



The Use of Short Rotation Woody Crops as a Waste Treatment Alternative

Martin Blank¹ and Richard Krygier Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Centre
¹Martin.Blank@NRCan-RNCan.gc.ca

Background

- More stringent wastewater treatment standards are being implemented
- Many of the >3500 treatment facilities in Canada are in need of repair and upgrading with a cost of \$13 billion of 30 years (CCME 2009)
- High cost of upgrading traditional waste treatment systems to meet new standards places strain on small rural communities
- Poplars and willows have high growth rates that lend to high water and nutrient utilization
- Biomass can be used in multiple end uses from relatively low to high value bio-products

Objective 1.0

Determine the implications of applying treated municipal wastewater and biosolids on biomass production and the environment

Results

- Monitored soil parameters similar in both irrigated and non-irrigated treatments
- Biomass production increased with introduction of irrigation
- low threat to groundwater from solute loading (Gainer 2012)

Table 2. Comparison of soil parameters over time from a SRWC plantation irrigated with treated municipal wastewater in Whitecourt, AB

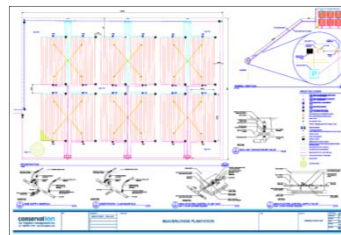
Year	Irrigated						Non-Irrigated					
	NO3-N (µg/g)	NH4-N (µg/g)	Avail P (µg/g)	pH	EC (mS/cm)	SAR	NO3-N (µg/g)	NH4-N (µg/g)	Avail P (µg/g)	pH	EC (mS/cm)	SAR
2006	26.2	3.27	12.68	6.74	0.21	0.202	20.2	1.59	20.87	6.63	0.17	0.201
2009	2.69	7.07	28.07	6.75	0.20	1.90	3.63	7.37	41.28	6.55	0.22	1.83
2011	112.4	ND	.	6.22	0.12	0.18	42.3	ND	.	6.86	0.09	0.25

Table 3. Biomass production (ODT/ha/yr) of three willow clones at year of harvest at in Whitecourt, AB

Year	SV01		SX61		SX64	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated	Irrigated	Non-irrigated
2009 (1 st harvest)	3.78	3.94	4.35	3.24	4.38	3.9
2010	6.58	5.28	5.87	3.51	4.52	3.27
2011 (2 nd harvest)	5.20	5.16	5.25	4.43	5.91	4.34
2012	6.93	7.50	7.03	6.72	8.14	7.04

Table 1. Description of network sites in Alberta

Location	Plantation type	Natural Region	Soil Type	Subsoil texture
Whitecourt	willow	Central Boreal Mixedwood	Gleyed Dark Gray Chernozem	Clay
Beaverlodge	willow	Dry Boreal Mixedwood	Black Solod	Clay-Clay Loam
Clairmont	hybrid poplar	Peace River Parkland	Black Solod	Clay Loam
Ohaton	willow	Central Parkland	Black Solodized Solonetz	Clay Loam
Edmonton	willow and poplar	Central Parkland	Eluviated Black Chernozem	Clay



Objective 2.0

Identify and demonstrate multiple benefit potential of the system, furthering higher value uses and environmental/social benefits of biomass end products

Discussion

- Rural communities and forest industry looking for ways to diversify and lower operating costs
- Treatment of wastes and production of a dedicated fibre supply close to the community and conversion facilities provides many opportunities (win-wins):
 - New fibre source for industries- traditional and new (bioenergy, bioproducts – eg. biochar)
 - Energy source for communities (wood heating of facilities)
 - New income source for communities, public and industry (sale of wood fibre, new products)
 - New employment or business opportunities (planting, management, harvesting, spreading, products, conversion)
 - Known areas for waste disposal/land spreading- reduces uncertainty
 - Reduced costs of transportation and incorporation (to dedicated plantations)
 - No need for expansion of treatment facilities (plantations use wastes)
- Environmental impacts and public perception
 - Crop better suited for waste treatment than agriculture species (nutrient, water and contaminants treatment)
 - Crop does not enter the food chain
 - Waste becomes a resource while producing a renewable feedstock
- Simple scenario
 - Community with 200 residents uses 100m³ of water per day has treatment lagoons that address BOD concerns but must upgrade to also address NH3 in its effluent
 - Addition of an aeration system (\$480,000 capital, \$37,000 O&M) – CCME 2006
 - SRWC plantation of approx. 7 ha (total cost \$221,000) - Hurdle 2012

Current activities demonstrating additional/multiple benefits

- Combustion heat for office/shop facilities Camrose County
- Enabler in composting process – City of Edmonton, Edmonton Waste Management Centre of Excellence
- Feedstock for production of biochar – Alberta Biochar Initiative and Alberta Innovated Technology Futures
- Development of a systems dynamics model for SRWC plantation – Nguyen 2014, University of Alberta

Traditional Waste Treatment Meets An Alternative Waste Treatment Process



References

Gainer, A. (2012). Quantification of deep drainage flux and drainage water quality characterization below the root zone of a short rotation coppice of willow and poplar receiving municipal treated wastewater irrigation in the lower foothills natural subregion of Alberta. MSc Thesis, Soil Science, Department of Renewable Resources, University of Alberta.
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 Hurdle, P. (2012) Decision support tool. Canadian Wood Fibre Centre, Canadian Forest Service, Edmonton.
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