World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:11, No:03, 2017

Comparison of Several Peat Qualities as Amendment to Improve Afforestation of Mine Wastes

Authors : Marie Guittonny-LarchevêQue

Abstract : In boreal Canada, industrial activities such as forestry, peat extraction and metal mines often occur nearby. At closure, mine waste storage facilities have to be reclaimed. On tailings storage facilities, tree plantations can achieve rapid restoration of forested landscapes. However, trees poorly grow in mine tailings and organic amendments like peat are required to improve tailings' structure and nutrients. Canada is a well-known producer of horticultural quality peat, but some lower quality peats coming from areas adjacent to the reclaimed mines could allow successful revegetation. In particular, hemic peat coming from the bottom of peat-bogs is more decomposed than fibric peat and is less valued for horticulture. Moreover, forest peat is sometimes excavated and piled by the forest industry after cuttings to stimulate tree regeneration on the exposed mineral soil. The objective of this project was to compare the ability of peats of differing quality and origin to improve tailings structure, nutrients and tree development. A greenhouse experiment was conducted along one growing season in 2016 with a complete randomized block design combining 8 repetitions (blocks) x 2 tree species (Populus tremuloides and Pinus banksiana) x 6 substrates (tailings, commercial horticultural peat, and mixtures of tailings with commercial peat, forest peat, local fibric peat, or local hemic peat) x 2 fertilization levels (with or without mineral fertilization). The used tailings came from a gold mine and were low in sulfur and trace metals. The commercial peat had a slightly acidic pH (around 6) while other peats had a clearly acidic pH (around 3). However, mixing peat with slightly alkaline tailings resulted in a pH close to 7 whatever the tested peats. The macroporosity of mixtures was intermediate between the low values of tailings (4%) and the high values of commercial peat alone (34%). Seedling survival was lower on tailings for poplar compared to all other treatments, with or without fertilization. Survival and growth were similar among all treatments for pine. Fertilization had no impact on the maximal height and diameter of poplar seedlings but changed the relative performance of the substrates. When not fertilized, poplar seedlings grown in commercial peat were the highest and largest, and the smallest and slenderest in tailings, with intermediate values in mixtures. When fertilized, poplar seedlings grown in commercial peat were smaller and slender compared to all other substrates. However for this species, foliar, shoot, and root biomass production was the greatest in commercial peat and the lowest in tailings compared to all mixtures, whether fertilized or not. The mixture with local fibric peat provided the seedlings with the lowest foliar N concentrations compared to all other substrates whatever the species or the fertilization treatment. At the short-term, the performance of all the tested peats were close when mixed to tailings, showing that peats of lower quality could be valorized instead of using horticultural peat. These results demonstrate that intersectorial synergies in accordance with the principles of circular economy may be developed in boreal Canada between local industries around the reclamation of mine waste dumps.

Keywords : boreal trees, mine spoil, mine revegetation, intersectorial synergies
Conference Title : ICWMRE 2017 : International Conference on Waste Management, Recycling and Environment
Conference Location : Rome, Italy
Conference Dates : March 05-06, 2017