RIPE
Rural Investment to Protect our Environment

## Methodology and Sources for Dry-Seeded Rice

Specific to California and regions south of I-10, as required by California Air Resources Board

| Ecosystem Service | $/Acre/Year | Citation |
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| GHG Mitigation (at $51/tonne CO2e) | $56 | Low-end value:<br>A 2020 report by the Environmental Defense Fund finds that replacing wet seeding with dry seeding, as approved by the California Air Resources Board, would reduce greenhouse gas emissions by 260,800 tCO2eq per year in the Sacramento Valley. NRCS demonstrates that 500,000 acres of rice are grown in this region. Therefore, dry seeding provides a GHG mitigation value of .47 tonnes CO2eq per acre. Multiplying this value by $51 per tonne CO2e equals $24 per acre.<br><br>Sources:<br>- Jeremy Proville, et al. "Agricultural Offset Potential in the United States." EDF. April 2020. 1<br>- "Creating and Quantifying Carbon Credits from Voluntary Practices on Rice Farms in the Sacramento Valley: Accounting for Multiple Benefits for Producers and the Environment." NRCS. 2010.<br><br>High-end value:<br>Methane:<br>● A 2015 study found that in California trials, dry-seeded rice reduced emissions by 149kg methane per ha compared to wet-seeded rice, or 1.5 tonnes of CO2e per acre. Multiplied by $51 per ton, this equals $77 per acre.<br><br>Source: Maegan B. Simmonds, et al. "Modeling Methane and Nitrous Oxide Emissions from Direct-Seeded Rice Systems." 2015.<br><br>Nitrous Oxide:<br>● According to the Arkansas Rice Production Handbook, wet-seeded rice requires 25% more nitrogen fertilizer than dry-seeded rice. The handbook provides guidance |

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| | | for N application for dry-seeded rice at an average rate of 135 pounds N per acre or 61.23 kg N per acre. A 25% increase would thus equal 15kg N per acre. Keeler et al. (2016) find the social cost of N fertilizer to be at least $.5 per kg in each county of Minnesota due to N2O emissions. They derived this number using a SCC of $38 per metric of CO2e. Therefore, a SCC of $51 per metric of CO2e would convert $0.5 per kg of N to $.67 per kg of N. Multiplying 15kg N per acre by $.67 per kg N = $10 per acre.<br><br>Sources:<br>- Jarrod Hardke and Bob Scott. Water-Seeded Rice, "Arkansas Rice Production Handbook." 2018.<br>-<br>- Trenton Roberts, et al. Soil Fertility, "Arkansas Rice Production Handbook." 2018.<br>- Bonnie L. Keeler, et al. "The Social Costs of Nitrogen." 2016. |
| Water Savings | $9 | Lunquist et al. (2015) found a mean water use reduction of 271.5 fewer cubed meters per acre, or .22 acre-feet, for dry-seeded rice compared to wet-seeded rice in California. NRCS values water savings at $41 per acre-foot in 2022 dollar values. Multiplying the two values equals $9 per acre.<br><br>Sources:<br>- Bruce Linquist, et al. "Water Balances and Evapotranspiration in Water- and Dry-Seeded Systems." 2016.<br>- "Final Benefit-Cost Analysis for the Environmental Quality Incentives Program (EQIP)." NRCS. 2010. |

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| Air Quality (Human Health) | $79 | According to the Arkansas Rice Production Handbook, wet-seeded rice requires 25% more nitrogen fertilizer than dry-seeded rice. The handbook provides guidance for N application for dry-seeded rice at an average rate of 135 pounds N per acre, or 61.23 kg N per acre. A 25% increase would thus equal 15kg N per acre. Keeler et al. (2016) estimate that the human health cost of N fertilizer in equals $4.75 per kg of N fertilizer, or $5.24 per kg N in 2021 dollars. Multiplying 15kg N per acre by $5.24 per kg equals $78.60 per acre.<br><br>Sources:<br>- Jarrod Hardke and Bob Scott. Water-Seeded Rice, "Arkansas Rice Production Handbook." 2018.<br>- Trenton Roberts, et al. Soil Fertility, "Arkansas Rice Production Handbook." 2018.<br>- Bonnie L. Keeler, et al. "The Social Costs of Nitrogen." *Science Advances*. 2016.<br><br>Note: Additional international sources indicate increased nitrogen use efficiency for dry seeded rice compared to transplant-flooded rice (e.g., 6-26% increased NUE according to Liu et al., 2014). |
| **Total** | **$144** | |

**For more information, visit www.RIPEroadmap.org or contact Clara Greider at CGreider@RIPEroadmap.org.**