Effects of source and length of storage time on the quality of fine grade baled peat moss

M. Mofidpoor[1], M. Krzic[1] and L. Principe[2]

[1] Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC Canada V6T 1Z4
Phone: +1 7787721129), e-mail: mofid1975@yahoo.com;

[2] West Creek Farms Ltd., Fort Langley, BC Canada V1M 2S5

Summary

The effects of the source and the length of storage time on chemical and physical properties of a fine grade peat moss were studied. Nine bales of peat moss from upper, less decomposed layers of a bog in Manitoba (MB) and nine bales of peat moss from lower, more decomposed layers of a bog in Alberta (AB) were sampled after 1, 3, and 10 months of storage. The MB peat moss had a larger particle size and a greater NH_4-N content. The AB peat moss had higher pH, electrical conductivity (EC), and NO_3-N content. In MB peat moss particle size decreased at 10 months storage time and pH increased at 3 months. In AB peat moss, particle size decreased at 3 months, while plant available water increased at 10 months. This study suggests that the growing media industry should consider the source and the length of storage time as factors affecting the quality of peat moss.

Key index words: peat moss, length of storage, source, greenhouse, particle size.

Introduction

Peatlands cover an area of about 110 million ha in Canada, which accounts for 25% of the world's peat (Hood, 1999). Peat moss is harvested from lass than 0.01% of total land under peat bogs in Canada (Daigle and Daigle 2001) and the majority of peat moss used in the growing media industry in western Canada originates from bogs in AB and MB. Factors such as depth of harvested layers, methods of harvesting and processing affect the quality of peat moss as growing media in horticulture industry (Puustjärvi, 1983; Visscher, 1988 and Noble *et al.*, 1999). Peat moss quality may also be affected by lengthy storage time; however, no studies have been undertaken to determine the influence of storage time on baled peat moss properties. The objective of this study was to assess the effects of peat moss source and length of storage time on peat moss quality.

Materials and Methods

Site Description and Sampling

Peat moss used in this study was harvested from a bog by the Lake Winnipeg in MB (52° 07′N, 97° 15′W) and a bog in Vilna about 150 km NE of Edmonton, AB (54° 06′, N and 111° 55′ W). Harvesting of the peat moss from the bog in MB commenced in 2004 and the peat moss samples used in this study were obtained from the second harvest done in May 2005. Harvesting of the bog in AB has started about seven years prior to this study (i.e., around 1998). Only the fine grade peat moss was analyzed.

Laboratory Analysis

Total elements were determined on a 7.9 *M* HNO_3, and 2.42 *M* HCl extract (Smoley, 1992). Ash content was determined by weight loss on ignition at 375-600°C (Karam, 1993). Ash color was rated according to the Munsell Soil Color notation. Size distribution of organic particles was determined by wet sieving method (Dinel and Levesque, 1977), using sieves with openings of 1.000, 0.425, 0.150, and 0.075 mm. Water retention was determined on a 0.5 MPa pressure plate extractor (Klute, 1986). pH and EC were determined by the saturated media extract method (BCMAFF, 1999). Available NH_4 and NO_3 were determined on a 2 *M* KCl extract (Keeney and Nelson, 1982).

Results

Site Conditions

To characterize peat moss harvested from two bogs, total element content, ash content and ash color were determined. The levels of macronutrients (e.g., P and K) as well as micronutrients (Fe, Cu, and Zn) and majority of the other elements (Al and Na) were higher in MB peat relative to the AB peat. The MB peat had a light beige color ash (i.e., 10YR 8/4), while the ash of the AB peat had a less intense almost white color (10YR 8/2). The color difference was due to the higher Fe content in MB peat. The ash contents of two peat mosses were similar.

Particle Size Distribution (Wet Sieving)

The percentage of the MB peat moss particles, passing 1 mm size sieve was lower than AB peat moss, indicating that peat moss from the upper, less decomposed layers of the MB bog contained larger particles than peat harvested from lower, more decomposed layers of a bog in AB (Fig. 1)

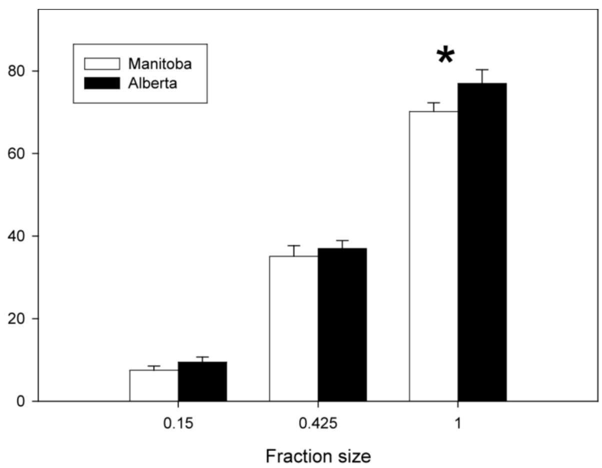

Figure 1. Percent of particles of Manitoba and Alberta fine grade peat moss passing each sieve size. Error bars represent standard error of the mean (n=9). Means for peat moss particle size with * are significantly different at $p < 0.05$.

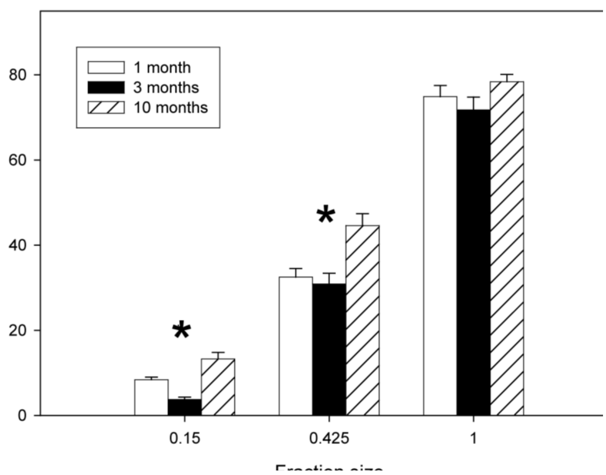

Figure 2. Percent of particles of Manitoba fine grade and Alberta fine grade peat moss passing each sieve at 1, 3, and 10 months of storage time. Error bars represent standard error of the mean (n=9). Means for storage time with * are significantly different at $p < 0.05$.

Among the 3 storage times studied, 10 months of storage resulted in the highest amount of the particles passing 0.15 and 0.425 mm sieve sizes, while the smallest amount of the particles passing these two sieve sizes was found at 3 months of storage time (Fig. 2). This shows that the size of peat particles decreased with increasing storage time.

Plant Available Water

The plant available water was calculated as the difference between water content determined at 0.002 and 0.05 MPa. There was no significant difference in plant available water between two sources of peat moss, while storage time increased the amount of plant available water.

Chemical Properties

At all three times of storage, MB peat moss had a significantly lower pH relative to the AB peat moss (Table 1). At 1 month storage time, pH of MB peat moss was significantly lower than pH of peat moss stored for 3 months. In AB peat moss, pH at 3 months storage time was significantly lower than other storage times. MB peat moss had a significantly lower EC relative to the AB peat moss (Table 1). Length of the storage time did not have an effect on EC of both peat moss sources.

At all storage times, MB peat moss had greater level of NH_4-N than AB peat moss (Table 1). Storage time had no effect on the amount of NH_4-N in both peat moss sources. MB peat moss had no NO_3, while AB fine peat moss showed significantly higher level of NO_3 -N. For both sources of peat, storage time had no effect on the amount of NO_3 -N.

Discussion

The total elements data (e.g., greater P, K, and micronutrient contents) indicate that MB peat is less decomposed than AB peat. These data were in agreement with the dominance of larger organic particles in MB peat. The observed dominance of the smaller particle size in AB peat moss could be attributed to the longer excavation period in this bog relative to the MB bog. Longer period of a bog excavation means that harvesting is done from deeper and more decomposed layers. The smaller particle size in stored peat moss could be result of the microbial degradation. In a similar study, Puustjärvi (1983) reported that due to self heating and the decomposition of stockpiled peat the proportion of particles <1 mm was greater than 50%, while the expected proportion of fresh peat particles <1 mm ranged from 20 to 40% (author did not specify the length of storage time).

Lack of difference in plant available water between two sources of peat moss contradicts the result of the experiment done by Puustjärvi (1983), which reported that peat moss with smaller particle size could have a greater water holding capacity. On the other hand, increase in plant available water in AB peat moss could be attributed to the smaller particle size at 10 months of storage time.

Lower pH in MB peat moss relative to AB peat moss was due to higher total Al and Fe contents in MB peat moss. Williams and Wheatley (1988) reported that the pH in blanket peat bogs increased with depth. Our data suggested the same trend, since pH values were greater in AB peat moss, which has been harvested from deeper, more decomposed layers. Higher salinity, indicated by higher EC values, of the AB peat moss is most likely caused by alkaline parent material on this site and the fact that peat moss was excavated from deeper layers that were in relative proximity of this parent material.

Lower level of NH_4-N observed in AB peat moss might be due to the greater depth of excavation in this bog. Attenuation of aeration with depth and lower amounts of other nutrients such as P and K (Table 1) in AB peat could have inhibited the microbial activity leading to lower amounts of NH_4-N. Williams and Wheatley (1988) also reported that the amount of NH_4-N decreased with depth in oligotrophic peat. The absence of NO_3-N in MB peat was most likely related to its lower pH and consequently absence of ammonium-oxidizing (nitrifying) bacteria.

Table 1. Chemical properties of Alberta and Manitoba fine grade peat moss at 1, 3, and 10 months of storage time (standard error of the mean in the brackets, n=9). F-values following * are significantly different at p<0.05.

Bog	Storage time (months)	pH	EC (Sm^{-1})	NH_4	NO_3
				-----------(mg kg^{-1})-----------	
Manitoba	1	4.2(0.09)	0.006(0.001)	220(20.0)	0
	3	4.4(0.06)	0.007(0.001)	230(20.0)	0
	10	4.4(0.05)	0.006(0.001)	200(20.0)	0
Alberta	1	4.9(0.05)	0.038(0.003)	30(10.0)	30(10.0)
	3	4.8(0.03)	0.041(0.003)	40(10.0)	40(10.0)
	10	4.9(0.03)	0.039(0.003)	70(30.0)	40(10.0)
Source of variation	*df*	*F-value*			
Bog type (B)	1	386.13*	989.21*	127.25*	194.99*
Storage (S)	2	1.48	2.19	0.24	1.19
B _ S	2	15.56*	0.37	1.54	1.75

Similar observations were made by Williams and Wheatley (1988) who reported trace amounts of NO_3-N in freshly collected samples of peat moss from an oligotrophic deep blanket bog in Scotland. Results of this study show that in case of a concern about particle size the growing media industry should store peat moss for less than 10 months.

References

BCMAFF. (1999). On-site testing of growing media and irrigation water. [Online]. Available at http://www.agf.gov.bc.ca/ornamentals/floriculture/testing.pdf. [31 May 2007].

Dinel, H. and Levesque, M. (1976). Une technique simple pour l'analyse granulometriquede la tourbe en milieu aqueux. *Canadian Journal of Soil Science* **56**, 119-120.

Hood, G. (1999). Canadian peat harvesting and its effect on the environment. In A. P. Papadopoulos (ed.), *Growing media and Hydroponics. Proceedings of the International Peat Symposium, Windsor, Ontario, Canada, 19-26 May 1997,* pp. 597-601. International Peat Society.

Karam, A. (1981). Chemical properties of organic soils. In M.R. Carter (ed.) *Soil Sampling and Methods of Analysis.* pp. 459-471. Canadian Soil Science Society.

Keeney, D.R. and Nelson, D.W. (1982). In M.R. Carter (ed.) *Soil Sampling and Methods of Analysis. Part 2,* pp. 643-698. Soil Science Society of America.

Klute, A. (1986). Water retention. In M.R. Carter (ed.) *Soil Sampling and Methods of Analysis. Part 1*, pp. 635 – 662. Soil Science Society America.

Noble, R., Doborvin-Pennington, A. Evered, C.E. and Mead, A. (1999). Properties of peat-based casing soils and their influence on water relations and growth of mushroom*(Agaricus bisporus). Plant and Soil* **207**, 1-13.

Puustjärvi, V. (1983). Effect of self-heating in stockpiles on the structure of horticultural peat. *Peat and plant yearbook* 57-63. Association of Finish Peat Industries.

Smoley, C.K. (1992). *Methods for the determination of metals in environmental samples. Environmental monitoring systems laboratory,* 24 pp. U.S. Environmental Protection Agency. Cincinnati, Ohio, USA, Office of Research and Development.

Visscher, H.R. (1975). Structure of mushroom casing soil and its influence on yield and microflora. *Journal of Agricultural Science* **23**, 36-47.

Williams, B.L. and Wheatley, R.E. (1988). Nitrogen mineralization and water table height in oligotrophic deep peat. *Biology and Fertility of Soils.* **6,** 141-147.