Participatory prioritization of climate-smart agriculture techniques: Case study of processes and outcomes from the Tra Hat Climate-Smart Village in Vietnam

Working Paper No. 281

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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Titles in this series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

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Abstract

Participatory research allows groups and individuals to reflect and decide on their societal issues together. Such research was employed in Tra Hat Climate-Smart Village (CSV) in Vietnam to see if specific climate-smart agriculture (CSA) techniques could be adopted in the village. In line with the adoptability of CSA techniques, their scaling potential in the nearby areas of Tra Hat CSV was examined as well. Results showed that farmers deemed the CSA techniques related to rice production as priorities, which included laser land levelling, alternate wetting and drying, straw baler and rice root cutter, and Phosphorous fertilizer reduction, among others. Alongside CSA techniques on rice production, multiple crop and livestock practices were prioritized by the farmers due to their economic and environmental benefits. These CSA techniques could then be integrated into the "1M5R" or the "1Must-5Reductions" package, one of the current agricultural extension supports provided by the government. Gendered differences also emerged from the study, showing the preferred CSA techniques of male and female farmers and the factors that influenced them for their decisions. Regardless, they all believed that the CSA techniques they identified as priorities could increase incomes, ensure food security, and protect their environment. Results of this study exhibit the critical role of participation in empowering communities and the scaling potential of specific CSA techniques.

Keywords
participation; empowerment; agricultural extension; gender; research methods.

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Last but not least, we appreciate the collaboration of farmers in Tra Hat CSV and surrounding areas in Bac Lieu, which have been valuable to the study.

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Acronyms

CC & SLR	climate change and sea level rise
CSA	climate-smart agriculture
CSV	Climate-Smart Village
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	Consultative Group on International Agricultural Research
DARD	Department of Agriculture and Rural Development
PPS	Plant Protection Sub-division
OBS	organization baseline study
VBS	village baseline study
HH	household
FGD	focus group discussion
P	Phosphate
N	Nitrogen
LCC	Leaf Color Chart
AWD	Alternate Wetting and Drying
2R	Two Rice Crop
3R	Three Rice Crop
PRG	Participatory Research Group
WS	winter-spring
SA	summer-autumn
AW	autumn-winter
QLPH	Quan Lo-PhungHiep
MRD	Mekong River Delta
1M5R	1 Must-5 Reduction
3R3G	3 Reductions, 3 Gains

Introduction

Participatory research consists of a range of approaches and techniques with the primary objective of shifting the power from the researcher or technical 'expert' to those making decisions and to those who will be affected by these decisions. These are often community members or community-based organizations. In participatory research, these individuals and groups analyze and reflect on the information generated in order to manage conflicts, reach consensus, and make decisions (the process and outcomes are documented as part of the research process). Participatory research involves discussion, but the main goal is to move the discussion to making decisions, planning, and action. The researchers facilitate the process that allows participants (often multiple stakeholders with competing interests) to discuss their problems, conceive possible solutions, and propose actions which could be taken. The research conducted by the Participatory Research Group (PRG) aims to guide the decision-making processes to fair outcomes through providing balance in power structures, often through techniques that give voice to underserved groups (i.e., women, minorities, youth, and impoverished or landless individuals).

The study presented in this paper used a range of participatory research methods, including focus group discussions, multi-stakeholder meetings, participatory inquiry, action research, oral testimonies, and story collection. This multi-method approach provides a foundation for prioritizing and goal-setting which is documented through collective analysis, digital photo stories, drawing and essay writing competitions, participatory video, and immersions.

Prioritization of climate-smart agriculture techniques

A participatory approach was applied to examine the potential for implementing a range of climate-smart agriculture (CSA) techniques[1] in Tra Hat Climate-Smart Village (CSV) and determining the potential to out-scale CSA technologies to the surrounding regions.

The CSA Targeting and Priority Setting Methodological Framework (Ronnie et al. 2015) provides a stepwise procedure of identifying a CSV-specific list of current and anticipated climate changes and risks and possible potential CSA techniques (see Figure 1).

[1] Note: Throughout the report, the term “CSA techniques” will be used to represent “CSA technologies and practices”.

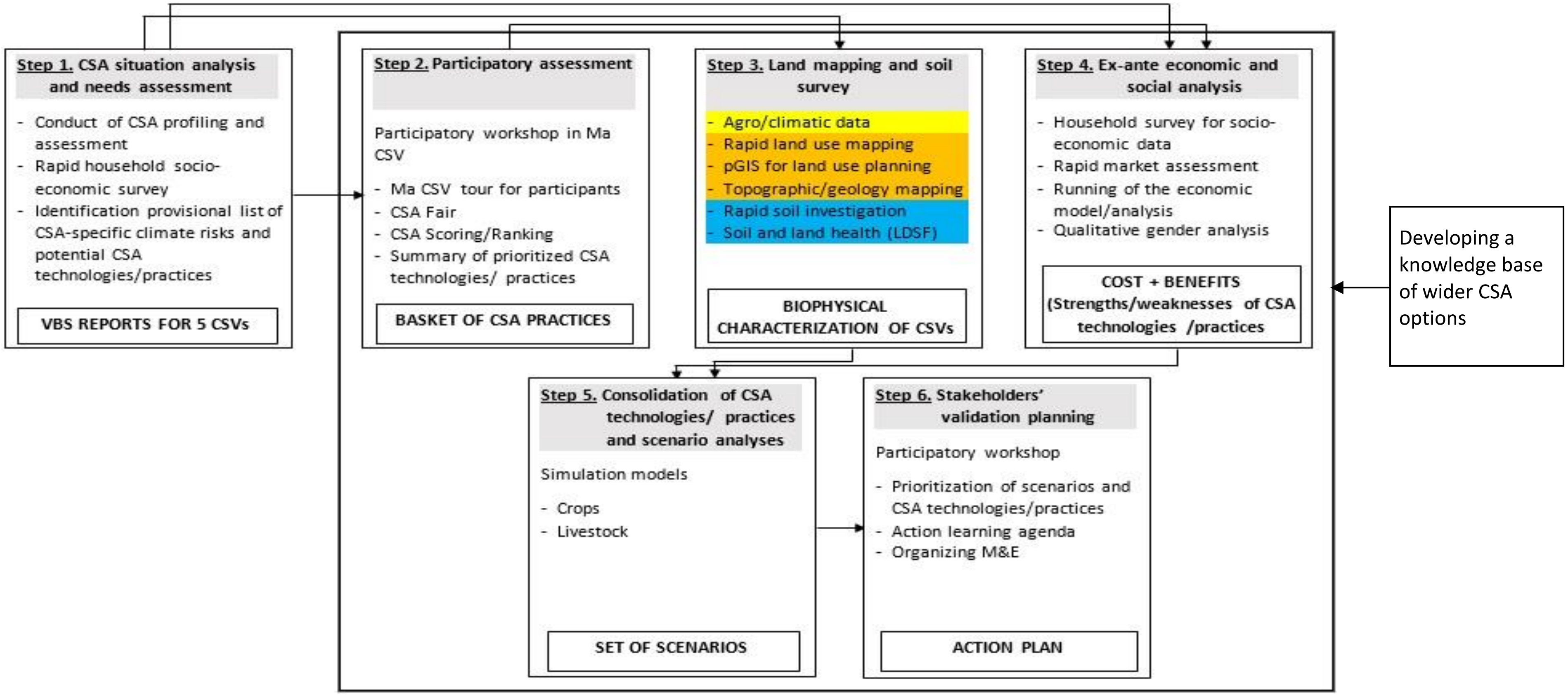

Figure 1. The CSA Targeting and Priority Setting Methodological Framework (Ronnie et al, 2015)

Table 1 summarizes the selected processes that were modified from the six-step priority-setting process (Ronnie et al. 2015) and implemented by the Tra Hat CSV team in Tra Hat CSV.

Table 1. Selected processes for priority setting CSA practices in Tra Hat CSV

Steps of process	Action
Selection of initial basket of promising technologies	Consultation meeting with local authorities at DARD
Preparation of potential CSA practices at Tra Hat with *ex ante* assessment of the initial basket of promising technologies	Supported by DARD on previous results of trials in Bac Lieu
Discussion with farmers on promising technologies	Workshop with technology posters was held at Tra Hat from 22-23 October 2015 with participation by 40 farmers[2].
Interactive technology event	Discussion with farmers in introduction section for CSA practices in the workshop (Question and Answer on CSA)
Scoring and final ranking of promising technologies by farmers	Farmers scored CSA practices.
Selection of one or more promising technologies for testing	Scoring data analysis and report
Review selected prioritized CSA practices	Comparison with results of household survey and KI interview
Validation of CSA practices for out scaling at other regions in Bac Lieu	Consultation meetings with DARD

Out-scaling potential

Scaling out a prioritized CSA practice is more effective if it is included in a package of technologies planned for dissemination by local government. In the Mekong River Delta (MRD), a well-known and effective policy is the dissemination of a rice production package known as '3R3G' (3 Reductions, 3 Gains) implemented in 1990s and then later, '1M5R' (1 Must Do, 5 Reductions) out-scaled in the early 2000s. 1M5R is still the current policy promoted by national extension to improve rice production practices in the MRD. In 1M5R, one “must” is “must use qualified certified seed”. The other five "reductions" are reducing the amount of seed, fertilizer, pesticide, amount of irrigated water during rice production, and reducing loss in postharvest. Examining how the proposed CSA techniques can fit into the current extension dialogue can strengthen the potential for dissemination. An important component of the participatory prioritization process is to operate with a lens on out-scaling given the multitude of stakeholders involved.

[2] See Appendix 1 for program and Appendix 2 for posters

Location and geography

Tra Hat CSV pinpoints at longitude 105.65 - 105.70 and latitude 9.35 - 9.38, administratively in Chau Thoi Commune, Vinh Loi District, Bac Lieu Province. With 306 ha area, it is located at the tail end of Quan Lo faced with lack of fresh water and threat of salinity intrusion during dry season (December to April). Moreover, in the rainy season (from May to November), some low areas of the village are inundated by heavy rain. The situation will be more serious in the future under impacts of climate change and sea level rise (CC&SLR).

The situation of irrigation, drainage and soil fertility is presented in Table 2. It indicates there is a lack of irrigated water in dry season and some flooding areas in rainy season. Currently, three main land-use types are distributed across four areas in Tra Hat CSV: Land unit (LU) 1: Triple-rice crop or double-rice crop; LU 2: Double-rice crop; and LU 3: Upland crop (Figure 2). The map in Figure 2 shows that 80% of Tra Hat is under 2-rice (2R) crop production cycles in summer-autumn (SA) and autumn-winter (AW). Some other areas are 3-rice (3R) crops and a small area is upland crop.

Table 2. Land characteristic on land units in Tra Hat CSV

Land unit	Irrigation	Flood possibility	Soil fertility	Current land use
LU 1	Not enough Irrigated	30 cm	Rich	Triple-rice crop (1a) Double-rice crop (1b)
LU2	Not enough Irrigated	No flood	Medium	Double rice crop
LU3	Enough Irrigated	No flood	Medium	Upland crop

(Source: Nguyen Hieu Trung et al. 2015).

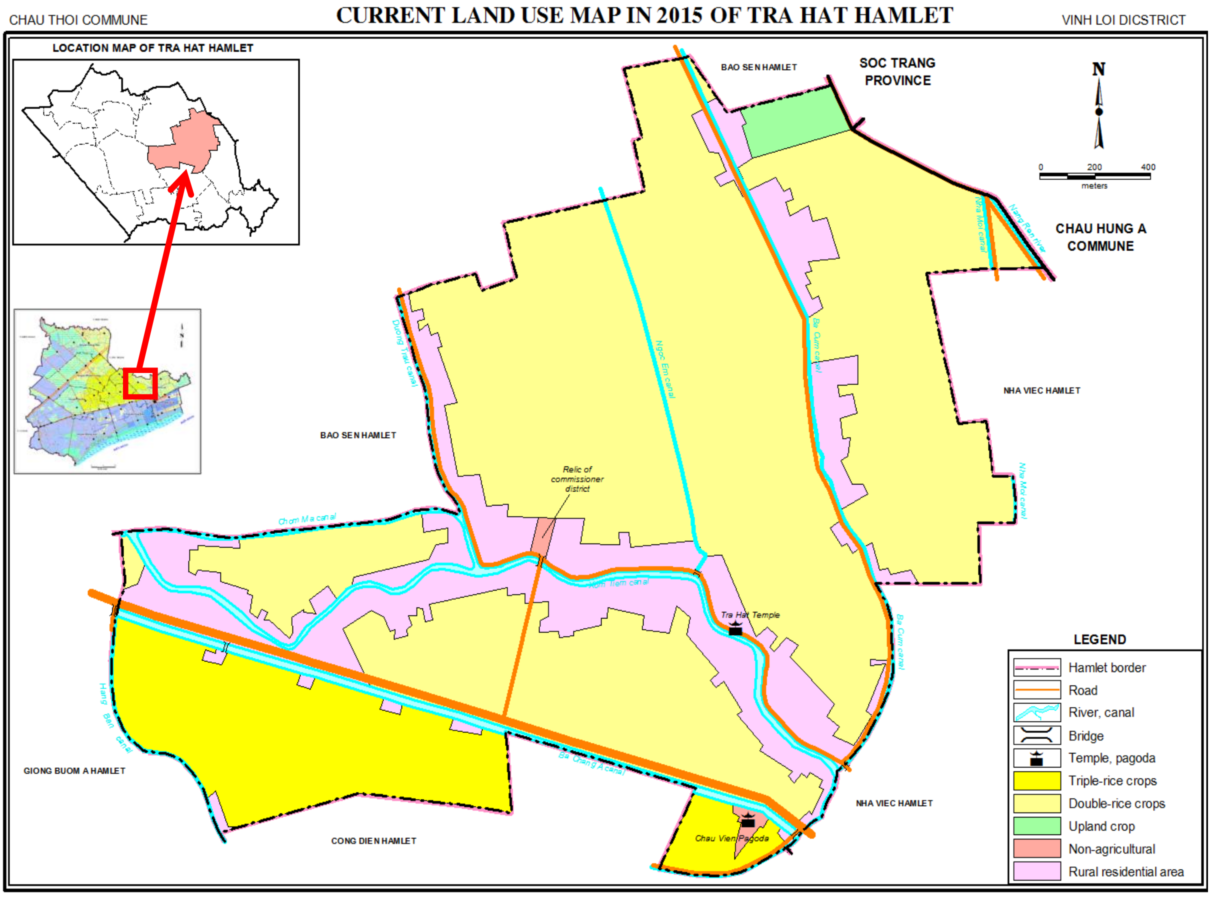

Figure 2. Present land use map of Tra Hat CSV

Cropping calendar per year is presented in Figure 3, where the traditional rice variety "Tai Nguyen" is popular in Tra Hat CSV with stable yield, high quality, and good price. The disadvantage of this rice is long duration (4-5 months depending on weather) and growth is slowed by low photosynthesis over these months. Rice crops grown in other seasons are short duration varieties such as RVT or OM 4900. 3R crops in Tra Hat CSV are similar to those in other surrounding areas in Vinh Loi district.

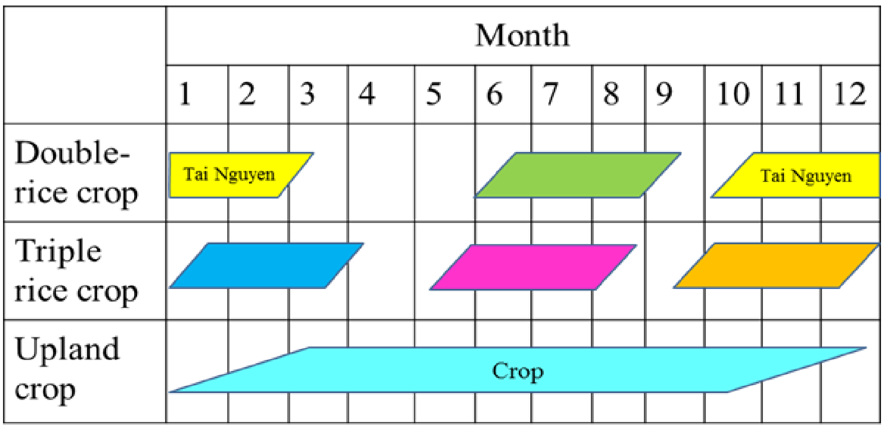

Figure 3. Cropping systems in Vinh Loi, Bac Lieu

Table 3 shows the household level characteristics of the main livelihood and food security sources paired with their constraints to production in Tra Hat CSV. The main problems stem from the lack of quality seeds / stocks, the lack of improved climate-smart agriculture (CSA) techniques, and no/low market access.

Table 3. Constraints for livelihood in rice production and in the households

Characteristics	Problems
• 2 R crops, higher yield • Main income and food	• End tail of QLPH, only enough water for 2 R crops system
• Modern varieties in SA (May-Sept)	• Drought in early stage • More pest and diseases • Prefer more varieties with higher yields
• Traditional variety (Mua - Tai Nguyen) in AW (Oct-Feb)	• Submergence in early stage • Lodging • Less purified seed • More pest and diseases
• Orchards at HH • Main source of household consumption	• Mixed fruit garden (i.e., coconut, mango, etc.) • Does not generate much cash income • Fast conversion to rice land
• Vegetables	• Less than 3% commercial • Difficult to find market
• Piggery - small scale	• Low profit and high market risk • Diseases
• Chicken and duck raising • Main source for food security	• low productivity and profit • market risk • Diseases
• Fish pond- small scale, mixed types of fish	• Low productivity

Source: VBS report (Phong et al. 2014)

Methodology

The study presented herein employed Focus Group Discussions (FGDs) including posters and videos to facilitate the discussion. Twenty female and male farmers were invited to participate in the two-day workshop on Participatory Selection of CSA practices with the IRRI-CCAFS team from 22 to 23 October 2015 in Tra Hat CSV.

In this workshop, the CSV implementation team explained 19 potential CSA practices using posters, presentations, and videos. Each farmer was provided a booklet of CSA practices one week before the workshop. During the workshop, the CSV team and farmers discussed the feasibility and outcomes of potential CSA practices.

Sampling procedure

The 20 farmers invited to the workshop were purposefully selected based on the location of their households in relation to the cropping capability (2R-fertile Soil, 2R- normal Soil and 3R) so that farmers from multiple LU areas were represented.

Scoring sheet and data analysis

During the workshop on CSA practices, guidelines of CCAFS FP 1.1 were followed to use the checklists in Tables 4 and 5 for discussion (Ronnie et al. 2015). The checklists guided the discussion regarding the necessary conditions for a successful intervention and the expected results and changes from the intervention.

Table 4. Checklist to assess the feasibility of promising CSA technologies and practices based on conditional suitability

Input criteria: related to the conditions that are necessary for the intervention to have a good chance of success in generating expected benefits in the context of the CSV.

History
• Is this intervention new to the village? • Have some other projects previously tested this intervention in the same village or in the same district or province? • If the intervention is not new to the village, has it worked before and why? Has it not worked before and why? • Are there any historical constraints for this technology to be tested in this village and what could be done to overcome the constraints?
Resources/assets
• Under what biophysical conditions will the intervention be effective? • What are the other resources need in terms of capital investment, operational costs and human resources? • Are there any constraints for this technology to be tested in the village because of resource/asset access? If so, what could be done to overcome these constraints?
Social and gender relations and differentiation
• Does this intervention require the participation of men or women in particular? If so, why and in what ways? • What is the level of inputs required by women and men, and what are the implications for their time, labour, capacity, skill investments? • Are there powerful individuals in the village who may influence the intervention in one way or another? How will this affect different households, women and men? • Are there any constraints for this technology to be adopted in this village because of social and gender relationships? What could be done to overcome these constraints?
Market, value chain/extension services
• Does this intervention concern one or more products that have market demand? • Are viable input and output value chains established to support the intervention? • Are there technical services available to support farmers to implement this intervention, e.g., CSV team, local line agencies, private sector, other CGIAR centres?
Policy/law
• Are there government policies and regulations that promote or constrain the intervention? • If there are such constraints, what could be done to overcome the constraints?
Climate smartness criteria
• What climate smartness dimensions does the intervention address, e.g., water, soil, pests and diseases, seeds and breeds, information, markets? • What specific climate-related challenges or opportunities does this intervention respond to in terms of mitigation and/or adaptation?
Financial resources and capacity of CSV team to support this intervention
• Are sufficient funds, staff capacity, and time available to implement the intervention? • What are the guesstimates of the total cost of the intervention? • What resources might be available from the project, the community or elsewhere? • How do available resources compare to estimated costs?

Table 5. Checklist to assess the feasibility of promising CSA technologies and practices based on outcome expectations

Outcome criteria: related to the expected results and changes brought about by the technology.

Sustainable resource use/conservation
• How does the intervention affect the environment and natural resource base? • What could be done to maximize positive impact? • What could be done to minimize or avoid negative impact?
Women empowerment/equity
• How might the intervention affect women's empowerment and equity within the village? • What could be done to maximize the positive impact? • What could be done to minimize or avoid negative impact?
Poverty reduction
• How does the intervention affect income generation and HH asset accumulation? • How does it affect HH labour allocation? • What could be done to maximize the positive impact? • What could be done to minimize or avoid negative impact?
Food security
• How does the intervention affect HH food security? • What could be done to maximize the positive impact? • What could be done to minimize or avoid negative impact?
Overall assessment
• How many output goals does the intervention contribute positively to? How? • How many output goals does the intervention contribute negatively to? How? • What could be done to maximize positive results? • Should the intervention be proposed for the community evaluation given the pros and cons and possible future risks? • Is additional research warranted to provide more information to the community to discuss all the pros and cons and the risks?

Score card

In the scoring sheet for each CSA practice or technique (Table 6), levels of capacity needed for investment or input and levels of each outcome in terms of livelihood improvement were categorized in three columns for each of the inputs and outcomes. There are five inputs and six outcomes for the CSA technique assessment. In addition to increasing household income and protecting the environment, providing food security, gender equality and resilience to climate change are required components in the selection of a CSA technique.

For evaluation of a CSA technique, farmers selected a suitable category for each of the five inputs and six outcomes from the scoring sheet depending on their household capacity for inputs and their point of view on CSA techniques.

Table 6. Climate-smart technology/practice characterization and scoring card

INPUTS: having the capacity	**Need least capacity for inputs**	**Need moderate capacity for inputs**	**Need high capacity for inputs**
1. The average investment costs per household*	Lower than 5 mil. VND	Between 5 and 10 mil. VND	Higher than 10 mil. VND
2. The amount of labour per household*	Lower than 20 hours per week	Between 20 and 80 hours per week	Higher than 80 hours per week
3. Degree of interest and need of women	No need women to participate	Women can participate some hours alongside male labour	Women participate mostly in practice
4. Outside technical support needed	No need	Some training needed	Regular training needed
5. Amount of cooperation needed among villagers	none	Now and then	continuously
Subtotal score			
OUTCOMES: livelihood improvement	**less livelihood improvement**	**moderate livelihood improvement**	**High livelihood improvement**
1. Natural resource conservation (water, soil, air, crop, trees, livestock, fish, etc)	One natural resource better managed /conserved	Two natural resource better managed /conserved	Two natural resource better managed /conserved
2. Food security	No direct contribution	Food shortage reduced	Food shortages eliminated
3. Income generation	No new source of income	A new source of Irregular income	A reliable income
4. Benefit for women	Women will not	Women will	Women will greatly benefit
5. Community development	No benefits to community	Benefit to some households	Greatly benefits the whole community
6. Respond to climate change	No direct response	Take time to response	direct response
Subtotal scores			
Total scores **Likelihood of success**			

*Best guesstimates to be prepared by the research team based on local context
Note: Standards for input 1 (investment cost) and input 2 (labour hours) have been estimated based on the statistical average data in rice production in MRD (GSO of Vietnam, 2014).

Computation of score

In the ideal condition, farmers would score "least capacity of support needed" for all cases of inputs and they would score "high improvement for livelihood" for all outcomes. This would result in a maximum subtotal score of 5 for inputs, 6 for outcomes, for a total maximum score of 11.

Scores are reported as a percentage which is the subtotal score for input/output per category divided by the total possible score of 11. In this paper, we report only on CSA practices that received over 50% score for the input category “needs least capacity for input” and over 50% for the outcome category “high livelihood improvement”.

Results and discussion

The list of potential CSA techniques evaluated in the participatory prioritization workshop on 22-23 October 2015 in Tra Hat CSV is presented in Table 7. There were two groups of CSA techniques, one was for rice production and the other group addresses multiple crop and livestock practices. Since rice production is the main income of people in Tra Hat CSV, improved practices in rice and in other crops/livestock applied at the household level are important for food security.

Table 7. CSA techniques evaluated by farmers

CSA techniques for rice production
1. Laser land leveling for rice field 2. Water saving technique for rice (AWD) 3. Straw baler and rice root cutter 4. Using straw for mushroom 5. Using straw for compost 6. Smart applying of N fertilizer using Leaf Color Chart (LCC) 7. Reducing Phosphorus fertilizer 8. Sowing machine 9. Improve certified seed 10. Modern rice with salinity tolerance
CSA for increasing healthy livelihood, environment and food security of HH and village
11. Improving piggeries with sanitation treat 12. Raising chicken 13. Yellow cat fish 14. Yellow catfish and frog 15. Growing Dragon fruit on hyacinth compost 16. 2R + soybean or 2R + sesame

Table 8 shows the scores given for different CSA techniques revealing farmers' preferences. The scores are presented as percentages (i.e., 100% score would mean lowest input need and highest livelihood improvement). The scores are reported separately by gender.

In table 8, all CSA practices have been ordered by ranked score provided by farmers' responses. Low scoring CSA practices, such as piggery or growing upland crop in rice based system (soybean/sesame in rice-based system), were left out of the evaluation as they were considered unfeasible practices to improve the livelihood of farmers in Tra Hat CSV.

Table 8. Livelihood improvement ranking and percentage score of CSA practices

No.	CSA practice in rice production	Male	Female
1	AWD	63	73
2	Straw compost by applying Trichoderma	60	58
3	Applying seed sowing machine	54	-
4	Straw baler machine	60	-
5	Reduction of Phosphate (P) for paddy soil	52	61
6	LCC for Nitrogen (N) application	-	64
7	Growing straw mushroom	58	-
8	Laser land leveling	54	-
9	Short duration and salt tolerant rice varieties	-	52
10	Purifying current traditional seed	-	51
11	Reduction of seed	52	
	CSA practice in HH		
12	Growing dragon fruit	53	-
13	Yellow catfish + Frog	-	50
14	Raising chicken	52	-

Note: Scores are presented as a percentage of input + output score/total possible score (11). Piggery and growing soybean or sesame in rice-based systems were left out as they received low scores and were deemed infeasible for livelihood improvement in Tra Hat

To triangulate perceptions of CSA techniques, data was combined from the FGDs with farmers, HH surveys, and KI interviews. The HH surveys were conducted in Tra Hat CSV on 5-9 November 2015 and the KI interviews took place on 12-14 November 2015 in Bac Lieu Province.

In Table 9, several CSA practices were selected by multiple stakeholders as having the highest capability of dissemination: laser land levelling for rice field, saving water through alternate wetting and drying water management, Phosphorous fertilizer reduction, baling straw and cleaning field between seasons with rice root cutter, and making compost from rice straw. Piggeries were also preferred by farmers in HH survey and KI because of its important in food security and second source of income after rice production. However, the sanitary of this should be improved for protection of friendly- environment in the village.

In Bac Lieu, the development of agricultural machineries is recognized slowly compared to other provinces. It needs a consideration of local government in policy, finance and organizing the implementation pathway for these rice-based CSA mechanics practices in the region. The role of private sector is also important in support agricultural mechanism.

Table 9. Comparison of CSA techniques/practices in different Scoring WS, HH survey and KI interviews

CSA technologies	Scoring	HH	KI
Straw baler and rice root cutter	✓	✓	✓
Using straw for mushroom	✓		✓
Using straw for compost	✓	✓	✓
Smart applying of N fertilizer using LCC		✓	
Reducing Phosphorus fertilizer	✓	✓	✓
Water saving technique for rice (ADW)	✓	✓	✓
Sowing machine	✓		
Improve certified seed	✓	✓	
Laser land leveling for rice field	✓	✓	✓
Modern rice with salinity tolerance	✓		
Improving piggeries with sanitation treat		✓	✓
Chicken and duck raising	✓		
Yellow cat fish			
Yellow catfish and frog	✓		
Growing Dragon fruit on hyacinth compost	✓		
2 rice + soybean or sesame			

Note: Highlighted colors indicate the management period for the CSA technique (blue=field preparation/pre-planting, yellow=crop management, red=post-harvest management).
Source: data from participatory scoring workshop, HH survey and KI interview for prioritized CSA practices in 2015 at Tra Hat CSV

Packages of CSA practices

The current rice production improvement package support by government and agricultural extension is 1M5R, which promotes using certified seed, and reducing seed rate, fertilizer, pesticide, water, and post-harvest losses. It is an advantage that this package is already prioritized for out scaling because most of the CSA techniques identified through this project can be integrated into 1M5R. Therefore, out-scaling one of the prioritized CSA techniques will be supported if it can be combined into the existing policy and activities. For example, alternate wetting and drying (AWD) is a water saving technique for paddy which also satisfies a criterion of saving water in 1M5R package. Additionally, it dually satisfies the CSA criteria by saving water and reducing green house gas emissions from rice production by half.

The sequence of management recommendations that improve the application of qualified seed, including laser land levelling and machine sowing. Combining the practice of using qualified seed with laser land levelling and a seed sowing machine for large scale application could double or triple performance of rice crop establishment.

The recommended sequence for the three CSA practices to be implemented during the growth stages include: alternate wetting and drying, using the leaf color chart, and reducing phosphorous fertilizer. These practices satisfy the criteria of saving water, reducing green house gas emissions, reducing cost of fertilizer (N and P) and pesticide. To effectively out-scale these practices, they can easily be integrated into the 1M5R extension plans and policy.

A combine harvester is recommended for harvesting rice on field and is commonly used in the MRD. Combine harvesting is a common practice in Tra Hat CSV and Bac lieu province; however, using a straw baler machine for collection of straw on field has rarely been used in the area. This reluctance of adoption may be due to a lack of available machinery and also farmer uncertainty to the benefit of straw removal. Farmers see straw baling and rice root cutting as an extra cost and do not know what they can do with it once it has been baled. There seems to be an issue with market demand for straw and a comprehensive analysis for the rice straw supply chain is needed. Raising awareness and promoting straw baling and removal will be ineffective at leading to behavior change if there is a market failure that was not considered. Local farmers will likely continue to burn rice straw in the field given its simplicity and ease of disposing of the straw quickly before the next season. Wider social impacts of burning and its contributions to air pollution and respiratory health problems can also be considered in an effort to mainstream policies that can improve straw market infrastructure and encourage straw removal.

We recommend a complete package to connect straw residue with product development through improving the value chain. Straw can be used to make straw compost where high-value mushrooms can be cultivated or the straw can be used to make biodegradable products that are alternatives to plastic products (i.e., packing material, flatware, cutlery, flower pots, etc.). For the most efficient removal and transport of straw, a baler is recommended.

Gender differentials

For household level CSA practices, women preferred to participate in activities such as piggeries, raising fish, chicken, and growing trees. Our study found out that women are more likely to support these CSA practices even if high inputs are required for these practices (Figure 4). Male farmers supported low input for CSA practices in HH and they did not like any high inputs for practices in HH because most of them believe main income was from rice production. So, they preferred to invest more inputs for CSA practices in rice production as their main livelihood (Figure 5).

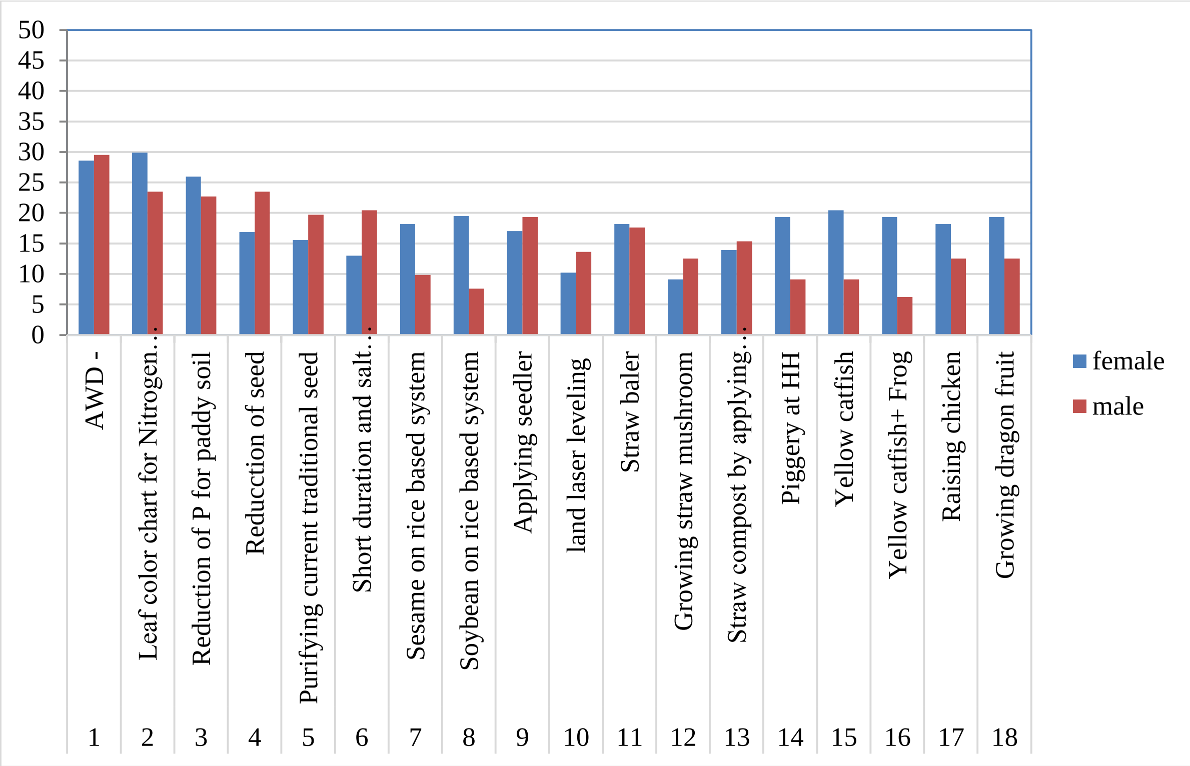

Figure 4. Score difference between male and female farmers in preference of high input for CSA practices

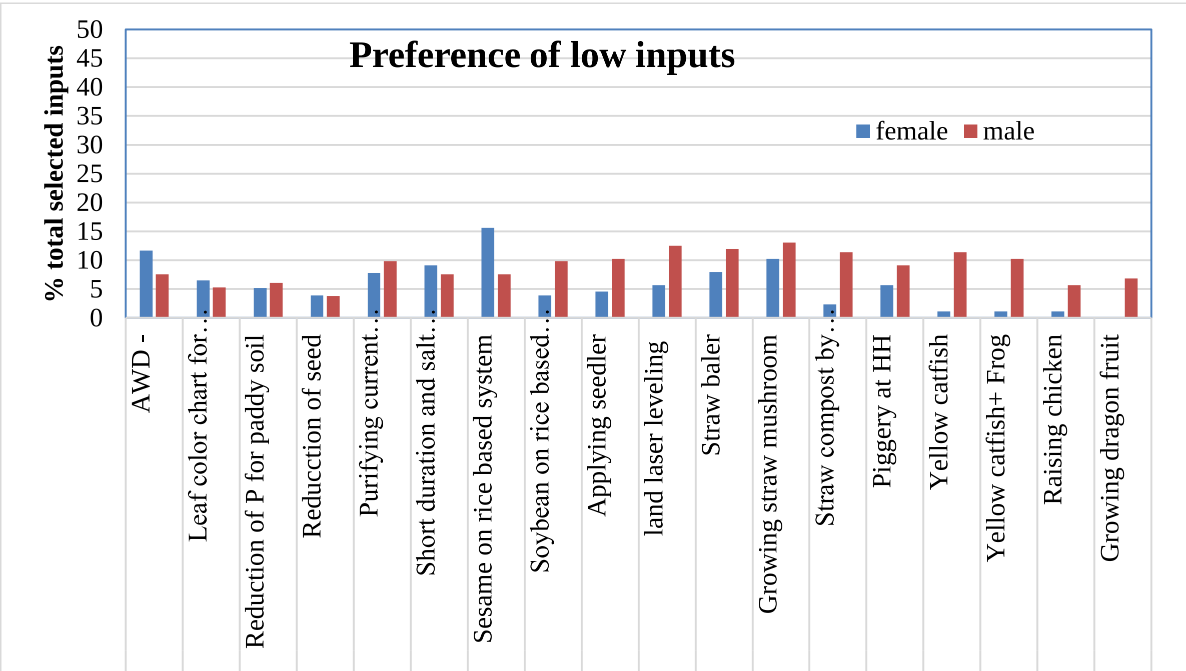

Figure 5. Score difference between male and female farmers in preference of low input for CSA practices

The score difference between men and women on evaluation CSA practices to improve livelihood can be seen in Figure 6. It focuses on how many resources can be managed or conserved while providing reliable income and benefit for women. Women believed most CSA practices in rice production were reliable incomes and good for environmental management. They felt CSA practices in the HH would not bring much reliable income. But male farmers believed CSA practices in HH would be great benefit to women. Both of female and male farmers agreed that CSA practices in HH were important source for daily food and food security.

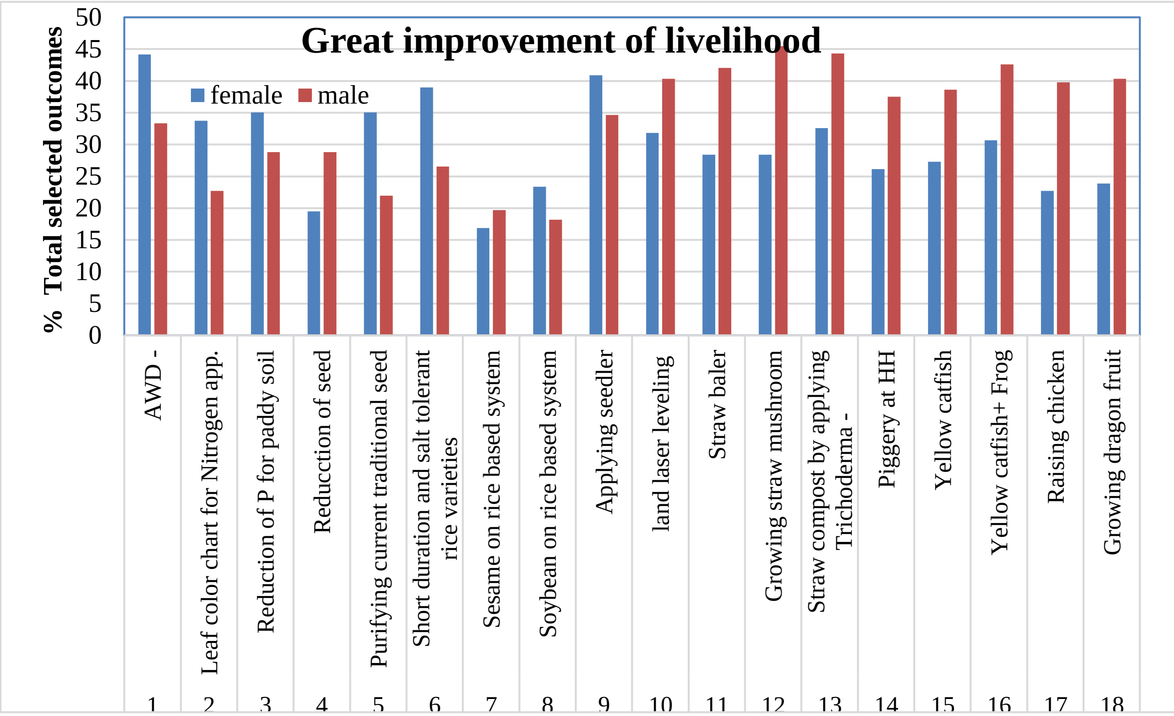

Figure 6. Score difference between male and female farmers in perceptions of livelihood improvement if applying CSA practices

Conclusions

CSA practices in rice production are an important improvement to livelihood, income, and ensuring long-term food security for farmers in Bac Lieu and these practices can be integrated into 1M5R agriculture extension policy as an advantage to out-scaling.

In rice production, the following practices can be prioritized: practicing AWD; reducing N and P fertilizers; laser land levelling; baling straw and cutting rice roots (machine operation); and straw composting. These CSA techniques have been prioritized through participatory workshops, HH surveys, and KI interviews.

CSA practices at the household production level (including non-rice crop production and livestock/aquaculture) should be considered as a main source of household daily food and food security for the community. Piggery is encouraged to be developed with environmental concerns carefully considered and with the introduction of good quality stocks.

Packages of CSA practices integrated into existing extension policies, such as 3R3G, 1M5R, VietGAP, and Sustainable Rice Platform (SRP) would be an effective method for dissemination as the messages and recommended practices are in line with the overall recommended practices. Balance between the development of CSA practices in rice production and at the household level could bring reliable outcomes for increasing household livelihood, food security and protecting the environment for individual and community-wide benefits.

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APPENDICES

Appendix 1. Workshop on "Participatory selection of CSA at Tra Hat CSV" on 22-23 October 2015

Program for 22 Oct 10 2015

Time	Content of Activities	Participants	Leaded by
8:00- 8:10	Introduction program, objective and opening remarks	10 female and 10 male farmers, 2 representatives of authorities of commune and district, and Tra Hat board	LM Duong, 1rep. authority of district
8:10-8:30	Participants review posters that will be discussed in the next program today (they are similar to A4 posters that were delivered to villagers in last weekend)	All	
8:30- 10:00	I. Introduce and scoring CSA on rice production		
	Part 1: In 1P5G package		ND Phong
	Water saving technique AWD	youtube	
	N Fertilizer saving: LCC		
	P fertilizer reduction		
	Seed reduction using sowing machine	youtube	
	To restore seed quality for rice production		
10:00-10:30	Break and visit posters	All	
10:30-11:30	Part 2: Potential alternative crop replaced for Winter-Spring rice crop:	All	LM Duong
	Modern rice with salinity tolerance and short duration		
	Sesame		
	Soybean		
11:30-12:00	Discussion and Closing of day 1		ND Phong

Program of 23 October 2015

Time	Content of Activities	Participants	Leaded by
8:00- 8:10	Introduction program, objective	10 female and 10 male farmers, 2 representatives of authorities of commune and district, and Tra Hat board	LM Duong,
8:10-8:30	Review the posters will be discussed by participants in next section of program ((they are similar to A4 posters that were delivered to villagers in last weekend)		
8:30- 10:00	I. Introduce and scoring CSA on rice production		ND Phong
	Part 3: Mechanization in rice production and straw management		
	Laser leveling of field	video	
	Sowing machine (the same content with poster 4)		
	Making straw baler	Video	
	Using straw for making mushroom		
	Making compost from straw		
10:00-10:30	Break and visit posters		
10:30-12:10	II. Introduce and scoring CSA in Household area		TNL Duyen
	Piggery		
	Raising yellow catfish	Video	
	Raising yellow catfish+ frog		
	Raising chicken		
	Using water hyacinth to make compost for planting dragon fruit in garden	Video (vegetable production	
12:10-12:30	Discussion and Closing of day 2		NDPhong
12:30-2:00	Meeting Lunch with organizers and Tra Hat CSV operational board		NDPhong+ LM Duong

Note: 20 farmers will be invited daily (10 M, 10 F). Invited farmers will be selected based on distribution of their HH on landuse map of Tra Hat CSV (2x 2R, 3R).

Appendix 2. Posters of CSA techniques/practices

They were placed in order with the list in program of Workshop in Appendix 1

CIAT | CGIAR | Research Program on Climate Change, Agriculture and Food Security | CCAFS | IRRI

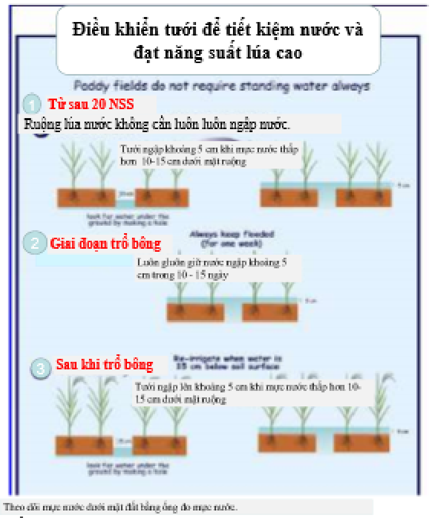
KỸ THUẬT TƯỚI NGẬP KHÔ XEN KẼ CHO LÚA (Alternate Wetting and Drying)

Ngô Đăng Phong
Viện Nghiên cứu Lúa Quốc Tế (IRRI)

RATIONALE

- Irrigated rice production requires a lot of water for irrigation. It is a critical time in dry season (from Jan to Apr) for water supply for rice when rivers and canals dry up while water demand does not reduce in the rice-growing areas.
- Therefore, the application of water-saving irrigation techniques for rice at the end of rainy season and in dry seasons (autumn-winter season and winter-spring season) can reduce water consumption and ensure enough necessary water for rice production without reducing rice yields.
- Alternate wetting and drying (AWD) technique proposed by IRRI has been implemented in many countries in the world as well as in some regions of Mekong River Delta Vietnam like An Giang and Bac Lieu provinces in 2004 and 2011 respectively.

ĐẶC ĐIỂM KỸ THUẬT



(Nguồn: hiệu chỉnh từ IRRI)

Điều kiện: Đất không bị phèn mặn nặng, ruộng phải chuẩn bị bằng phẳng, bờ bao chặt chẽ không thất thoát nước và có kênh mương chủ động nước tưới tiêu.

Theo dõi mực nước trong ống để quyết định tưới

HIỆU QUẢ KINH TẾ VÀ MÔI TRƯỜNG

- Năng suất lúa có tăng do rễ lúa phát triển khỏe và cứng cây, từ đó tỉ lệ đổ ngã ít và thất thoát lúa ít.
- Giảm bơm tưới 3-5 lần tùy theo địa hình và thời tiết. Từ đó giảm chi phí bơm cho vụ lúa từ 100.000-1.000.000 đồng/ha/vụ.
- Giảm khí thải nhà kính 10%-30%.
- Bền vững về mặt môi trường, giúp tiết kiệm nước tưới, năng lượng bơm và tăng cường thoáng khí cho đất trong các vụ.
- Góp phần trong gói kỹ thuật 1P5G mang lại hiệu quả cho vụ lúa.

KHẢ NĂNG ỨNG DỤNG VÀ HẠN CHẾ

- Thích hợp đa số cho lúa vụ mùa khô (Đông Xuân, Hè Thu) và vùng có nhu cầu tiết kiệm nước.
- Không áp dụng cho đất phèn nhiều và mặn, đất quá gò hay quá trũng không điều tiết nước dễ dàng.
- Không áp dụng cho nơi không có hệ thống kênh mương chưa chủ động tưới tiêu, nơi ruộng phía trong phải bơm chuyền.
- Ruộng chưa bằng phẳng, mặt bằng ruộng đa số chưa được cải tạo nên việc áp dụng kỹ thuật TNKXK còn gặp nhiều hạn chế.

SỬ DỤNG BẢNG SO MÀU LÁ LÚA CHO BÓN ĐẠM
(Leaf color chart for fertilizing N effectively)

Ngô Đăng Phong
Viện Nghiên cứu Lúa Quốc Tế (IRRI)

RATIONALE

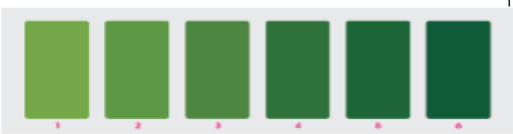
- Currently, there are more than 30 percent of N fertilizer applied for rice production losses transferring into Green House Gas Emission (GHG). The surplus of N fertilizer applied on rice production could also cause polluted environment since it penetrates into ground water or accumulates into grains leading to low quality standard for rice exporting.
- Applying the leaf color chart (LCC) can calculate the right amount of N fertilizer needed by rice at specific growing stage. This helps reducing the N fertilizer surplus for each time of apllying fertilizer, thus save the input costs of N fertilizer and reduce the development of pests and rice lodging.
- Besides, when the loss of N fertilizer is decreased, the emission of GHG caused by applying N fertilizer is also declined.
- LCC has been applied in Rice crop management (RCM) program of IRRI and performed in many countries and in Vietnam (2003).

ĐẶC ĐIỂM KỸ THUẬT

Thời điểm so màu lá lúa:

1. Xác định đúng thời điểm bón phân lần thứ 2 và 3 lúc 20 ngày và 40 ngày sau khi sạ.
2. Các lần bón phân kế tiếp (nếu có): Khi lúa trổ xong đan vào chắc, nếu màu lá ở khung số 3 trở xuống mới cần bón thêm đạm. Lượng phân bón thêm là 2-3 kg urê/ công. Lúc này lúa bị nhiễm bệnh thì bón thêm đạm.

CHÚ Ý: Cần bón đủ lượng phân lân và kali vào các thời điểm đúng theo hướng dẫn chi tiết trong quy trình bón phân lúa cao sản phát kèm.



CÁCH SO MÀU TRONG RUỘNG LÚA

Nên so màu vào cùng thời gian (vào sáng sớm hoặc chiều mát).

Chọn ngẫu nhiên ít nhất 20 lá lúa (lá trên cùng khi mà lá kế tiếp đã ra được 2/3 phiến lá) từ 4-5 vị trí khác nhau trên ruộng. Ghi nhận số khung màu của từng lá rồi tính trị số trung bình của 20 lá đã được so màu.

Nếu trị số trung bình màu lá lúa rơi vào trong các khung thấp hơn khung màu chuẩn (khung số 4) (khung 1,2 & 3) là lúc lúa thiếu đạm, nên cần bón ngay thêm lượng đạm theo bảng hướng dẫn sau đây:

Giai đoạn sinh trưởng	Vụ hè thu	Vụ đông xuân
20 - 25 ngày sau sạ	4 - 6kg urê/công	6 - 8kg urê/công
40 - 45 ngày sau sạ	4 - 6kg urê/công	5 - 7kg urê/công

KHẢ NĂNG ỨNG DỤNG VÀ HẠN CHẾ

- Áp dụng tốt cho các giống lúa cao sản ngắn ngày.
- Thử nghiệm ở ĐBSCL tốt. Tuy nhiên cần điều chỉnh cho các vùng miền khác nhau theo đất đai.
- Sự thiếu hụt các loại phân K và P có thể ảnh hưởng đến sự chính xác của BSMLL.

HIỆU QUẢ KINH TẾ VÀ MÔI TRƯỜNG

- Bón lượng đạm gần đúng theo yêu cầu sinh trưởng của cây lúa.
- Giảm lượng đạm dư khi bón lúa.
- Giảm khí thải nhà kính do giảm lượng thất thoát đạm.
- Tăng cường tính bền vững về mặt môi trường
- Góp phần trong gói kỹ thuật 1P5G mang lại hiệu quả cho vụ lúa.

GIẢM LƯỢNG LÂN BÓN CHO LÚA
(P Fertilizer Reduction)

(Kết quả từ dự án CLUES)

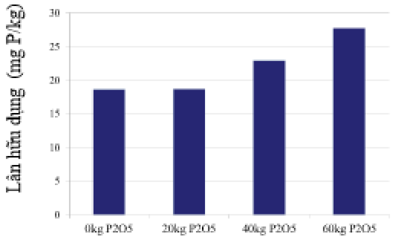
Ngo Dang Phong
Viện Nghiên cứu Lúa Quốc Tế (IRRI)

RATIONALE

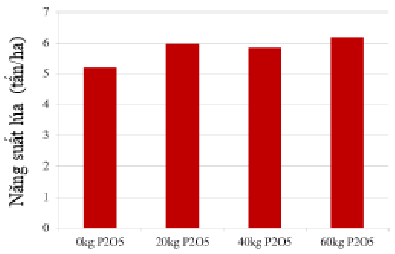
- Phosphorus (P) is one in three essentially nutritional elements for agricultural crops. In the summer-autumn season, P fertilizer has positive influences on reducing amount of alum, mitigate organic toxicity and increasing salinity and drought tolerance. Unlike in winter-spring season, the soil surface of rice field would experience cracking and drying in the summer-autumn season. Therefore, air would go into soil through cracks and capillaries of top soil and would penetrate deeper into below soil layers, this would activate the oxidation of alum in soil that. The high content of alum could cause the toxicity for rice and limiting in rice growth. P is necessary to apply before rice season.
- The current amount of P fertilizer applied by farmers is excessive over the need of rice, hence the P fertilizer surplus has been accumulated in rice soil for many years. For this reason, applying the right amount of P fertilizer for rice production is required due to reducing input costs without decreasing rice yields.

ĐẶC ĐIỂM KỸ THUẬT

Các thí nghiệm giảm phân lân trong 6 vụ của dự án CLUES_IRRI cho thấy chưa có ảnh hưởng rõ ràng của việc giảm lân đến việc giảm năng suất lúa tại các vùng đất phù sa, sét mặn nhẹ và phèn nhẹ. Việc giảm lân qua các vụ không gây biến động lớn hàm lượng lân trong đất. Do đó, một khuyến cáo của dự án là có thể bón với liều lượng 20-40 kg P_2O_5/ha cho đất lúa mà năng suất lúa vẫn không đổi.



Hình. Hàm lượng phân P dễ tiêu trong đất



Hình. Năng suất lúa ứng với các mức phân lân bón

KHẢ NĂNG ỨNG DỤNG VÀ HẠN CHẾ

- Có thể bón giảm phân P (20-40 kg P_2O_5/ha) trên đất phù sa, đất phèn nhẹ và mặn nhẹ.
- Có thể áp dụng kết hợp bón giảm P với tưới khô-ngập xen kẽ.

HIỆU QUẢ KINH TẾ VÀ MÔI TRƯỜNG

- Bón giảm lân vẫn đảm bảo yêu cầu sinh trưởng và năng suất của cây lúa.
- Giảm chi phí mua lân nên tăng thu nhập của nông dân, giúp nông dân sản xuất lúa thích nghi hơn với BĐKH
- Hạn chế tác động xấu của sản xuất lúa đến môi trường đất làm tăng cường tính bền vững về mặt môi trường
- Góp phần giảm trong gói kỹ thuật 1P5G mang lại hiệu quả cho sản xuất lúa.

DỤNG CỤ SẠ THƯA BẰNG MÁY
(Sowing machine)

(Số liệu từ Chi Cục BVTV Bạc Liêu)

Ngo Dang Phong
Viện Nghiên cứu Lúa Quốc Tế (IRRI)

RATIONALE

- Rice seeding with the appropriate seed density would not only reduce production cost but also increase rice yield.
- Rice seeding by machine would save human labours, seeds, and it ensures more uniform spacing and plant density that led to increase rice yields .
- By using seedling machine, seeds would not be emerged during the heavy rains.

ĐẶC ĐIỂM KỸ THUẬT

- Diện tích ruộng trình diễn: 1 ha (giống OM 4900)
- Lượng giống: 80kg / ha tiết kiệm số với đối chứng (ĐC sạ 140kh/ha)

Ruộng	Tên giống	Liều lượng (kg/ha)	Phương pháp sạ	Ngày sạ
Mô hình	OM 4900	80	Sạ máy	24/6/2015
Đối chứng	OM 4900	140	Sạ lan	24/6/2015

Ruộng	Số bông/m² (bông)	Số hạt chắc/bông (hạt)	% hạt lép	Trọng lượng 1.000 hạt (gr)
Mô hình	422	83/114	21	24
Đối chứng	432	80/116	26	24

KHẢ NĂNG ỨNG DỤNG VÀ HẠN CHẾ

- Sạ hầu hết các loại giống và thời tiết có mưa và phun rải được phân.
- Có thể áp dụng cho các diện tích canh tác lúa tại Trà Hất.
- Khó khăn: tập quán canh tác của người dân khó thay đổi.

HIỆU QUẢ KINH TẾ VÀ MÔI TRƯỜNG

- Giá máy: 2.000.000đ đến 5.900.0000đ (4 loại)
- Tổng chi phí bình quân cho mô hình: 18.355.000đ/ha, giảm 3.860.000 đ/ha.
- Năng suất ước tính: 7,60 tấn/ha, tăng 0,09 tấn/ha.
- Tổng thu ruộng mô hình: 34.200.000 đ/ha, tăng 405.000 đ/ha.
- Lợi nhuận ruộng mô hình 15.845.000 đồng/ha, tăng 4.265.000 đồng.

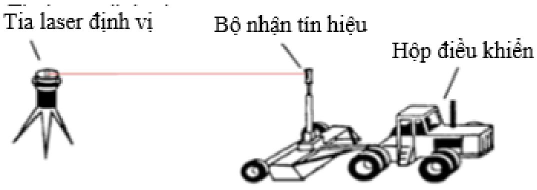
MÁY SAN PHẲNG ĐIỀU KHIỂN BẰNG TIA LASER
(Laser Land Leveling)

(Số liệu cung cấp bởi Trung tâm Năng Lượng và Máy NN Đại học Nông Lâm TP HCM)
Ngo Dang Phong
Viện Nghiên cứu Lúa Quốc Tế (IRRI)

RATIONALE

- Land leveling is needed for rice production because it improves irrigation efficiency and conserving water; plant growth is more uniform, which helps achieves higher yields. Therefore, this practice reduces rice production costs by reducing consumption of water, seeds, fertilizers, chemicals and fuel as well as decreasing rice lodging.
- Applying laser land leveling is not costly because well maintained fields require laser leveling only once every 3-4 years.
- Laser land leveling has been introduced by Bac Lieu seed Center since 2005. However, this practice has not been disseminated due to unsolved problems of lacking off machines and high initial investment cost.
- Laser leveling would be appropriately applied in dry season where is only 2R regions (summer-autumn season and autumn-winter season) and one season without cultivating (spring-summer season).

ĐẶC ĐIỂM KỸ THUẬT



HIỆU QUẢ KINH TẾ VÀ MÔI TRƯỜNG

- Năng suất lúa tăng trung bình 0,5tấn/ha, tăng thu nhập 2.500.000 đ

-Giảm chi phí:

- Ít cỏ dại do độ đồng đều đất và nước => giảm công làm cỏ 70%
- Giảm xăng dầu 11lần bơm tưới (28l =>10,5 l/ cho 1 vụ 7 lần bơm) # 500.000 đ
- Giảm các chi phí khác: giống, phân bón, thuốc trừ sâu.

Giảm chi phí # 2.000.000 đ

-Chi phí thuê san ủi (tùy địa phương): 5-10 triệu đ/ha

-Kể từ vụ 3 trở đi thì sẽ có lời do giảm chi phí, lao động chăm sóc và tăng năng suất lúa.

-Về mặt môi trường, san ủi laser sẽ giúp tiết kiệm nước tưới và giảm thuốc trừ sâu, máy sạ hàng có thể áp dụng dễ dàng.

KHẢ NĂNG ỨNG DỤNG VÀ HẠN CHẾ

- San ủi laser chỉ có thể thực hiện ở vùng đất có thời gian trống vào mùa khô.
- Thích hợp cho cánh đồng lớn hoặc cánh đồng ghép thửa lại.
- Cần sự hỗ trợ của địa phương.

MÁY CUỐN RƠM (Straw Baler Machine)

(Tổng hợp dựa theo tài liệu tham khảo)

Ngo Dang Phong
Viện Nghiên cứu Lúa Quốc Tế (IRRI)

RATIONALE

- A large amount of straw leaving on field after harvest. Straw burning refers to cleaning field practice in short during between two consequent rice seasons. It is common and simple practice in Mekong River Delta (MRD). However, this practice produces much more density of CO2 during burning and has adverse impacts by pollutes air environment. The air pollution consequent contributes to green house gas emission and climate change.
- By using baler machine, most of straw on field is gathered in bales and the open burning could not happen regularly.
- Straw could also be utilized for straw mushroom growing or rice straw compost. The benefits of these practices have been proved by actual production of farmers. However the high cost of baler machine is one of the main restrictions for the dissemination of this technique.
- Currently, many households in MRD bought baler machine to collect straw resulting in improving household income and avoiding straw burning. Nowadays, many kinds of straw baler machine have been introduced in public (Seeing references on website).

ĐẶC ĐIỂM KỸ THUẬT (Hình có tính cách minh họa)

- Sử dụng máy cuốn rơm, cọng rơm không bị nát và bó thành cuộn, mỗi cuộn có trọng lượng khoảng 12-15 kg đối với rơm khô, vừa gọn nhẹ, vừa dễ chuyên chở, một giờ máy cuốn rơm có thể thu gom và ép thành cuộn 3-5 công rơm
- Với tốc độ hoạt động khá nhanh, khoảng 30 giây đã hoàn thành, cho ra 1 cuộn rơm khoảng 12-15kg. Trong vòng 10 phút có thể hoàn thành 1 công đất. Sau khi đầy thùng chứa thì máy có thể đưa sản phẩm về điểm tập kết chứ không cần thêm phương tiện thu gom.
- Công suất hoạt động của máy khoảng 400-500 cuộn/ngày.

HIỆU QUẢ KINH TẾ

- Chủ máy: Đầu tư 1 máy tự hành khoảng 400 triệu đồng. Thu được 2 triệu/ngày sau khi trừ chi phí. Sau hai năm sẽ lấy lại vốn.
- Ruộng nông dân: trung bình 1 cuộn bán khoảng 13.000đ - 17.000đ. Với ruộng lúa năng suất 5 tấn/ha, lượng rơm ước tính 3 tấn/ha thì sẽ được khoảng 250 cuộn rơm, thu hoạch khoảng 3.500.000đ.

KHẢ NĂNG ỨNG DỤNG VÀ HẠN CHẾ

- Hiện nay trên địa bàn DBSCL, máy cuộn rơm trên đồng ruộng chưa nhiều vì giá thành của máy cuốn rơm khá cao, do đó nông dân thường chỉ thuê máy.
- Nhiều nông dân đang trông chờ chính sách hỗ trợ vốn ưu đãi giống như máy gặt đập liên hợp để tận dụng hết rơm ra trên đồng, đưa vào mục đích có lợi trong sản xuất, giảm tác hại cho môi trường.

Tài liệu tham khảo:

1. http://angiang-sweden.com/index.php/vi/tin-tuc-va-su-kien/item/70-may-cuon-rom-giai-phap-huu-hieu-sau-khi-thu-hoach-lua
2. http://www.chauthanh.soctrang.gov.vn/wps/portal/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gLR1dvZ09LYwN_50BnA0-zEDdnH0t3ryADY_2CbEdFAKymN6w!/?PC_7_8AEKCI930OCQC0I6TFCL9GJRG4_WCM_CONTEXT=/wps/wcm/connect/ubndhuyenchauthanh/siteofubndhuyenchauthanh/tin+tic+su+kien/tin+trong+huyen/maycuonromgiaiphaphieuquakhithuhoach
3. http://www.z755.com.vn/22201-may-cuon-rom-giai-phap-tan-thu-phu-pham-thanh-nguyen-lieu-co-gia-tri.html

KỸ THUẬT TRỒNG NẤM RƠM
(Straw Mushroom)

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INTRODUCTION

- Straw mushroom *(Volvariella volvacea)* is saprophytic mushroom, living in the tropic areas. Straw mushroom is cultivated popularly in East and Southeast Asia countries. Mushroom grown on rice straw is called straw mushroom.

- Estimated twenty five million tons of rice straw generated annually, Mekong Delta, Vietnam implies a great potential to develop a business on straw mushroom, which improves income for farmers as well as reduces open straw burning on rice fields.

QUY TRÌNH TRỒNG NẤM RƠM

Trồng nấm rơm ngoài trời

1. Ủ rơm đống từ 10 – 12 ngày (2 – 3 ngày đảo/lần).
2. Đánh dòng nấm, rải meo nấm rơm vào dòng nấm.
3. Phủ rơm áo cho dòng nấm sau 3 – 5 ngày sau khi rải meo nấm rơm.
4. Tưới nước và bắt đầu hái nấm từ 10 – 12 ngày sau khi rải meo nấm rơm.

Trồng nấm rơm trong nhà

1. Ủ rơm đống từ 10 – 12 ngày (2–3 ngày đảo/lần).
2. Ép rơm ủ thành khối, rải meo nấm rơm vào khối rơm để trong nhà thoáng mát và có nhiệt độ ổn định.
3. Phủ nilon 5 – 7 ngày để giữ cho khối rơm ẩm.
4. Tưới nước và bắt đầu hái nấm từ 10-12 ngày sau khi rải meo nấm rơm.

THUẬN LỢI VÀ KHÓ KHĂN CỦA TRỒNG NẤM RƠM

Thuận lợi

- Nguồn rơm dồi dào
- Dễ bán nấm rơm
- Dễ trồng nấm rơm
- Lao động trồng nấm có kinh nghiệm

Khó khăn

- Thị trường tiêu thụ chưa phong phú
- Ảnh hưởng của thời tiết
- Nguồn cung cấp và chất lượng meo nấm
- Giá lao động ngày càng cao

Một số hình ảnh về nấm rơm ở Đồng Bằng Sông Cửu Long


Mua rơm bằng ghe


Mua rơm cuộn


Ủ rơm đống 10 – 12 ngày


Chất nấm rơm ngoài trời


Thu hoạch nấm


Chợ nấm rơm Thơm Rơm


Chất nấm rơm trong nhà


Chất nấm rơm trong nhà


Thu hoạch nấm rơm tươi


Nấm rơm sấy khô


Nấm rơm muối


Nấm rơm đóng hộp

Phân tích chi phí doanh thu lợi nhuận trồng nấm rơm trên 10 tấn rơm

Lượng rơm sử dụng	Số tiền (1.000 đồng)	%
Số mét dòng nấm	156	
Chi phí rơm	9.500	66
Chi phí mướn đất	200	1
Chi phí nhân công	3.100	22
Chi phí meo	1.000	7
Chi phí khác	500	3
Tổng chi phí	14.300	
Lượng nấm thu hoạch	900	
Giá nấm	28	
Tổng doanh thu	25.200	
Lợi nhuận	10.900	

TÀI LIỆU THAM KHẢO

Kỹ thuật và quy trình trồng nấm rơm. http://www.namtuoi.biz/ky-thuat-trong-nam/ky-thuat-va-quy-trinh-trong-nam-rom.html

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LÀM PHÂN RƠM SỬ DỤNG *TRICHODERMA*

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INTRODUCTION

- Rice straw decomposes slowly due to high content of linnin (10%). Besides, the time between two consecutive rice crops is only from 2 weeks to one month. Thus, there is not enough time for decomposition of straw leaved on field after harvest, or even for collected rice straw in garden of household.
- Trichoderma is a type of fungi that lives in all soil types and other diverse habitat. That is the fungi in soil that can be cultured commonly.
- The application of *Trichoderma* on straw will speed up the process of straw decompostion. Besides, using compost made of rice straw promotes the development of the plant root and nutrient in the soil. This is an option of using rice straw effectively.

QUY TRÌNH Ủ PHÂN RƠM VỚI TRICHODERMA

Sử dụng *Trichoderma* trực tiếp trên ruộng lúa

1. Rải rơm ra mặt ruộng và phun chế phẩm *Trichoderma* lên rơm. Tưới nước cho rơm để có độ ẩm nhất định.
2. Sau 2 – 3 tuần cày vùi rơm vào đất cho rơm tiếp tục phân hủy.

Ủ phân rơm với *Trichoderma*

1. Xếp rơm rạ và xác bã thực vật theo lớp (20 – 30 cm/lớp) và tưới nước. Có thể bổ sung phân chuồng hoặc phân urê.
2. Rải hoặc phun một lớp *Trichoderma* rồi tiếp tục xếp đống ủ theo lớp cho tới khi đống ủ cao khoảng 1,5 m.
3. Sử dụng bạt nhựa để đậy và chèn kỹ đống ủ.
4. Thăm đống ủ sau 2 – 3 tuần và sau 1 – 1,5 tháng có thể sử dụng phân rơm.

THUẬN LỢI VÀ KHÓ KHĂN CỦA SỬ DỤNG PHÂN RƠM PHÂN HỦY NHANH

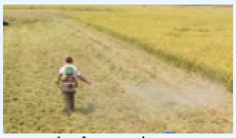
Thuận lợi

- Tiết kiệm chi phí do mua phân hóa học
- Dễ sử dụng
- Cải thiện kết cấu đất

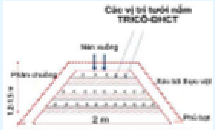
Khó khăn

- Thiếu lao động
- Thiếu nước vào mùa khô
- Hiệu quả ap dụng chậm phân hữu cơ
- Khó tìm mua chế phẩm

Một số hình ảnh về sử dụng phân rơm ở Đồng Bằng Sông Cửu Long



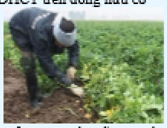
Phun chế phẩm trực tiếp lên rơm trên đồng ruộng



Sơ đồ ủ phân hữu cơ và vị trí chủng nấm Trico – ĐHCT trên đồng hữu cơ

Ủ phân rơm

Ủ phân rơm



Sử dụng phân hữu cơ với Trichoderma cho hoa màu

Các loại Trichoderma

Phân tích chi phí doanh thu lợi nhuận tăng thêm của việc sử dụng phân rơm rải với Trichoderma và phân chuồng

Sử dụng rơm rải có bổ sung phân chuồng	Sử dụng (1.000 đồng)	
	Phân hữu cơ	Phân hóa học
1. Chi phí tăng thêm (đồng/ha)		
Trichoderma	300	
Phân chuồng	100	
Chi phí lao động rải phân và rơm	1.100	
2. Lợi ích tăng thêm		
Tiết kiệm chi phí phân bón	5.400	7.000
Giảm dịch bệnh	1.000	2.000
3. Lợi ích ròng (2 – 1)	60	
Ủ phân rơm		
Chi phí ủ phân		
Vật liệu	700	
Trichoderma	100	
Nhân công	1.100	
Tổng chi phí	1.900	
Doanh Thu (1,000,000 đồng/tấn)	6.000	
Lợi nhuận	4.100	

TÀI LIỆU THAM KHẢO

Ứng dụng chế phẩm sinh học Trichoderma ủ phân hữu cơ, một biện pháp hiệu quả và bền vững. http://www.phanbondientrang.vn/tin-tuc/thoi-su-nong-nghiep/82--phan-hu-c-bng-ch-phm-sinh-hc-trichoderma.html

Trường Đại học Cần Thơ. Tricô-ĐHCT Sản Phẩm Sinh Học Cải Thiện Đất Trồng http://baovecaytrong.com/kythuatsanphambvtvchitiet.php?Id=82&nhom=bvtv

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