

PEAT

By Raymond L. Cantrell

Peat is a renewable, natural organic material of botanical origin and commercial significance that is deposited over more than 4% of the Earth's surface, where it plays an active role in the dynamics of our planet's ecosystem. Commercial peatlands are situated predominately in shallow wetlands areas of the northern hemisphere, where large deposits developed from the gradual decomposition of plant matter under anaerobic, or oxygen free, conditions.

Peat has widespread use as a plant growth medium in a variety of horticultural and agricultural applications, where its fibrous structure and porosity promote a unique combination of water retention and drainage characteristics, along with an affinity for plant available mineral nutrients. Commercial applications include potting soils, lawn and garden soil amendments, and turf maintenance on golf courses. In industry, peat is used primarily as a filtration medium to remove toxic materials from mine and process waste streams, pathogens from sewage effluents, and deleterious materials suspended in municipal storm drain water. In its dehydrated form, peat becomes hydrophobic, and is a highly effective absorbent for fuel and oil spills, on both land and water.

In 1994, the United States continued as a significant producer and consumer of peat for horticultural, agricultural, and industrial purposes. A variety of peat types was extracted and processed from over 70 identified operations in 20 of the lower 48 States, and Alaska, including reed-sedge, sphagnum moss, humus, and hypnum moss, in order of importance. Approximately 85% of U.S. peat production was from the Southeast, and Great Lakes States, where Florida, Michigan, and Minnesota ranked as the dominant producers. The United States imported about 55% of its total domestic peat requirements, principally from Canada, where there were extensive deposits of sphagnum peat moss. A small amount of peat was exported. (*See figure 1.*)

U.S. peat production and sales continued to be in a long term downward spiral, according to data reported to the U.S. Bureau of Mines (USBM) by domestic producers. Record high imports of Canadian sphagnum retained apparent domestic consumption at a relatively flat 1.2 million metric tons. The U.S. peat

industry has been adversely impacted by stringent wetlands legislation at the Federal and State levels in recent years, that has hampered the permitting of new bogs for replacement or expansion. Several producers were integrating compost into their product lines to absorb a wealth of renewable organic material generated by the nation's efforts to recycle yard waste.

Production

Peat production in the United States decreased 7% between 1993 and 1994, according to the USBM annual survey of domestic peat producers. This was in line with a long-term trend of declining U.S. peat production, a concomitant drop in the number of domestic operations, relatively flat domestic consumption, overall, and the capture of an increasing market share by Canadian sphagnum peat moss producers shipping to the United States. (*See table 1.*)

Geographically, domestic production was dominated by several operations in the Great Lakes region, and the Southeast, where Florida, Michigan, and Minnesota were the dominant producers, in order of importance, according to information reported to the USBM by the industry. Approximately 20% of U.S. production was from operations in the Midwest, Northeast, and western States. Large operations—23,000 tons and above—accounted for more than 65% of total U.S. production. Reed-sedge peat accounted for about 70% of domestic production by weight; sphagnum moss, 15%; humus, 9%; and hypnum moss, 6%. (*See tables 2, 3, and 4.*)

Consumption

Domestic peat sales volume in 1994 trended downwards and amounted to 552,000 tons, or 45% of total U.S. apparent domestic consumption. Packaged materials were about 54% of total domestic sales tonnage and commanded premium prices. Canadian imports reached a record high 645,000 tons, and accounted for 54% of total U.S. apparent domestic consumption. Ireland and several other countries, principally in Scandinavia, shipped minor tonnages that accounted for less than 1% of total U.S. peat demand. A small drop in domestic inventories accounted for the

remainder. Domestic peat sales, by weight, followed the same relative distribution trend as production, led by reed-sedge, humus, sphagnum moss, and hypnum moss, in order of importance. High quality sphagnum peat moss ranked second to reed-sedge on a volume basis, however, because of its high fiber and low density characteristics. Thus, reed-sedge sales were about 70% of the total, by volume; sphagnum moss, 18%; humus, 7%; and hypnum moss, 5%.

Approximately 95% of domestic peat was sold for use in general soil improvement, potting soils, earthworm culture, the nursery business, and golf course maintenance and construction, in order of importance. The remainder was used in a variety of applications, including seed inoculants, vegetable cultivation, mixed fertilizers, packing for flowers and plants, and in the industrial sector. Worcester Peat of Cherryfield, Maine, operated the only peat fired electrical power/plant in the United States. (*See tables 3, 5, and 6.*)

Stocks

U.S. peat stocks fell by a moderate 6%, to about 250,000 tons in 1994. Reed-sedge peat was 68% of the total; sphagnum, 15%; humus, 10%; with hypnum moss and other forms accounting for the remainder. (*See table 4.*)

Prices

The total f.o.b. plant value of domestic peat sold in the United States in 1994 was \$15.3 million, according to the USBM annual survey of domestic peat producers. Although the total value of domestic peat fell relative to 1993, owing to a decline in sales volume, the average unit value was up slightly to \$27.70 per ton, compared with \$27.50 in 1993. The total wholesale value of the U.S. peat supply in 1994, including imported material, amounted to more than \$141 million, compared with about \$135 million in 1993.

Reed-sedge peat was valued at \$8.7 million, f.o.b. plant, and accounted for 57% of total domestic product sales value; followed by sphagnum moss, \$4.5 million, 29%; humus, \$1.3 million, 8%; and hypnum moss, \$0.9 million, or 6% of total. On a unit value basis, packaged sphagnum moss was valued at near

\$100 per ton, f.o.b plant; hypnum moss, \$65 per ton; humus, \$22 per ton; and, reed-sedge, \$17 per ton. (See tables 1, 3, 5, 7, and 8.)

Foreign Trade

The United States continued to export minor tonnages of peat, which amounted to 23,000 tons in 1994. U.S. peat was valued at \$2.2 million, or about \$95 per ton, free-along-side-ship (f.a.s.). U.S. peat exports were principally to Latin American countries. (See table 8.)

Canadian sphagnum moss import volume reached a record high of 665,000 tons in 1994, and carried a customs value of \$126 million, or \$189 per ton. This was \$6 per ton, or 3% higher than the comparable unit value in 1993. Imports from Ireland were 600 tons, and carried a customs value of \$76,000 or \$127 per ton. Ireland's Shamrock Peat brand was selected as the material of choice for greens reconstruction at the Atlanta Athletic Club golf course in Georgia. Seven countries, including Denmark, Finland and Norway in Scandinavia; Germany and the Netherlands in Western Europe; together with New Zealand and Sri Lanka; shipped 3,500 tons that carried a customs value of \$509,000 or \$146 per ton.

World Review

Twenty-two countries were known to produce peat in 1994, according to information available to the USBM. Countries in the former U.S.S.R. were estimated to account for about 84% of global peat production, although a continuing decline was believed to have occurred owing to political restructuring and unfavorable economic trends. Russia, the Ukraine, and Belarus were the leading producers in the former U.S.S.R., in order of importance. The Baltic Republics of Estonia, Latvia, and Lithuania also produced significant quantities of peat.

Peat production outside the former U.S.S.R. was dominated by Finland, Ireland, Germany, Sweden, and Canada, in order of importance, which, in combination, accounted for 15% of global production. The remainder was produced principally by the United States, with minor contributions from countries in Africa, Eastern Europe, Latin America, Western Europe, and Oceania. (See table 9.)

Canada.—Natural Resources Canada reported that Canadian peat production reached a new record high of 1.1 million tons in 1994. New Brunswick was the principal factor, where production was up 65% to 465,000 tons. Total Canadian peat shipments were estimated at 952,000 tons valued at \$138 million. The eastern provinces of New Brunswick and

Quebec accounted for 60% of the total, while Alberta and Manitoba, in western and central Canada, respectively, shipped another 33%. The remainder was supplied from Newfoundland, Nova Scotia, and Saskatchewan. Canada consumed about 19% of total shipments and exported the remainder.¹

China.—The first international peat conference ever organized in China under the auspices of the International Peat Society (IPS)—"Wetland Environment and Peatland Utilization"—was held August 9-11, 1994, in the northeastern city of Changchun. The historic peat conference was organized by the Changchun Institute of Geography of the Chinese Academy of Sciences, and was cosponsored by Wuhan Institute of Survey and Geophysics and supported by the National Natural Science Foundation of China and Changchun Branch of the Chinese Academy of Sciences.

According to the Director of the Changchun Institute of Geography, there are 25 million hectares (ha) of wetlands in China. The mires cover roughly 11 million ha, of which the share of geological peatlands is over 4 million ha. There has been a long history of peatland use for the cultivation of rice, vegetables, and cotton. Other information revealed that there were a total of 37 peat production sites in China, which include 7 billion tons of peat, principally in Jilin and Heilongjiang Provinces. In Heilongjiang Province, there is a joint Chinese-American company producing horticultural peat for Far Eastern markets.²

Former U.S.S.R.—The Russian National Committee of the IPS reported that as of January 1991, explored and forecast peat reserves in Russia comprised 161.2 billion tons of conventional air dried peat (40% moisture), and were concentrated at 46,119 peat deposits comprising an area of about 46.3 million ha. In 1975, 135 million tons was reported to have been extracted, followed by increasing quantities. In 1992, after the dissolution of the U.S.S.R., production was reported to have declined to 61.2 million tons, of which about 88% was for horticultural/agricultural use, and 12% for fuel use.

Large specialized enterprises of the Russian Fuel Association extracted all fuel peat and peat for processing and about 16% of agricultural peat. Agricultural peat was extracted, for the most part, on various small sites belonging to nonindustrial organizations. The trend, however, is toward extraction by larger, more specialized industrial peat enterprises.³

Current Research and Technology

Researchers at the Natural Resources

Research Institute (NRRI), University of Minnesota at Duluth, were studying the growth and regeneration of sphagnum top moss. NRRI reported that top moss is a renewable resource, and may be harvested in 5-10 year rotations. In Wisconsin, sphagnum top moss is harvested for commercial use in hanging baskets, wreaths, seed germination, and as a packing material. NRRI research demonstrated that top moss also shows potential as an effective oil sorbent, and that Minnesota has the potential to participate in a variety of top moss markets if successful regeneration can be accomplished.⁴

U.S. Bureau of Mines research personnel at Salt Lake City, UT, continued to report the successful commercial introduction of its patented Bio-Fix Bead peat technology. The technology was being commercialized at the Asarco Globe Facility in Denver, CO, a facility that refines a variety of metals. Hazardous mine waste effluent streams and other industrial waste streams containing cadmium, copper, lead and zinc have been effectively treated. Because of the peat bead's affinity for metal ions at very low concentrations, treated effluents frequently meet National Drinking Water Standards and other discharge criteria.⁵

Outlook

The outlook for horticulture and associated businesses is bright, because global demand for various plants, flowers, ornamental trees, natural turf, and outdoor recreational activities continues to grow at impressive rates. The U.S. Department of Agriculture anticipates that the growth in monetary value for this industry in the United States will outpace that of traditional agriculture throughout the remainder of the decade. The outlook for the domestic peat industry, therefore, will likely be governed by several variables, including future wetlands environmental regulation, the ability to permit new bogs, growth and competition from recycled yard wastes and other natural organic materials, Canadian competition, and the degree of market penetration by flowers and ornamentals from offshore.

¹Bergeron, M. Peat 1994. Natural Resources Canada (Ottawa, Ontario), 1994, 10 pp.

²International Peat Society Bulletin 25, 1994, Jyväskylä, Finland, pp. 41-54.

³Work cited in footnote 1, pp. 55-58.

⁴NRRI Now. Top Moss Shows Commercial Potential. Nat. Resour. Res. Inst., Univ. of MN, Duluth, winter, 1995, p. 6.

⁵Jeffers, T. H., and A. E. Isaacson. Peat Moss in Plastic Beads: New Waste Water Treatment. AMC Journal, Nov. 1994, pp. 5-8.

OTHER SOURCES OF INFORMATION

U.S. Bureau of Mines Publications

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Peat Annual Report, 1991-93

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Malterer, T. J., B. McCarthy, and R. D. Adams. The Use of Peat in Waste Treatment. Presented to the 1995 SME Annual Meeting, Denver, CO, Mar. 1995, 7 pp.

NRRI Now. NRRI Scientist Attends International Peat Symposium in China. Nat. Resour. Res. Inst., Univ. of MN, Duluth, autumn 1994, p. 7.

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TABLE 1
SALIENT PEAT STATISTICS 1/

		1990	1991	1992	1993	1994
United States:						
Number of active producers		82	76	71	67	70
Production	thousand metric tons	692	632	599	616	574
Sales by producers	do.	721	703	652	612	552
Bulk	do.	360	348	288	343	255
Package	do.	361	355	365	268	297
Value of sales	thousands	\$19,200	\$17,800	\$16,700	\$16,800	\$15,300
Average per metric ton		\$26.63	\$25.29	\$25.68	\$27.54	\$27.22
Average per metric ton, bulk		\$19.58	\$20.22	\$19.31	\$19.62	\$18.70
Average per metric ton, package or baled		\$33.65	\$30.26	\$30.71	\$37.67	\$26.44
Exports	thousand metric tons	12	13	22	8	23
Imports for consumption	do.	543	573	639	648	669
Consumption, apparent 2/	do.	1,230	1,250	1,230	1,290	1,240
Stocks, December 31: Producers'	do.	357	298	308	269	252
World: Production	do.	180,000	165,000	155,000 r/	144,000 r/	139,000 e/

e/ Estimated. r/ Revised.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits, except prices.

2/ Apparent consumption equals U.S. primary production plus imports minus exports plus adjustments for industry stock changes.

TABLE 2
RELATIVE SIZE OF PEAT OPERATIONS IN THE UNITED STATES

Size in metric tons per year	Active operations		Production (thousand metric tons)	
	1993	1994	1993	1994
23,000 and over	8	9	363	380
14,000 to 22,999	6	2	92	37
9,000 to 13,999	5	4	57	45
5,000 to 8,999	8	11	53	71
2,000 to 4,999	13	10	38	28
1,000 to 1,999	6	9	7	10
Under 1,000	21	25	7	4
Total 1/	67	70	616	574

1/ Data may not add to totals shown because of independent rounding.

TABLE 3
U.S. PEAT PRODUCTION AND SALES BY PRODUCERS IN 1994, BY STATE 1/

Region and State	Active operations	Production	Sales		
		Quantity (thousand metric tons)	Quantity (thousand metric tons)	Value 2/ (thousands)	Percent packaged
Northeast					
Pennsylvania	7	11	11	\$296	10
Other 3/	8	63	26	1,270	XX
Total	15	74	37	1,560	XX
Great Lakes					
Michigan	8	156	156	5,090	92
Minnesota	9	37	37	3,010	34
Other 4/	15	57	63	1,360	XX
Total	32	250	256	9,470	XX
Southeast					
Florida	9	214	206	3,230	18
Other 5/	2	24	24	574	XX
Total	11	238	230	3,810	XX
West					
Washington	4	3	3	111	--
Other 6/	8	8	26	389	XX
Total	12	11	29	500	XX
Total or average	70	574	552	15,300	54

XX Not applicable.

1/ Data are rounded by the U.S. Bureau of Mines to three significant digits; may not add totals shown.

2/ Values for f.o.b. producing plant.

3/ Includes Maine, Massachusetts, New Jersey, New York, and West Virginia.

4/ Includes Illinois, Indiana, Ohio, and Wisconsin.

5/ Includes North Carolina, and South Carolina.

6/ Includes Colorado, Iowa, Montana, and North Dakota.

TABLE 4
U.S. PEAT PRODUCTION AND PRODUCERS' YEAREND STOCKS
IN 1994, BY KIND 1/

Kind	Active operations	Production (metric tons)	Percent of production	Yearend stocks (metric tons)
Sphagnum moss	14	87,800	15	37,900
Hypnum moss	10	31,400	6	2,540
Reed-sedge	35	392,000	68	173,000
Humus	15	51,400	9	25,500
Other	2	11,400	2	12,400
Total	70 2/	574,000	100	252,000

1/ Data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Number of active operations include plants producing multiple kinds of peat.

TABLE 5
U.S. PEAT SALES BY PRODUCERS IN 1994, BY TYPE AND USE 1/

Use	Sphagnum moss			Hypnum moss			Reed-sedge		
	Quantity		Value (thou- sands)	Quantity		Value (thou- sands)	Quantity		Value (thou- sands)
	Weight (metric tons)	Volume 2/ (cubic yards)		Weight (metric tons)	Volume (cubic yards)		Weight (metric tons)	Volume (cubic yards)	
Earthworm culture medium	44	78	\$1	--	--	--	47,500	105,000	\$723
General soil improvement	32,600	168,000	3,530	8,950	22,900	\$528	208,000	497,000	4,920
Golf courses	3,630	20,000	266	1,450	3,200	43	7,940	22,100	315
Ingredient for potting soils	181	500	6	14,000	31,800	219	144,000	304,000	2,180
Mixed fertilizers	--	--	--	567	1,250	31	--	--	--
Nurseries	9,790	50,300	609	1,350	5,000	53	16,300	40,400	444
Packing flowers, plants shrubs, etc.	185	1,700	62	45	100	1	181	500	6
Seed inoculant	--	--	--	--	--	--	4,540	10,000	88
Vegetable growing	--	--	--	340	750	5	--	--	--
Other	503	1,310	15	--	--	--	--	--	--
Total	46,900	242,000	4,490	26,700	65,000	881	429,000	978,000	8,680
	Humus			Other			Total		
	Quantity		Value (thou- sands)	Quantity		Value (thou- sands)	Quantity		Value (thou- sands)
	Weight (metric tons)	Volume (cubic yards)		Weight (metric tons)	Volume (cubic yards)		Weight (metric tons)	Volume (cubic yards)	
Earthworm culture medium	916	1,950	\$18	--	--	--	48,500	107,000	\$742
General soil improvement	36,100	67,700	1,010	12	25	(3/)	286,000	755,000	9,990
Golf courses	1,410	2,810	24	--	--	--	14,400	48,100	648
Ingredient for potting soils	5,540	11,100	77	--	--	--	164,000	348,000	2,480
Mixed fertilizers	--	--	--	--	--	--	567	1,250	31
Nurseries	2,610	5,300	79	--	--	--	30,100	101,000	1,180
Packing flowers, plants shrubs, etc.	272	500	3	--	--	--	684	2,800	71
Seed inoculant	--	--	--	--	--	--	4,540	10,000	88
Vegetable growing	771	1,500	17	12	25	(3/)	1,120	2,280	22
Other	1,870	3,530	55	--	--	--	2,380	4,840	71
Total	49,500	94,400	1,280	24	50	\$1	552,000	1,380,000	15,300

1/ 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Volume of nearly all sphagnum moss was measured after compaction and packaging.

3/ Less than 1/2 unit.

TABLE 6
AVERAGE DENSITY OF DOMESTIC PEAT SOLD IN 1994 1/

(Kilograms per cubic meter)

	Sphag- num moss	Hypnum moss	Reed- sedge	Humus	Other
Bulk	284	558	593	665	617
Package	239	475	555	694	--
Bulk and package	254	537	573	688	617

1/ To convert kilograms per cubic meter to pounds per cubic yard multiply by 1.685.

TABLE 7
PRICES 1/ FOR PEAT IN 1994

(Dollars per unit)

	Sphag- num moss	Hypnum moss	Reed- sedge	Humus	Other	Average
Domestic:						
Bulk:						
Per metric ton	47.48	16.78	16.32	19.21	26.73	18.70
Per cubic yard	12.53	8.69	9.02	11.82	15.32	9.60
Packaged or baled:						
Per metric ton	97.99	64.49	16.94	22.23	--	26.44
Per cubic yard	21.70	28.44	8.74	14.36	--	12.29
Average:						
Per metric ton	78.81	27.16	16.65	21.36	26.73	27.22
Per cubic yard	18.59	13.55	8.87	13.60	15.32	11.11
Imported, total, per metric ton 2/	XX	XX	XX	XX	XX	171.3148

XX Not applicable.

1/ Prices are f.o.b. plant.

2/ Average customs value.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF PEAT MOSS, 1/ 2/
BY COUNTRY

Country	1993		1994	
	Quantity (metric tons)	Value 3/ (thousands)	Quantity (metric tons)	Value 3/ (thousands)
Canada	645,000	\$118,000	665,000	\$126,000
Ireland	875	127	600	76
Other 4/	2,350	406	3,490	509
Total	648,000	118,000	669,000	126,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Poultry and fertilizer grade.

3/ Customs value.

4/ Includes Denmark, Finland, Germany, Netherlands, New Zealand, Norway, and Sri Lanka.

Source: Bureau of the Census.

TABLE 9
PEAT: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country 3/	1990	1991	1992	1993	1994 e/
Argentina: Agricultural use	7 r/	1 r/	1 r/	11 r/	11
Australia e/ 4/	11	11	11	11	15
Belarus: e/					
Agricultural use	XX	XX	10,000	10,000	10,000
Fuel use	XX	XX	4,000 r/	4,000 r/	6,000
Burundi	12	10	12	10 e/	10
Canada: Agricultural use	716	856	740	801 r/	1,020 5/
Denmark: Agricultural use (sales)	225 6/	184 r/	195	189 r/	190
Estonia: e/					
Agricultural use	XX	XX	5,000	4,500	4,500
Fuel use	XX	XX	600	600	1,000
Finland:					
Agricultural use	330 e/	220	355	350 r/ e/	550 5/
Fuel use	4,500 e/	2,310	5,100	5,000 r/ e/	8,000
France: Agricultural use e/	200	200	200	200	200
Germany: Western states: 7/					
Agricultural use	2,980	2,880	2,720	2,740 r/	2,800
Fuel use	238	225 e/	188	180 r/	180
Hungary: Agricultural use e/	65	65	65	65	65
Ireland:					
Agricultural use	229	249	300 e/	300 e/	250
Fuel use	6,430	4,770	6,200	6,500 e/	6,400
Latvia: e/					
Agricultural use	XX	XX	5,000	4,500	4,500
Fuel use	XX	XX	300	300	500
Lithuania: e/					
Agricultural use	XX	XX	5,000	4,500	4,500
Fuel use	XX	XX	100	100	200
Netherlands e/	300	300	300	300	300
Norway: e/					
Agricultural use	30	30	30	30	30
Fuel use	1	1	1	1	1
Poland: Agricultural and fuel use e/	50	50	50	50	50
Russia: e/					
Agricultural use	XX	XX	80,000	70,000	60,000
Fuel use	XX	XX	5,000	5,000	4,000
Spain e/	77	75	70	70	70
Sweden: e/					
Agricultural use	250 5/	263 5/	260	250 e/	250
Fuel use	1,400	1,400	1,400	1,400	1,400
Ukraine: e/					
Agricultural use	XX	XX	20,000	20,000	20,000
Fuel use	XX	XX	1,000	1,000	1,000
U.S.S.R.:					
Agricultural use e/	150,000	140,000	XX	XX	XX
Fuel use	11,200	10,000	XX	XX	XX
United States:					
Agricultural use	692	632	599	616	547 5/
Fuel use	W	W	W	W	W
Total fuel use	23,800	18,700 r/	23,900 r/	24,100 r/	28,700
Grand total	180,000	165,000	155,000 r/	144,000 r/	139,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." XX Not applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through June 20, 1995.

3/ In addition to the countries listed, Austria, Iceland, and Italy produce negligible amounts of fuel peat. The Eastern states of Germany and Venezuela are major producers, but output is not officially reported, and available information is inadequate for formulation of estimates of output levels.

4/ Excludes data from some states.

5/ Reported figure.

6/ Reported production figure.

7/ Production in eastern states has historically been confidential; no basis exists for reliable estimation.

8/ Dissolved in Dec. 1991.