Rice Cultivation in the Sacramento-San Joaquin Delta

Inclusion in the CDFA Healthy Soils Demonstration Program Type A Projects

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Executive Summary

This report provides a scientific analysis of implementation scenarios of rice cultivation to re-saturate soils in the Sacramento-San Joaquin Delta as a conservation management practice in the Healthy Soils Program. Implementation of this practice is expected to reduce organic matter oxidation from the highly organic soils located within the Sacramento-San Joaquin Delta and reduce greenhouse gas (GHG) emissions. To assess the environmental impact of Rice Cultivation in the Sacramento-San Joaquin Delta (RCSSJD) as a new eligible agricultural management practice for the California Department of Food and Agriculture (CDFA) Healthy Soils Incentives Program, the California Department of Food and Agriculture Office of Environmental Farming and Innovation (CDFA OEFI) and the California Air Resources Board (CARB) performed a literature review and biogeochemical modeling of different crop management scenarios. This evaluation was used to develop suggested guidelines for implementing practices and outline future research steps.

The Denitrification-Decomposition Model (DNDC) was used to model rice cultivation for different management scenarios and estimate GHG emissions and soil carbon storage. Modeling results compared rice cultivation practices to baseline scenarios typical in the Sacramento-San Joaquin Delta region to calculate GHG emissions reductions. The simulation for rice cultivation examined different agronomic practices for residue and water management. Baseline scenarios included the continuous cultivation of corn, alfalfa, or tomatoes which are the most common crops in the Sacramento-San Joaquin Delta by acreage. In addition, CDFA and CARB staff consulted and received feedback from a crop advisor, academics, and farmers in the Delta region during the modeling process.

The GHG emission reductions from the implementation of RCSSJD were variable, with some modeled scenarios showing moderate net emission reductions while other scenarios indicating increased net emissions. The emission reductions were affected by factors such as the initial crop type before transitioning to rice, the water table depth during the off-season, and post-harvest crop residue management. The scenario with the greatest potential for emission reductions was transitioning from corn to rice, removing only 50% of crop residue after harvest, and flooding during the off-season. The scenario with the lowest potential for emission reductions that resulted in increasing net GHG emissions was transitioning from fallow land to rice, removing only 50% of crop residue, and not flooding in the off-season. The DNDC model showed some limitations in simulating RCSSJD in highly organic soils due the complexity in soil processes. Given the challenges in modeling RCSSJD, the variable emission reductions estimates with different management practices, and other implementation challenges for the practice, the practice has been recommended to be included in the Healthy Soils Demonstration Program Type A practice list instead of the Healthy Soils Incentives Program. This recommendation aims to promote research into the most effective management practices for rice cultivation that would lead to significant net emission reductions for potential future inclusion as an eligible practice for the Healthy Soils Incentives Program.

Introduction

New conservation management practices recommended for inclusion in the Healthy Soils Program are submitted by the public during periodically released Calls for New Practice Proposals. The submitted proposals undergo an external review and then the proposed practices, after passing review, are recommended by the Environmental Farming Act Science Advisory Panel (EFA-SAP). For practices to be included in the Healthy Soils Incentives Program and Healthy Soils Demonstration Program Type B Projects, it must be demonstrated that the practice results in quantifiable net GHG emission reductions with implementation standards. Practices which show promise but require further investigation into the efficacy of GHG emission reductions can be introduced through the Healthy Soils Demonstration Program Type A Projects to allow for continued research and development of implementation methodology.

The new conservation management practice, RCSSJD, was submitted during the 2020 HSP Call for New Proposals. This proposal underwent external review and preliminary EFA-SAP approval in 2021 to be included into the Healthy Soils Incentives Program if GHG emission reduction estimates and implementation standards could be developed from the existing literature. This document provides a literature review, a discussion of the GHG emission modeling, suggested practice implementation guidelines and payment rates, and research gaps identified for GHG emission quantification. We conclude that RCSSJD should not be included in the Healthy Soils Incentives Program but instead the Healthy Soils Demonstration Program Type A Projects.

Definition

The preliminary definition for the RCSSJD practice involves the conversion of land within the Sacramento-San Joaquin Delta region that is currently used for annual, non-rice agriculture to rice-only cultivation. Rice cultivation as a potential new practice in the Healthy Soils Demonstration Program Type A Projects is geographically limited to the Sacramento-San Joaquin Delta region to target highly organic soils that have been and continued to be subjected to rapid oxidation and degradation. For this practice, the implementation of residue and water management strategies plays a major role in mitigating GHG emissions. This definition is subject to change based on findings from ongoing research, including those funded by Healthy Soils Demonstration Program Type A Projects.

Problem Statement

The highly organic soils that encompass much of the Sacramento-San Joaquin Delta region were built over millennia by the repeated deposition of organic-rich sediment carried by the Sacramento and San Joaquin rivers and deposited as the two rivers flow into the San Francisco Bay. In the 1800's, networks of levees were built to channelize the flow of water through the Delta region and allow for the draining of the land to isolate islands of highly organic soils ideal for farming (Atwater et al., 1979). The land used for farming enhanced soil organic matter oxidation due to the dryer conditions, land disturbance, and lack of new organic matter inputs, leading to organic matter loss, land subsidence, and carbon dioxide (CO_2) emissions (Deverel and Rojstaczer, 1996). Conversion of land use to rice cultivation would allow for re-flooding of these soils, which would limit rapid oxidation of organic matter that in turn slows organic matter loss and reduces GHG emissions. The proposed land management conversion from annual, non-rice crops to rice cultivation also allows land to continue in agricultural production while addressing key land conservation needs. However, there are still unanswered questions related to the GHG emission reductions, data validation, and practical implementation costs and guidelines.

Modeling Approach

DNDC Model

The DNDC model is a process-based simulation model developed to study carbon and nitrogen biogeochemistry in agroecosystems. It focuses on the processes occurring in terrestrial soils and simulates activities of different functional groups of microbes based on environmental conditions such as temperature, moisture, pH, redox potential (E_h), and substrate concentration. The model includes processes like decomposition, nitrification, denitrification, fermentation, and methanogenesis. Nitrification-induced nitrous oxide (N_2O) production is modeled based on soil ammonium concentration under aerobic conditions, while denitrification-induced N_2O production occurs under anaerobic conditions after soil saturation. The model calculates soil redox potential using the Nernst equation and employs standard Michaelis-Menten kinetics to model the activities of anaerobic microbial groups.

The hypotheses supporting the DNDC simulations of soil GHG emissions are as follows: **a)** Soil GHG emissions, including CO_2, N_2O, and methane (CH_4), result from oxidation-reduction reactions facilitated by microbial-mediated electron exchange between electron donors and acceptors, **b)** The occurrence of electron exchange is determined by the soil E_h, which is described by the Nernst Equation. This thermodynamic equation calculates E_h based on the concentrations of paired oxidative and reductive forms of dominant oxidants in the soil, **c)** Once the suitable E_h is established, bacterial functional groups rapidly grow to their full capacity within a short period (hours or days) due to rapid regeneration, and **d)** After microbial capacity is established, the reaction rate is primarily controlled by the concentrations of relevant substrates, as described by the Michaelis-Menten Equation. DNDC currently monitors microbial activities primarily based on three drivers: E_h, dissolved organic carbon as an electron donor, and oxidants as electron acceptors. Nitrification-induced N_2O production is incorporated into DNDC, considering ammonium (NH_4+) and ammonia (NH_3) levels as key drivers under aerobic conditions. A comprehensive description of the model, including equations and scientific basis, can be found at http://www.dndc.sr.unh.edu/. In addition, the DNDC model has been previously implemented to estimate GHG emission reductions from other Healthy Soil practices including compost application and Whole Orchard Recycling (WOR).

Model Implementation

The DNDC model requires site-specific data on (1) soils (soil organic carbon (SOC), bulk density, pH, and soil texture), (2) daily weather (minimum and maximum temperature and precipitation) and (3) management practices (fertilizer use, planting and harvesting dates, tillage, and irrigation). Thus, the model was implemented using information on weather, crop, soil, and agricultural management practices specific to California.

The site chosen for modeling was the Twitchell Island, located in Sacramento County (38.10875°N, -121.6530°W). Table 1 summarize the site-specific soil properties used in DNDC. This site was chosen due to its extensive documentation and the numerous studies carried out in the past. Also, considering the high variability of organic matter in the Sacramento-San Joaquin Delta, with SOC levels fluctuating between 6% and 52% (Deveral et al., 2016), the SOC content at Twitchell Island is indicative of the average conditions prevalent in the region.

Table 1. Soil properties at the Twitchell Island, Sacramento County.

Depth (cm)	Bulk density (g cm^{-3})	SOC (%)	C:N	pH
0 -30	0.65	15	14.1	6.2
30 -45	0.57	31	15.6	6.2

Baseline Scenarios

Baseline conditions were defined as the common land uses or management practices in the region, which are expected to transition into rice cultivation. Four baseline scenarios were selected and represent the top crops by acreage in the region (Medellín-Azuara et al., 2018). Crops modeled in the baseline crops scenarios included corn (82,392 acres in the region), tomato (29,181 in the region) and alfalfa (77,576 acres in the region). The fallow land use scenario was also included as a likely future scenario due to water scarcity. Crop management practices were determined by consultation with crop advisors and researchers in the Delta.

Crop Management Practices

Corn

Site-specific information for the 2021 corn variety trial in the Delta available at the University of California Cooperative Extension (UCCE) website was used to parameterize the model to standard corn management practices in the Delta (UCCE, 2021). This information was complemented with consultation from a crop advisor. Although corn grown in the Delta is either used for silage or grain depending on market conditions, for modeling purposes silage production was selected. Table 2 and 3 summarize the crop management data and parameters used to model corn production in DNDC. Irrigation management was determined following recommendations from University of California's Agricultural and Natural Resource (UCANR) (https://ucmanagedrought.ucdavis.edu/Agriculture/Crop_Irrigation_Strategies/Corn/).

Alfalfa

Because there was no site-specific information for alfalfa production in the Delta, a general manual for alfalfa production in California was used to parameterize the model (https://anrcatalog.ucanr.edu/Details.aspx?itemNo=3512). This information was complemented with previous modeling work funded by CARB (Haden et al., 2013, Li et al., 2014). Table 2 and 3 summarize the crop management data and parameters used to model alfalfa production in DNDC.

Tomatoes

Because there was no site-specific information for tomato production in the Delta, a general manual for tomato production in California was used to parameterize the model (https://anrcatalog.ucanr.edu/pdf/7228.pdf). Tomato production practices were complemented with verbal communication with a crop advisor in the Delta region. Table 2 and 3 summarize the crop management data and parameters used to model tomato production in DNDC (Verhoeven et al., 2017).

Table 2. Crop management data used in the DNDC model.

Cropping System	**Nitrogen applied (kg/ha)**	**Date**	**Activity**
Corn	80	15-Mar	Cultivator
		20-Apr	Planting
		15-Mar/15-Apr	Fertilization
		1-Oct	Harvest
		15-Oct	Disking
Tomato	162	4-Apr	Cultivator
		1-May	Planting
		12-Apr/ 13-May	Fertilization
		31-Aug	Harvest
		20-Oct	Disking
Alfalfa	17	1-Jan	Planting
		15-May	Fertilization
		4-Apr/ 3-Jun/6-Jul/ 11-Aug/ 15-Sep/ 15-Nov	Harvest
Rice	40	3-Mar	Cultivator
		15-Mar	Planting
		15-Sep	Harvest
		1-Nov	Chisel plow
		3-Nov	Disking

Table 3. Crop and environmental data and parameters used in the DNDC model.

	Corn	**Tomato**	**Alfalfa**	**Rice**
Simulated years	1998-2021	1998-2021	1998-2021	1998-2021
Parameter				
Grain C/N	50	26	11.5	40
Leaf C/N	80	26	12	42
Stem C/N	80	26	12	78
Root C/N	80	45	25	43
Max. biomass C (kg C ha^{-1})	12600	3700	7100	10000
Grain fraction	0.4	0.36	0.01	0.45
Leaf fraction	0.22	0.22	0.4	0.13
Stem fraction	0.22	0.22	0.3	0.33
Root fraction	0.16	0.2	0.29	0.009
Water demand (kg H_2O kg DW^{-1*})	150	900	200	508
Optimum temperature (°C)	30	25	20	27
Thermal time (°C)	2550	1400	5000	3200

* DW: Dry weight.

Management Strategies

A review of the rice crop management scenarios that could mitigate GHG emissions from rice production was conducted. Table 4 summarize results by practice. We found that water management, residue management, and nutrient management are the management strategies that contribute the most to mitigating GHG emissions.

Table 4. Review of rice crop management strategies that mitigate GHG.

Management Strategy	**Practice**	**Outcome**
Water management	Permanent flooding	- There's an inverse relationship between CH_4 and N_2O emissions from rice cultivation. - Techniques for managing water and organic matter that decrease CH_4 emissions may lead to an increase in N_2O emissions.
	Alternate wetting and drying (AWD)[1]	- The global warming potential (GWP) of CH_4 and N_2O emissions was decreased by 45–90%. - The efficiency of water use was enhanced by 18–63%. - As the intensity of AWD increased, allowing the soil to dry more between flooding events,

		yields decreased while other benefits increased. - The reduction in GWP was primarily due to a decrease in CH_4 emissions, as changes in N_2O emissions were minimal among the treatments.
	AWD with nutrient management[2]	- Maintaining a continuous flood resulted in low N_2O emissions regardless of the nitrogen rate. - High N_2O fluxes were observed during specific field drainage periods before harvest, especially at high N rates. - The nitrogen rate did not have a significant impact on CH_4 and N_2O emissions during the fallow period. - The fallow period itself made a substantial contribution to annual emissions, representing 56% of the total N_2O emissions across different nitrogen rates.
Residue management	Straw removal[3]	- Production of CH_4 from the anaerobic decomposition of organic matter from residues left in rice fields.
Nutrient management	Nitrogen fertilizer [5]	- SOC played a significant role in regulating both CH_4 and N_2O emissions. - Nitrogen fertilization led to a 77.2% reduction in annual CH_4 emissions in the field with 6% SOC, but this effect was not observed in other fields with higher SOC. - Nitrogen fertilization did not impact annual N_2O emissions, which averaged 8.9, 5.2, and 1.9 kg N_2O ha^{-1} for the fields with 6%, 11%, and 23% SOC, respectively.

[1]Linquist et al., 2015; [2]Pittelkow et al., 2013; [3]Linquist et al., 2012; [4]Linquist et al., 2006; [5]Ye et al., 2016.

GHG Emission Reductions

For each transitioning crop or baseline, including corn, alfalfa, tomatoes, and fallow land, and under each management scenario, DNDC was run for a continuous span of 24 years. The duration of the model run facilitated the initialization of the model and allowed the carbon stocks to approach a state of new equilibrium. The results were averaged over a 24-year over the simulation period and reported as average annual values. The calculation of soil CO_2 emissions aligned with the USDA's COMET-Planner methodology (Swan et al., 2016) by considering changes in SOC. The estimates for N_2O emissions account for emissions directly arising from fertilizer usage, crop residues, and SOC decomposition. The estimates for CH_4 emissions include emissions resulting from the decomposition of SOC or crop residues in anaerobic conditions. The GHG emissions were expressed as carbon dioxide equivalents (CO_2e) by multiplying the amount of each GHG by its global warming potential. Overall, the GHG emission reductions for each scenario was calculated as the sum of the changes in SOC, N_2O, and CH_4 between the baseline crop and that with rice cultivation.

Table 5 presents the GHG emission reductions for each modeled water and residue management strategy. Positive values indicate a reduction in GHG emissions, while negative values indicate an increase in GHG emissions. Modeling results from implementing the RCSSJD practice indicated:

1. *Residue retention reduces CH_4 emissions*: Across different crops and irrigation methods, retaining rice residue during the rice growing season generally leads to higher CH_4 emissions. This suggests the importance of managing residue to minimize CH_4 release.
2. *No flooding reduces N_2O emissions*: Comparing scenarios with and without flooding irrigation during the rice growing season, it can be observed that no flooding tends to result in lower N_2O emissions. This indicates that alternative irrigation practices may help mitigate N_2O emissions.
3. *Off-season SOC changes were variable*: The impact of different crops and management practices on SOC during the off-season is variable. Some scenarios show significant decreases in SOC, while others show slight increases. The rate of carbon loss from agricultural activities is expected to be higher in soils with a high organic content, such as those found in the Sacramento-San Joaquin Delta region.
4. *Net CO_2e emissions show diverse trends*: The net CO_2e emissions, representing the overall GHG impact, exhibit mixed results across different scenarios. Some scenarios show reductions in net emissions, while others show increases. This underlines the need for site-specific analysis and tailored management strategies to effectively mitigate GHG emissions.

Overall, the modeling findings aligned with findings in available literature on rice crop management strategies and emphasize the importance of considering multiple management practices (residue and water management, transitioning crops, etc.) (Table 4), when aiming to reduce GHG emissions and promote healthy soil practices.

Table 5. The GHG emissions from rice cultivation and baseline scenarios. Positive values indicate GHG emission reductions, while negative values indicate GHG emissions increase.

Baseline	**Rice growing season**	**Off-season**	**SOC**	**CH_4**	**N_2O**	**Net GHG Emissions**
	Residue	**Irrigation**	**MT CO2e/ha/yr**			
Corn						
Rice	Retained	Flooding	3.7	-5.1	3.6	**2.2**
Rice	50% retained	No flooding	2.2	-0.1	-2.0	**0.1**
Rice	50% Retained	Flooding	2.7	-1.3	2.6	**4.0**
Tomato						
Rice	Retained	Flooding	1.4	-5.1	1.3	**-2.4**

Rice	50% retained	No flooding	-0.2	-0.1	2.2	**1.9**
Rice	50% retained	Flooding	0.3	-1.3	1.4	**0.5**
Fallow						
Rice	Retained	Flooding	-10.3	-5.1	2.5	**-12.9**
Rice	50% retained	No flooding	-11.9	-0.1	-3.0	**-15.0**
Rice	50% Retained	Flooding	-11.3	-1.3	1.5	**-11.1**
Alfalfa						
Rice	Retained	Flooding	-7.4	-5.1	4.8	**-7.8**
Rice	50% retained	No flooding	-9.0	-0.1	3.5	**-5.6**
Rice	50% Retained	Flooding	-8.5	-1.3	4.8	**-4.9**

Model limitations for GHG emission reductions estimates

- According to the model, most N_2O fluxes occurred in the off-season (winter). However, no studies that measure GHG fluxes during the fallow season in the Delta were found. Most estimates only emissions during the rice growing season. This makes validation of the model difficult, increasing uncertainty.
- Overall, DNDC showed limitations in modeling rice cultivation in highly organic soils. Also, it was observed that DNDC overestimated GHG emissions during dry-down periods. These limitations are intrinsic to the model development and are beyond the scope of this analysis.

Co-Benefits

Converting land to previously used for non-rice, annual agriculture to rice can increase habitat for migrating waterfowl, including many threatened or endangered species of waterbird (Petrie and Petrik, 2017). Specifically, off-season flooding of the rice fields can bolster habitat within the Pacific Flyway during bird migration season (Strum et al., 2013). Additionally, growers may be eligible for additional funding opportunities from government programs and private organizations designed to promote habitat for migrating waterfowl which could further support their rice cultivation practice. To balance potential GHG emissions from flooding during the off-season for migratory waterfowl, growers can control the amount of rice residues left on the field post-harvest.

Proposed Management Guidelines

Minimum guidelines are provided to structure the implementation of this practice. A list of suggested guidelines for implementation is also provided – these are guidelines that the modeling has indicated that the inclusion of one of more of these practices would enhance GHG emission reductions. Both the minimum guidelines and suggested guidelines are subject to change with additional information provided by ongoing research, including from Healthy Soils Demonstration Program Type A Projects.

Minimum Management Guidelines

A list of minimum management guidelines is outlined below. These minimum guidelines are based on the results from the modeling and data validation which suggest inclusion in practice implementation will best help meet program objectives of sequestering carbon and reducing GHG emissions.

1. In the year prior to practice implementation, the land was managed for non-rice, annual crop agriculture (e.g., corn)
2. The project land is located only within the Sacramento-San Joaquin Delta region (Legal Delta Boundary - 2001- DWR [ds586] GIS Dataset (ca.gov))
3. Conversion of the area to rice production occurs within the grant term
4. Only agricultural use for a project field is for rice production
5. Expected lifetime of practice (rice production) is the grant term

Suggested Management Guidelines

The following practice implementation guidelines are provided as suggestions for grower adoption but not currently considered required. The modeling included in this study indicate inclusion of one or more of these management practices in the implementation would further reduce GHG emissions.

1. Flooding during the rice off-season (winter period) enhanced SOC in the long-term and increase re-saturation - use an off-season flooding minimum depth of 5 cm (1.97 inches)
2. Removing residue showed to have the greatest impact on reducing off-season CH_4 emissions - remove at least 50% of rice straw from the field after harvest.

Payment Rate Discussion

The Healthy Soils Incentives Program provides financial incentives to CA farmers and ranchers to implement conservation management practices. The incentives are provided as flat-rate payments for the successful implementation of the practices. Possible implementation costs and current conservation management practice program rates for related practices are presented to estimate potential payment rates for this practice. For RCSSJD, costs associated with adoption may be focused on the necessary and significant field restructuring, including land levelling and creation of the levees for rice-specific irrigation, required for conversion to rice cultivation (Rice Production Manual, 2018). The Healthy Soils Incentives Program bases payment rates for many eligible practices on rates from the USDA NRCS Environmental Quality Incentives Program (EQIP) for California. While RCSSJD is not currently included as a EQIP practice to tie directly to a payment rate, there are several practices which are included in these programs that may be included in field restructuring, such as dike construction (NRCS CPS 356) and precision land forming and smoothing (NRCS CPS 462).

Table 6 provides a payment rate estimate using the rates from 2022 EQIP and CPS for Dike/Levee Construction and Precision Land Forming and Smoothing for a levelled field, with levees covering 3-5% of the field area (Rice Production Manual, 2018) and 16-20 inches tall (Scott et al., 1961). The range in payment rates for the practice is large – for example, using the estimated total cost per acre for levelling the field and constructing 20-inch-tall levees which cover 5% of the land area is between \$859.48 / acre - \$1,848.46 / acre. Inclusion in Healthy Soils Demonstration Program Type A Projects may help hone the potential payment rates if the practice is to be included into the Healthy Soils Incentives Program in the future. Payment rates in subsequent years can be adjusted with any changes to CPS and EQIP price schedules and additional cost considerations outlined by ongoing research, including results from Demonstration Type A Projects.

Table 6. Estimated cost breakdowns per acre of start-up costs for practice implementation.

Dike/Levee Construction (price per acre) *Taken from 2022 EQIP and 2022 CPS Rate for Dike Construction Scenarios from NRCS CPS 356, Price per Cubic Yard, lowest and highest scenario payment rates	levees are 3 % of field & 16 inches tall	levees are 3 % of field & 20 inches tall	levees are 5 % of field & 16 inches tall	levees are 5 % of field & 20 inches tall	levees are 10% of field & 16 inches tall	levees are 10% of field & 20 inches tall
EQIP - Price per Cubic Yard, low \$3.93 (Class IV A and B, Wetland)	\$253.62	\$317.02	\$422.69	\$528.37	\$845.39	\$1,056.73
EQIP - Price per Cubic Yard, high \$6.46 (Material Haul, > 1 mile)	\$416.89	\$521.11	\$694.81	\$868.51	\$1,389.62	\$1,737.02
CPS - Price per Cubic Yard, low \$6.05 (Class IV A and B, Wetland)	\$390.43	\$488.03	\$650.71	\$813.39	\$1,301.42	\$1,626.78
CPS - Price per Cubic Yard, high \$9.96 (Material Haul, > 1 mile)	\$642.75	\$803.44	\$1,071.25	\$1,339.07	\$2,142.51	\$2,678.13
EQIP - Precision Land Forming and Smoothing (price per acre) *Taken from 2022 EQIP Rate for Precision Land Forming and Smoothing Scenario from NRCS CPS 462, Price per Acre, Minor Shaping scenario payment rate	\$331.11					

CPS - Precision Land Forming and Smoothing (price per acre) *Taken from 2022 CPS Rate for Precision Land Forming and Smoothing Scenario from NRCS CPS 462, Price per Acre, Minor Shaping scenario payment rate	$509.39

Conclusions and Suggested Research Areas to Fill Data Gaps

While the modeling results from this paper indicate that conversion to rice cultivation from some baseline scenarios will reduce GHG emissions, not all modeled scenarios indicated definitive GHG emission reductions. The uncertainty in the modeling may be contributed by the relative lack of in-field measurements to provide data validation. Outlined below are several topics for research that will improve understanding related to this practice implementation and GHG emission quantification.

- Modeling and validation for N_2O and CH_4 emissions
- Trial best management practices in rice production that reduce GHG emissions while promoting farmer adoption of the practice
- Cost analysis for crop conversion

This report indicates that the RCSSJD practice is best suited for the Healthy Soils Demonstration Program Type A Projects as data collection is required to validate reductions of GHG emissions. Further data collection from in-field trials will allow for a testing on the minimum and suggested implementation guidelines to best produce improved model inputs and a set of refined guidelines to be recommended if the practice should be included in the Healthy Soils Incentives Program. Furthermore, Demonstration Type A projects have an optional component of data collection for economic analyses on the production profitability of the practice which, if included in a project's scope of work, would provide additional information for refining the suggested payment rates for this practice. The proposal for inclusion of this practice in Healthy Soils Demonstration Program Type A Projects was discussed and recommended during the EFA-SAP Meeting on December 13, 2022.

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