Aquatic Weed Harvesting Costs And Equipment - 1972

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INTRODUCTION

The state of the art of aquatic weed harvesting dates from the time Adam picked up a handful of watercress, took a bite and liked it. But it was not until the middle of this twentieth century that machinery for harvesting aquatic weeds became commercially available. Since 1945, however, an estimated 50 to 75 harvesters have been produced commercially—mostly on an unintentionally non-profitable basis. The concentration of development efforts has largely focused on harvesting submersed weeds and the state of that art seems to have settled down to a basic design with the following common features: Underwater cutters mounted in front of an inclined porous conveyor; a holding area for the harvested weeds; the above mounted on a powered barge; this backed up by a handling and/or transporting system to shore and trucks. Although these criteria seem to be common to all harvesters built since 1945, efficiency of harvest has varied as the system designs have varied. Also, since 1945, all harvester design and manufacturing facilities seem to have centered in Waukesha County, Wisconsin. The originator of the first hardware was Mr. Matthew Grinwald of Hartland, Wisconsin. He eventually incorporated with others to form Aquatic Controls Corporation, originally also in Hartland. Grinwald soon split off from this corporation, forming Grinwald-Thomas Corporation. In 1968, a third, and new, corporation threw its hat in the "harvesting ring": Aquamarine Corporation. Subsequently, Aquatic Controls Corporation disappeared from the market place and Grinwald-Thomas was dissolved, leaving Aquamarine. Their harvesting system seems to have found its niche in aquatic control with 25 harvesters in operation by 1972.

Any effort, then, to analyze contemporary costs of weed harvesting must primarily involve contemporary equipment if it is to be meaningful. Secondly, access to locations of harvesting programs and their costs are critical to studies of harvesting costs. Accordingly, a cost and performance questionnaire was prepared for harvesting operations put into service in 1970 or later. Meaningful responses were received from six locations and are reported herein.

COLLECTION OF INFORMATION

Information was requested in the following areas for the year 1971: Acres harvested, tonnage harvested, harvester loads harvested, transport distances (both on land and water), equipment used, moves made between lakes, all manhours expended for reported harvesting period, equipment hours operated, maintenance down time and details, type weeds harvested, use of harvested weeds.

Due to differing interpretations of terminology, some of the data had to be rejected. For instance, "Is "down time hours" the time lost during the regular working hours?" Some of the information received was later determined to be based on hearsay, not statistical tabulations. The harvest figures reported and tabulated are all within the reasonable capabilities of the equipment used.

DISCUSSION

Table 1 tabulates "labor only" costs for one season. These dollars are readily available from accounting records. They include supervision, operating, maintenance and trucking costs. Cost per unit of performance was desired and two measurements of performance were chosen: acres harvested (120 acres harvested twice equals 240 'acres harvested') and tons harvested (as measured by truckloads statistically sampled and weighed on a truck scale, or by number of harvester loads times tons per load.)

The first column of Table 1 indicates labor cost/acre, and the second column tabulates labor cost/ton harvested.

TABLE 1. OPERATING AND MAINTENANCE LABOR COSTS REPORTED BY VARIOUS LOCATIONS FOR HARVESTING AQUATIC WEEDS IN 1971.

State	Labor Cost/Acre (Dollars)	Labor Cost/Ton Harvested (Dollars)
Province of Alberta, Canada	17.17	4.72
Berkeley, California	28.18	9.66
Big Bear Lake, California	21.46	0.60[a]
Detroit Lakes, Minnesota	(Not Available)	10.42
East Troy, Wisconsin	12.41	5.54
Dane County, Wisconsin	10.00	9.73

[a]An extremely heavy infestation of elodea and a short distance to shore.

With the exception of the Minnesota report, all reported costs were developed using Aquamarine equipment (in three cases using the three part AQUA-TRIO system, and in two cases using a Model H-650 Harvester only). The Minnesota report was based on the performance of an Aquatic Controls Corporation "Marine Scavenger" without a transport system. The second Wisconsin report was based on the cumulative performance of an AQUA-TRIO in conjunction with an early 1960's and a 1968 model Grinwald harvesting system.

Cost variations can be traced to not only equipment but weed type, infestation densities, transport distances (both across water and on land,) disposal requirements and personnel. Note that the cheapest cost per ton was reported as $0.60. The reason for this low cost was that the transport distance was on the order of 100 ft to the nearest shoreline where the very heavy harvest (reported by Big Bear Lake only as "elodea") was ejected onto the beach for cleanup by others.

The costs in Table 2 were copied from very precise information in the annual report to taxpayers of East Troy Sanitary District No. 1, East Troy, Wisconsin. (1) The actual harvesting of aquatic plants was done by two men who were high school teachers 9 months a year. They harvested 40 hr a week from June through August. Certain repair and weather-oriented downtime was experienced and is reflected in the numbers in Table 2.

TABLE 2. SUMMARY OF 1971 OPERATING EXPENSES FOR HARVESTING AQUATIC PLANTS FROM LAKE BEULAH AS REPORTED BY THE EAST TROY SANITARY DISTRICT NO. 1 EAST TROY, WISCONSIN.[a]

ACRES HARVESTED	260
TONS HARVESTED	711
Operating Salaries (2 men, 3 months)	$3,228.70
Operating Expense (Ins., Gas, Oil, Repairs, Truck, etc.)	2,295.50
Harvesting Supervision	97.12
TOTAL	$5,621.32[b]
Less non-recurring expense (Life jackets, fire extinguisher, high-pressure water pump, etc.)	375.50
NET OPERATING EXPENSE	$5,245.82
Cost Per Acre	$20.17
Cost Per Ton	$ 7.38

[a]Harvesting equipment consisted of a Harvester, Transport, and Shore Conveyor. Lake Beulah is 1100 acres of which 130 are harvested twice a year. Some of the weeds are hauled by truck to a public landfill site while some are dumped on otherwise inaccessible shorelines.

[b]Includes disposal by hauling to dump.

Measurements reported in Table 2 were made as follows: A large scale map of Lake Beulah was obtained. A lake survey of areas infested with weeds was plotted to scale on the map. Measurements of the areas of infestation were made in square inches. A simple calculation related to the scale of the map gave acres per square inch which then related to total area infested. Judicious use of plastic marker buoys directed the harvester operators to the areas to be harvested and controlled their progress according to the needs as determined by supervision.

Since Table 2 did not report the amortization costs on equipment, Table 3, entitled "Typical Harvesting Budget Calculation Sheet" was developed using 1972 list prices for an Aquamarine harvester plus shore conveyor.

Based on a reasonable preventive maintenance program, a 10-year equipment life can be expected. Leasing trucks is one of the more expensive ways to dispose of the weeds and will indicate high costs. As an alternative, a $3,000 used dump truck would suffice and a 200 mile/day requirement is high. The labor, maintenance, and contingency estimates are self-explanatory.

The last paragraph of Table 3 assesses costs/acre based on the performance of the total operation in acres harvested per season. As discussed in an earlier paragraph, total acres harvested depend on so many variables that performance predictions must remain very general until the specifics of a given harvest are determined. Generally, then, experience indicates a harvest of 0.33 to 0.66 acres/hr. Extending this figure into a year's harvest can then determine

TABLE 3. A TYPICAL BUDGET SHEET FOR HARVESTING AQUATIC PLANTS.

I.	Capital Investment for Aquamarine Corporation Equipment:		
	One H-650 Harvester	$28,900.00	
	One S-650 Shore Conveyor	7,200.00	
	One M-650 Mobilizing Assembly	1,805.00	
	Freight	687.00	
		$38,592.00	
	Annual Depreciation (10%/year)		$3,860.00
II.	Leased Truck & Hauling Expense:		
	200 miles per day; 5-day week; 66-day season		
	Leasing Fee—$290 for 3 months	$ 870.00	
	Mileage Cost—200 miles for 66 days @ 0.10/mile	1,320.00	
	Gasoline—20 gallons x 66 days x 0.20	264.00	
			$2,454.00
III.	Labor: 8-hr day; 66 days; two men at $4/hr/man[a]		$4,224.00
IV.	Harvesting Operating & Maintenance Expense		$1,200.00
V.	Contingencies (10%)		$1,162.00
VI.	ANNUAL ESTIMATED OPERATING COST		$12,900.00
VII.	Cost In Relation To Number Of Acres Harvested[b]		

Acre/Hr	Acre/Season	Cost/Acre
1.0	528	$24.50
0.5	264	48.50
0.3	176	73.00

[a]Includes fringe benefits

[b]Aquatic plants harvested 66 days during a season.

a projected "per acre cost." It is well to note that "per acre costs" can be drastically reduced by working more than 8 hr per day. Harvesters equipped with night lights are presently in operation.

CONCLUSIONS

The cost of harvesting aquatic weeds seems to be diminishing as equipment design improves. The selection of equipment is broadening, and new developments in the near future will be further reducing costs. These facts, combined with those recently published (2), indicate the further reason for increasing use of harvesting as a method for controlling growth of aquatic vegetation. The abstract says: "Studies of the effects of harvesting on hydrophytes in Lake Mendota, Wisconsin growth by at least 50%, two harvests reduced it by 75% and three harvests virtually eliminated plant material for the year. The studies also indicated that harvesting one year reduced the biomass the following year, especially in deep water. Three harvests during the previous year were most effective in controlling biomass the second year."

LITERATURE CITED

1. City of East Troy, Wisconsin. 1971. Report To Taxpayers. 5 p.
2. Nichols, S. and G. Cottam. 1972. Harvesting As A Control For Aquatic Plants. Water Resources Bulletin of American Water Resources Association, Bull. 8:1205.