Session 4.4 Resource efficient bioeconomy and social opportunities

Reed canarygrass (*Phalaris arundinacea*) for local, sustainable energy crop production on non-agricultural marginal lands.

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Reusing vacant or derelict, non-agricultural land for energy crops could deliver renewable energy that is secure, local and ethically acceptable, since brownfield sites, former landfills and other similar categories of peri-urban marginal land are potentially contaminated and manifestly unsuitable for food production. A range of societal benefits can be expected from this sustainable approach, including aesthetic improvement and enhanced ecosystem service delivery. For this activity to be both economically viable and environmentally benign, biomass productivity must be adequate, fuel quality sufficient and fuel contamination low enough to allow combustion without further environmental dispersion. Results are presented from 5 year extended monitoring of field scale trials of reed canarygrass first established on sites in NE England as part of the EU Life BioReGen Project (Biomass, Remediation, re-Generation: Reusing brownfield sites for renewable energy, LIFE05 ENV/UK/125). The results indicate annual yields of 4-7 odt.ha^{-1} are achievable on previously developed land from the second growth season, equivalent to 97GJ.ha^{-1} at contamination levels acceptable for domestic pellets.[1]

The purpose of the work was to explore the viability of biomass production on a range of derelict, underutilised and neglected land types, which are found across Europe in urban, peri-urban or post-industrial areas. If these non-agricultural land banks can deliver renewable energy services without displacing land from food production this would avoid the social and environmental conflicts of bioenergy production and landuse change, the so called food-fuel-water nexus.

The approach was through field scale trials in which SRC willow, Miscanthus, reed canarygrass (RCG) and switchgrass were each planted in 2007. The sites were amended with c. 500 t.ha^{-1} of green waste compost. They were monitored for relative biomass production using a combination of hand and mechanical harvesting, as appropriate to the species and its cropping regime. The data discussed here for RCG were based on a combination of random quadrat sampling and mechanised agricultural harvesting. Biomass samples were then analysed for a range of parameters relevant to its combustion, including calorific values, non-metals, potential contaminants, ash compositions and ash fusion temperatures.

While many authors have suggested using marginal lands for bioenergy production, relatively few studies have confirmed the effectiveness of this approach in terms of the actual biomass yield that is achievable with actual field trials. Furthermore, non-agricultural land, such as previously developed brownfield sites or landfills, could be contaminated, resulting in contaminant uptake, risking further dispersion to the environment on combustion.

Our results show that yields on non-agricultural lands are affected by physical ground conditions, giving a different productivity ranking to that observed on agricultural land. RCG showed consistently higher yields across all sites. It offers low cost, rapid establishment from seed, followed by successive annual harvesting at low water contents, together with the carbon and environmental benefits associated with cropping perennial grasses. It also appears to exhibit phyto-exclusion, rather than the phyto-extraction seen in SRC willow or Miscanthus, so can produce suitably "clean" biomass meeting current pellet standards (BS EN ISO 17225-6) from a "dirty" site.

[1] Lord (2015). Biomass & Bioenergy 78, 110-25.