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A constructed wetland to recycling sewage onsite as an engineered ecosystem for a sustainable biomass crop production of commodities

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Primary feedstock for alternative energy production (biomass conversion) is coming from commodities such as corn, soybean, sunflower, and sugarcane; which are main sources of food for humans and animals. Chemical fertilizers used to improve cultivated crops have three main macronutrients: nitrogen, phosphorus and potassium. They are the limiting factor to plant growth because of their relative scarcity and irreplaceable value. Septic tank effluents ("sewage") can be chemically considered one of the richest and most productive waters. Sewage is rich in nitrogen (5-7%) and phosphorus (3-5%), and in constructed wetlands; which are considered a viable green alternative to remove conventional and emergent contaminants from sewage, could be reclaimed as fertilizers. The feasibility of growing cultivated crop commodities (corn, soybean, sunflower) on top of a recirculating vertical flow constructed wetland (RVFCW) treating sewage on-site is reported. The RVFCW released an effluent up to 99% free of fecal coliform bacteria. Also, the treatment efficiencies (mean removal for the three cultivated crops) were high for biochemical oxygen demand (98%), total suspended solids (95%), ammonium-nitrogen (96%), total Kjeldahl nitrogen (95%), total nitrogen (81%), and total phosphorus (76%). The crop efficiency to remove potassium fluctuated from a relatively low for sunflower (38%), intermediate for corn (49%) to a high value of 77% for soybean. The crop yield of sunflower seeds was not calculated, but all the plants reached maturity and produced sunflower heads. The fresh dried weight of soybean (only beans) and corn (only kernel) was equivalent to 2,625 and 10,026 kg/ha, respectively. Production data and the good quality of the final effluent confirm that a RVFCW is a sustainable alternative technology to removing pollutants from wastewater. Also, the recycling of sewage effluent as a source of fertilizers (nutrients recovery), and water reclamation to grow first-generation of biofuel commodities is technically feasible. An economic impact study was not included.

Biography

García-Pérez has been working with the LaGrange County Health Department-Indiana for the last 18 years as the administrator and also as the environmental health specialist in charge of the onsite wastewater program focusing on constructed wetlands technology. His approach has been concentrated to offer a green alternative to conventional septic systems to treat wastewater onsite as a green mechanism to protect groundwater drinking supplies from sewage contamination. He has tried different pathways to improve the appealing of constructed wetlands as garden systems and also as a mechanism to recycling nutrients to grow commodities. He developed an educational webpage providing a lot of information regarding constructed wetlands to treat sewage onsite. He has also been involved in aquaculture, water quality research, and environmental projects in Colombia, Puerto Rico and USA.

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