Average Variable Cost	33.70	0.733	53.04	1.153	110.51	2.403
Average Total Cost	116.15	2.525	134.29	2.919	210.95	4.586

Fixed, variable and total costs for harvest machinery and equipment are reported in Table 3. Average fixed costs for hand-directed and tractor-powered methods of harvest are approximately equal. This was true even though the tractor-powered method was more capital intensive. This resulted from producers using the tractor-powered method to harvest about three times as many acres of turfgrass as those producers who used the hand-directed method. Average fixed cost for the palletizer was not offset by the increased acreage harvested and averaged $100.44 per acre, or approximately 24 percent more than the average fixed costs per acre for the tractor-powered hand rolled method of harvest.

Average variable costs for the palletized method of harvest accounted for much of the difference in average total cost for the three methods. The cost of additional gasoline, oil and replacement pallets accounted for the difference in average variable cost between the palletizer and the other two methods. Blade expense was constant for each method of harvest since deterioration of the blade was affected by the soil condition and not so much by the method of harvest. An average of one blade per acre harvested was used as the basis for this cost. Average variable cost for machinery and equipment (forklift, palletizer, tractor, pallets, fuel and oil) for the palletizer method was $110.51 per acre or 228 percent more than the $33.70 per acre cost for the hand-directed, hand rolled system and 108 percent more than the $53.04 per acre cost for the tractor-powered, hand rolled system of harvest.

Average total cost for machinery and equipment for the palletized method was $210.95 per acre or 82 percent more than the $116.15 total per acre cost for the hand-directed, hand rolled method and 57 percent more than the $134.29 cost for the tractor powered, hand rolled system of harvest (Table 3).

Individuals who perform harvest and delivery operations of turfgrass are continually charged with the responsibility of securing an adequate market for their product and services. Sales and administrative costs of performing this responsibility in the form of advertising, secretarial and bookkeeping services, office and utility expenses were $207.04 per acre harvested, or 4.501 cents per square yard of harvested turfgrass.

Total harvest cost (including sales and administrative costs, labor and machinery costs) was $572.46 per acre (12.445 cents per square yard) for the palletizer method. Individuals who used the hand-directed, hand-rolled system had the highest total harvest cost of $611.30 per acre, or 13.289 cents per square yard, while the tractor-powered, hand-rolled method had total harvest costs of $588.65 per acre, or 12.797 cents per square yard.[4]

The average cost for two methods of delivery of turfgrass is shown in Table 4. Costs for each method were based on the assumption that each delivery was made at maximum truck capacity to a single destination. Although most individuals reported this to be the usual case, some sent trucks that made more than one delivery stop and/or trucks that were partially loaded. Both of these conditions would increase the calculated average cost per yard for delivery of turfgrass for any single trip.

Table 4. Delivery Expense: Average Cost of Transportation by Alternative Methods, Maryland, 1976[a]

Item	Method I	Method II
	cents/yd²	cents/yd²
Depreciation	2.195	2.443
Repairs	1.164	1.571
Taxes (Tags)	0.421	0.393
Interest	0.866	0.964
Insurance	0.817	0.595
Average Fixed Cost	5.463	5.966
Labor	3.129	2.100
Gas and Oil	2.177	1.232
Average Variable Cost	5.306	3.332
Average Total Cost	10.769	9.298

[a]The trucks used for delivery were valued at $10,975 and $24,425 for Methods I and II, respectively. Depreciation was based on an expected useful life of five years, with 30 percent salvage value. Interest was charged at 8.5 percent of average investment while repairs, tags and insurance were computed from grower responses. Method I transported 350-400 yards of sod and Method II transported 650-700 yards of sod. Most palletized sod was transported under Method II, but each method could transport either rolled or palletized sod. Method II was equipped with a stationary boom to facilitate unloading.

Costs for each segment of the integrated turfgrass industry including production through transportation were developed for various sizes of farms and methods employed in producing, harvesting and marketing turfgrass. Average total cost for each combination of production, harvest and transportation including the options to purchase by the acre, sell by the acre, or sell harvested f.o.b. at the farm is reported in Table 5.

Although all possible combinations are reported in Table 5, several represent unlikely combinations of farm size and harvest technique. For example, costs reported for the smaller farms employing the highly mechanized harvest techniques may be understated and may lead to inflated estimates of the return to management. As described in footnote 4, costs for the various harvest practices were based on stated acreages that may not be attained each year by the smaller producers. However, some could reach the required size by increasing harvested acres through custom work for other farmers. Also, to produce turfgrass of comparable quality as that found on farms with greater than 300 acres, producers with farms of 100-150 acres and 151-300 acres would have to increase many of their variable production inputs. Table 1 shows that variable inputs for seed, fertilizer and herbicide were applied on the largest turfgrass farms at a greater expense per acre than on farms with 100-150 or 151-300 acres. Producers did this to insure adequate growth as well as improve the appearance of their product in order to command a premium price. Increasing the variable inputs used on the smaller farms to levels used on the largest farms would increase total costs

Table 5. Average Total Cost by Size of Farm and Level of Integration, Maryland, 1976

Production Option	No Harvest	Harvest Option (Including Sales and Administrative Costs)[a]			Transportation Option
		Hand-Directed Hand-Rolled	Tractor-Powered Hand Rolled	Palletizer, Palletized Handling	
	cents/yd²	cents/yd²	cents/yd²	cents/yd²	
Purchase by the Acre[b]	——	27.574	27.082	26.730	f.o.b. farm
	——	38.343	37.851	37.499	Method I
	——	36.872	36.380	36.028	Method II
Produce Less Than 100 Acres	13.481	26.770	26.278	25.926	f.o.b. farm
	——	37.539	37.047	36.695	Method I
	——	36.068	35.576	35.224	Method II
Produce 100-150 Acres	11.620	24.909	24.417	24.065	f.o.b. farm
	——	35.678	35.186	34.834	Method I
	——	34,207	33.715	33.363	Method II
Produce 151-300 Acres	10.878	24.167	23.675	23.323	f.o.b. farm
	——	34.936	34.444	34.092	Method I
	——	33.465	32.973	32.621	Method II
Produce Greater Than 300 Acres	12.161	25.450	24.958	24.606	f.o.b. farm
	——	36.219	35.727	35.375	Method I
	——	34.748	34.256	33.904	Method II

[a]Sales and administrative costs were 4.501 cents per square yard of harvested turfgrass.

[b]In lieu of production costs for those not producing turfgrass, the average price of $657.09 per acre for unharvested turfgrass was used in the cost calculation.

of production, thereby decreasing returns to management to less than that earned on the larger farms if all farms received the same price.

Return to management for various farm sizes, methods of harvest, methods of transportation, as well as the option to purchase turfgrass by the acre for later harvest and delivery is presented in Table 6. In determining the return to management, gross receipts for f.o.b. at the farm were based on a harvest of 4,600 square yards per acre and a harvest price of 55.3 cents per square yard. The price for delivered turfgrass was 70.8 cents per square yard. Purchase by the acre costs were based on the reported average price of $657.09 per acre for unharvested turfgrass. The other costs, other than management, were based on information in Tables 1-4 plus sales and administrative costs of 4.501 cents per square yard of harvested turfgrass. These costs are summarized in Table 5.

Table 6 shows that return to management ranged from a low of 28.530 cents per square yard on farms with less than 100 acres selling turfgrass f.o.b. at the farm (hand-directed harvest) to a high of 38.179 cents per square yard on farms with 151-300 acres where the palletizer was used to harvest and Method II was used to deliver turfgrass. **WTT**

(Table 6 is located on page 54.)

Table 6. Return to Management from the Sale and Transportation of Harvested Turfgrass by Alternative Methods of Production, Harvest and Transportation, Maryland, 1976[a]

Production Option and/or Size	Method of Harvest: Hand Directed, Hand Rolled	Method of Harvest: Tractor Powered Hand Rolled	Method of Harvest: Palletizer, Palletized Handling	Transportation Option
	cents/yd²	cents/yd²	cents/yd²	
Purchase by the Acre	32.457	32.949	33.301	Method I
	33.928	34.420	34.772	Method II
Produce Less Than 100 Acres	28.530	29.022	29.374	f.o.b. at farm
	33.261	33.753	34.105	Method I
	34.732	35.224	35.576	Method II
Produce 100-150 Acres	30.391	30.883	31.235	f.o.b. at farm
	35.122	35.614	35.966	Method I
	36.593	37.085	37.437	Method II
Produce 151-300 Acres	31.133	31.625	31.977	f.o.b. at farm
	35.864	36.356	36.708	Method I
	37.335	37.827	38.179	Method II
Produce Greater Than 300 Acres	29.850	30.342	30.694	f.o.b. at farm
	34.581	35.073	35.425	Method I
	36.052	36.544	36.896	Method II

[a]Method I transports 350-400 square yards of sod and Method II transports 650-700 square yards of sod. Most palletized sod is transported under Method II, but each method can transport either rolled or palletized sod. Returns on farms with 150 acres or less of turfgrass which harvested using the tractor-powered, hand rolled or the palletizer method are believed to be in excess of what could have been earned. In 1976, these farms did not harvest a sufficient volume of turf (at least 42.5 acres and 70.6 acres per machine per year for the two mechanized methods, respectively) to justify the harvesting costs which are implicit in the return to management. Returns to farms in the 151-300 acre range are also believed to be in excess of what could have been earned in 1976. Farms in this group generally produced turfgrass using a less intensive production schedule which would have been sold at a lesser price if it was sold on a harvested basis. Returns to management would thereby be decreased below those reported.