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## **Achieving low greenhouse gas emissions in a non-flooded rice system by using hybrid cultivars and UAS fertilization.**

Arlene Adviento-Borbe<sup>1</sup>, Sandhya Karki<sup>2</sup>, Joseph Massey<sup>1</sup>, Tim Williamson<sup>3</sup>, Neil Mayberry<sup>4</sup>

*1 USDA-ARS, Jonesboro, USA. 2 University of Arkansas-Fayetteville, Fayetteville, USA. 3 RiceTec, Inc, Alvin, USA. 4 YARA NORTH AMERICA, Tampa, USA*

Globally, rice paddies are a major source of anthropogenic methane (CH<sub>4</sub>) emissions. Not flooding rice has been shown to reduce CH<sub>4</sub> emissions but can increase N<sub>2</sub>O emissions and cause yield losses if both water and fertilizer N are not appropriately managed. Additionally, several studies have shown that rice hybrids reduce CH<sub>4</sub> while sustaining high grain yields. This study was conducted in two separate field trials in Northeast Arkansas (USA) to assess the potential to use rice hybrids and careful irrigation and fertilizer N management to reduce greenhouse gas (GHG) emissions and yield losses in furrow irrigated systems. For Field 1, main plots were irrigation practice (continuously flooded; CF vs furrow irrigation; RR) and sub-plots were four cultivar treatments (Inbred: CLL15; hybrids: RT7521FP, RT7321FPC, RT7321FPY) fertilized with urea. For Field 2, main plot was two Fertilizer N treatments (Urea vs UAS) with hybrid RT7421FP under furrow irrigation. Both fields received 168 kg N ha<sup>-1</sup> with two split applications. For both field trials (Fields 1 and 2), grain yields ranged from 8.32 to 13.5 Mg ha<sup>-1</sup>. No yield differences ( $P = 0.196-0.989$ ) among rice cultivars, irrigation or fertilizer N treatments were observed. Relative to CF, RR reduced seasonal CH<sub>4</sub> emissions by about (a) 86% when hybrids vs CLL15 were grown and (b) 50% when UAS fertilizer rather than UREA was used. However, N<sub>2</sub>O emissions increased by ca. 21% for RR relative to CF (Field 1). In both trials, total seasonal global warming potentials (GWP) were driven by CH<sub>4</sub> emissions rather than N<sub>2</sub>O emissions and ranged from 410 to 3,732 CO<sub>2</sub>eq emission ha<sup>-1</sup> season<sup>-1</sup>. Overall, GWP values decreased by ca. 77% when hybrids were grown using RR as compared to CLL15. GWP decreased by ca. 27% when UAS rather than urea was used. Moreover, yield -scaled GWP (GWPY) decreased by 33-83% when RR was used in combination with UAS or one of the three hybrids. These findings demonstrate that by growing a suitable rice hybrid in conjunction with UAS fertilization, potential exists to generate significantly lower GWP while sustaining high grain yields in a furrow irrigated rice system.