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Achieving Sustainable Agriculture with Treated Municipal Wastewater

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Abstract : Fresh water is a scarce resource which is essential for humans and ecosystems, but its distribution is uneven. Agricultural production accounts for 70% of all surface water supplies. It is projected that against the expansion in the area equipped for irrigation by 0.6% per year, the global potential irrigation water demand would rise by 9.5% during 2021-25. This would, on one hand, have to compete against the sharply rising urban water demand. On the other, it would also have to face the fear of climate change, as temperatures rise and crop yields could drop from 10-30% in many large areas. The huge demand for irrigation combined with fresh water scarcity encourages to explore the reuse of wastewater as a resource. However, the use of such wastewater is often linked to the safety issues when used non judiciously or with poor safeguards while irrigating food crops. Paddy is one of the major crops globally and amongst the most important in South Asia and Africa. In many parts of the world, use of municipal wastewater has been promoted as a viable option in this regard. In developing and fast growing countries like India, regularly increasing wastewater generation rates may allow this option to be considered quite seriously. In view of this, a pilot field study was conducted at the Jagjeetpur Municipal Sewage treatment plant situated in the Haridwar town of Uttarakhand state, India. The objectives of the present study were to study the effect of treated wastewater on the production of various paddy varieties (Sharbati, PR-114, PB-1, Menaka, PB1121 and PB 1509) and emission of GHG gases (CO2, CH4 and N2O) as compared to the same varieties grown in the control plots irrigated with fresh water. Of late, the concept of water footprint assessment has emerged, which explains enumeration of various types of water footprints of an agricultural entity from its production to processing stages. Paddy, the most water demanding staple crop of Uttarakhand state, displayed a high green water footprint value of 2966.538 m3/ton. Most of the wastewater irrigated varieties displayed upto 6% increase in production, except Menaka and PB-1121, which showed a reduction in production (6% and 3% respectively), due to pest and insect infestation. The treated wastewater was observed to be rich in Nitrogen (55.94 mg/ml Nitrate), Phosphorus (54.24 mg/ml) and Potassium (9.78 mg/ml), thus rejuvenating the soil quality and not requiring any external nutritional supplements. Percentage increase of GHG gases on irrigation with treated municipal waste water as compared to control plots was observed as 0.4% - 8.6% (CH4), 1.1% - 9.2% (CO2), and 0.07% - 5.8% (N2O). The variety, Sharbati, displayed maximum production (5.5 ton/ha) and emerged as the most resistant variety against pests and insects. The emission values of CH4 ,CO2 and N2O were 729.31 mg/m2/d, 322.10 mg/m2/d and 400.21 mg/m2/d in water stagnant condition. This study highlighted a successful possibility of reuse of wastewater for non-potable purposes offering the potential for exploiting this resource that can replace or reduce existing use of fresh water sources in agricultural sector.

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