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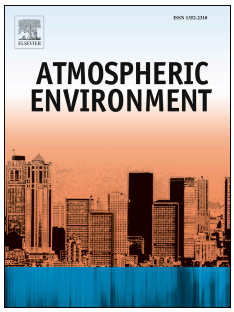

Net global warming potential and greenhouse gas intensity of conventional and conservation agriculture system in rainfed semi arid tropics of India

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Net global warming potential and greenhouse gas intensity of conventional and conservation agriculture system in rainfed semi arid tropics of India

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Abstract

Agriculture has been considered as one of the contributor to greenhouse gas (GHG) emissions and continues to increase with increase in crop production. Hence development of sustainable agro techniques with maximum crop production, and low global warming potential is need of the hour. To assess the mitigation potential of an agricultural activity, quantifying net global warming potential (NGWP) and greenhouse gas intensity (GHGI) of the activity is a way. But there is dearth of information on NGWP of conservation agriculture under rainfed conditions. Hence in this study two methods such as crop based ($NGWP_{crop}$) and soil based ($NGWP_{soil}$) were estimated from the data of the experiment initiated in 2009 in rainfed semiarid regions of Hyderabad, India with different tillage practices like conventional tillage (CT), reduced tillage (RT), zero tillage (ZT) and residue retention levels by harvesting at different heights which includes 0, 10 and 30 cm anchored residue in pigeonpea-castor systems. The results of the study revealed that under rainfed conditions CT recorded 24 % higher yields over ZT but CT and RT were on par with each other. However, the yield gap between the tillage treatments is narrowing down over 5 years of study. ZT and RT recorded 26 and 11 % lower indirect GHG emissions (emissions from farm operations and input use) over CT, respectively. The percent contribution of CO_2 eq. N_2O emission is higher to total GHG emissions in both the crops. Both $NGWP_{crop}$, $NGWP_{soil}$, $GHGI_{crop}$, and $GHGI_{soil}$ based were influenced by tillage and residue treatments. Further, castor grown on pigeonpea residue recorded 20% higher GHG emissions over pigeonpea grown on castor residues. The fuel consumption in ZT was reduced by 58 % and 81% as compared to CT in pigeonpea and castor, respectively. Lower NGWP and GHGI based on crop and soil was observed with increase in crop residues and decrease in tillage intensity in both the crops. The results of the study indicate that, there is scope to reduce the NGWP emissions by reducing one tillage operation as in RT and increase in crop residue by harvesting at 10 and 30 cm height with minimal impact on the crop yields. However, the trade-off between higher yield and soil health versus GHG emissions should be considered while promoting conservation agriculture. The $NGWP_{crop}$ estimation method indicated considerable benefits of residues to the soil and higher potential of GHG mitigation than by the $NGWP_{soil}$ method and may overestimate the potential of GHG mitigation in agriculture system.