



D 3.2 Investment options needed for scaling up the potential adaptation and mitigation options identified and their impacts

Udaya Sekhar Nagothu¹ and Trond Rafoss¹, Andrew Borrell²

¹**Norwegian Institute of Bioeconomy Research (NIBIO)**

²**University of Queensland (UQ)**

Vietnamese Academy of Agricultural Science (VAAS)

(Dr.Bo and Dr.Tuat, Vice President, VAAS)

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Abstract

Climate change and variability associated with natural hazards such as flooding, storms, droughts, increasing temperature, sea level rise and salinity have been a continuous threat to the life and property of Vietnamese society in the past and will continue to do so in the future if not addressed properly. A majority are smallholders, highly vulnerable and without the capacity to invest much in adaptation. Thus any new adaptation measures have to be simple, low cost, help in reducing greenhouse gases (GHGs), and easily adaptable. This manual draws lessons from selected mitigation and adaptation measures evaluated in the project. The manual examines three key aspects needed to scale-up and replicate the measures at the provincial level. The first is the institutional structures, including inputs needed, farmer and stakeholder capacity at the commune, district and provincial levels, barriers to scaling-up, and how to address them. Secondly, how demonstrating effective climate-resilient technologies on farmer fields, closely involving farmers, can provide good results for scaling-up. Third, the impacts of policies to enhance enabling environments for scaling-up. There is a need to prioritize short-term and long-term measures for scaling-up. It is important to generate funds to support the scaling-up, both from state and private sources. Active stakeholder integration is a necessary factor where the authorities, farmers, scientists, civil society and industry are working closely in the process. Knowledge transfer has to be done both through linear and non-linear extension models that will be more effective in providing timely and complete knowledge to farmers and stakeholders.

The project evaluated the performance of five rice varieties under different saline conditions and found that the TX111 variety currently available is more tolerant than the other varieties, giving the highest grain yield in a range from 0 to 4 g/L salt levels. No rice yields were harvested at 5 g/L salt levels. Besides, the impact of two slow-release nitrogen (N) fertilisers on rice yield was assessed and the emission of nitrous oxide was measured. Slow-release N fertilisers performed better, increased rice production, were found to be affordable by farmers, and thus could replace the common white urea fertiliser. The field evaluation to study the impacts of different fertilisers and their methane emissions demonstrated that the combined application of compost and NPK gave the highest CH₄ and N₂O fluxes, while the application of biochar alone gave lowest CH₄ and N₂O flux rates. Results also showed that biochar has the potential to reduce the GHGs and gave better yields of rice than the control. Green urea and orange urea reduced N₂O fluxes significantly ($p < 0.05$) compared to the conventional urea, but no significant differences were found with respect to CH₄ fluxes. The recommended cropping system is *spring rice – summer ratoon – early winter crop* (soybean, maize). This should increase employment opportunities for the farming and poor households of the area, as well as shortening the growth duration of rice in summer cropping systems.

Field demonstrations also showed that Alternate Wetting and Drying (AWD) Irrigation in rice performed better when compared with the conventional paddy system (as control) in Soc Trang and Tra Vinh provinces.

1.0 Introduction

Climate change and variability associated with natural hazards such as flooding, storms and droughts have been a continuous threat to the life and property of Vietnamese society in the past. With its 3,260 km coastline and highly varied geography, Vietnam is highly vulnerable to climate change (Das Gupta et.al 2007; Das Gupta et. al 2010). Rising temperatures, variability in the seasonality of rainfall, and sea level rise are the three main concerns for Vietnam, despite the uncertainty in climate projections. Studies have found that annual average temperatures have increased by 0.5-0.7 °C per decade during the last 50 years according to a report by ISPONRE (2009). Simulations of future climate change in Vietnam show that temperatures will increase further by 0.3 °C to 2.5 °C by the year 2070, significantly impacting on food production (Asian Disaster Preparedness Center, 2003). Shifts in temperature will also lead to more incidences of pest and disease out breaks, and subsequent reduction of yields if not managed properly (Johnston et al., 2010). Sea level rise will have serious implications for Vietnam with its extensive coastline and surrounding lowland areas, leading to salinity intrusion and loss of productive land (Asian Disaster Preparedness Center, 2003). Damage to rice production due to loss of rice land, based on scenarios of climate change for Vietnam, is very serious (MARD, 2009).

In order to invest in the future, Vietnam should make efforts to increase rice production by improving soil, land and water management practices, adjustment in rice cropping patterns through crop rotations with legumes, promoting rice varieties that can mature in shorter periods, tolerate salinity and drought, consume less water and tolerate new pest and disease problems. This is also in line with the Ministry of Agriculture and Rural Development (MARD) strategy to respond to climate change. However, any new adaptation measures have to be simple, help in reducing GHGs, low cost and easily adaptable, since the majority of farmers are small or marginal landholders with low investment capacity and the government does not have adequate resources.



Figure 1. First stakeholder workshop in NamDinh province

2.0 Adaptation and mitigation options identified for scaling up

Identification, evaluation and adaptation of suitable technologies is quite demanding and requires cross-disciplinary research. The ClimaViet project tried to address this challenge by emphasizing the importance of cooperation between scientists from various disciplines and developing a joint work-plan in the first phase of the project. This was followed by discussions with stakeholders to identify the most important challenges due to extreme weather and climate variability. Suitable adaptation measures were identified and then evaluated on farmer fields in real time conditions. Based on the results from 2 seasons, data was analyzed and recommendations on the selected measures prepared. These results and recommendations were later discussed with stakeholders at a workshop in May 2015, where representatives from the province, industry, civil society, farmers, MARD, and scientific institutes participated. The

ClimaViet project tried to involve stakeholders and decision-makers at different stages of the project. This enabled us to identify the most relevant adaptation measures that were prioritized by the stakeholders, and evaluate them in close cooperation with farmers. The selected measures that were evaluated were:

- the performance of five saline tolerant rice varieties under different saline conditions in two coastal districts in Nam Dinh province;
- the impact of slow-release N fertiliser on rice yield and impact of two slow-release N fertilisers on the emission of nitrous oxide in Nam Dinh province;
- the impact of two forms of organic fertiliser, compost and biochar, on rice production, and the estimated affect of these different fertilisers on methane gas emissions, soil fertility and yield in Nam Dinh province;
- the performance of rice-based cropping systems in Nam Dinh province (crop rotation of rice with soybean), including evaluating options for the spring, summer and winter crops in coastal regions;
- the performance of Alternate Wetting and Drying (AWD) Irrigation in Rice and comparison with conventional paddy system (control) in Soc Trang and Tra Vinh province;
- the performance of a new fertiliser regime under both irrigation methods in Soc Trang province; and
- the performance of drought-adapted and salt-adapted varieties under both AWD and conventional paddy systems in Tra Vinh province.

2.1 Key results from the field evaluation and recommendations

i) Salinity tolerance of rice varieties in field and pot experiments

High levels of salinity in irrigation water constrain rice production in the Nam Dinh Province of Vietnam. The extent of genetic variation in the response of rice varieties to increasing rates of salinity needs to be determined, including the critical levels of salinity that cause significant reductions in yield. A pot experiment was conducted to determine the response of five rice cultivars to increased salinity rates and evaluate genetic variation for salinity tolerance.

A rate of 4 g/L was the optimum for evaluating salinity tolerance. The grain yields of TX111 and M15 were equivalent at 4 g/L salinity, despite the higher yield of TX111 in the absence of salinity, indicating a degree of salt tolerance in M15 (Figure 2). In addition, M15 and BT7 have a similar grain yield in the absence of salinity, yet M15 yielded more than BT7 at 4 g/L salinity, indicating a degree of salinity tolerance compared with BT7. No rice yields were harvested at 5 g/L salt levels. The TX111 variety is generally more tolerant to salinity than other rice varieties and preferred by farmers.

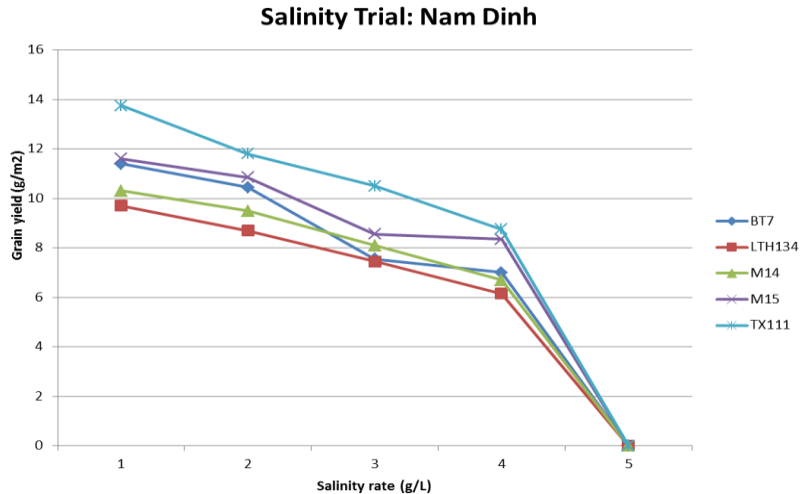


Figure 2. The yield response of five rice genotypes to five rates of salinity in a pot experiment.

Furthermore, the survival rate of plants at salinity levels of 4 g/L varied significantly among genotypes, with survival ranging from about 25% in BT7 to almost 50% in M15 and TX111 (Figure 3).

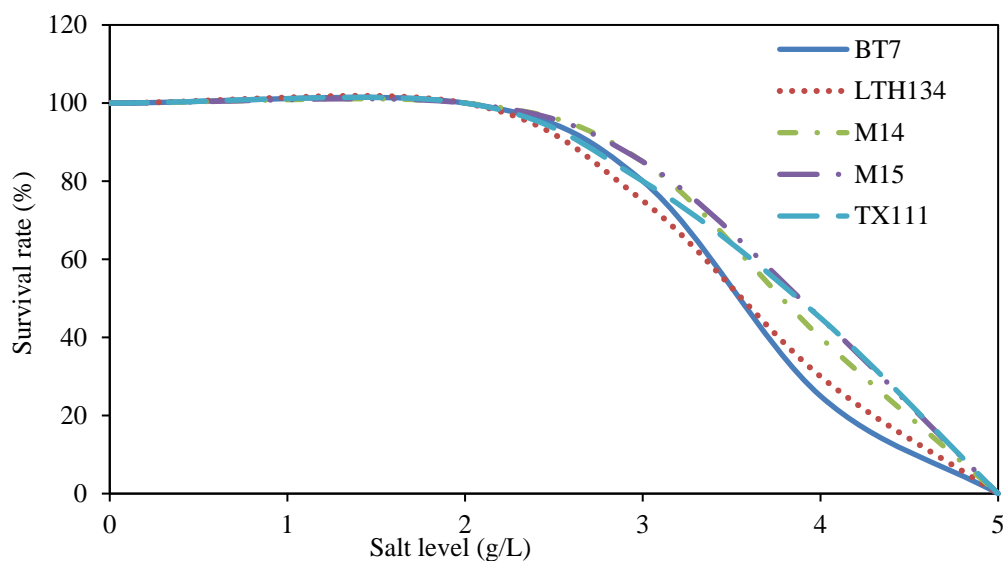


Figure 3. The survival rate of five rice genotypes with increasing levels of salinity.

TX111 (high yielding hybrid) and M15 (VAAS inbred line) produced similar yields across seasons and sites (6.5 and 5.7 t/ha), indicating that some of the VAAS inbred lines produce relatively high yield under saline conditions. Summarising, the key attributes of M15 and TX111 are:

- **TX111** is a longer duration variety, high tolerance to salinity, gives high yields, but the costs of seed is high at present.
- **M15** is high yielding and tolerant to salinity, good taste, low amylose content, high purity rate and high number of filled/ panicle, but, sensitive to blight disease.

More research is required to determine the robustness of the results. There is a need for long-term research programs to develop rice varieties that can tolerate higher salinity levels in the coastal areas of Vietnam and deliver good quality saline-tolerant rice varieties to farmers at cheaper prices.

ii) The impact of slow-release N fertiliser on rice yield

Urea is currently used to fertilise rice crops in the Nam Dinh Province of northern Vietnam. However, the nitrogen use efficiency (NUE) of urea appears to be relatively low in this system. Preliminary studies indicate that slow-release N fertilisers could increase NUE. It is also hypothesized that nitrous oxide emissions may be reduced by using slow-release fertilisers since nitrification, and consequently denitrification, would be reduced. Field experiments were conducted to evaluate the impact of slow-release N fertilisers on rice yield and to assess the impact of two slow-release N fertilisers on the emission of nitrous oxide (Figure 4).



Figure 4. Field trials in Nam Dinh province to measure CH_4 and N_2O emissions from rice grown under three nitrogen regimes.

Results from the field evaluation studies showed that, overall, slow-release nitrogen fertilizer had a positive effect on rice growth and development. Grain yield of two slow-release nitrogen urea treatments (orange and green urea) were significantly higher than the control treatment (Figure 5). The market prices of orange and green ureas are higher than the white urea. However, the rates of the slow-release fertilisers were less compared to standard urea. Slow-release nitrogen fertilisers increased rice grain yield at affordable prices, thereby presenting a viable option to the common white urea. As shown from our field evaluation studies, both the slow-release nitrogen (green and orange urea) reduced N_2O fluxes significantly ($p < 0.05$) less than the normal white urea while no significant differences were found with respect to $\text{CH}_4\text{-C}$ fluxes.

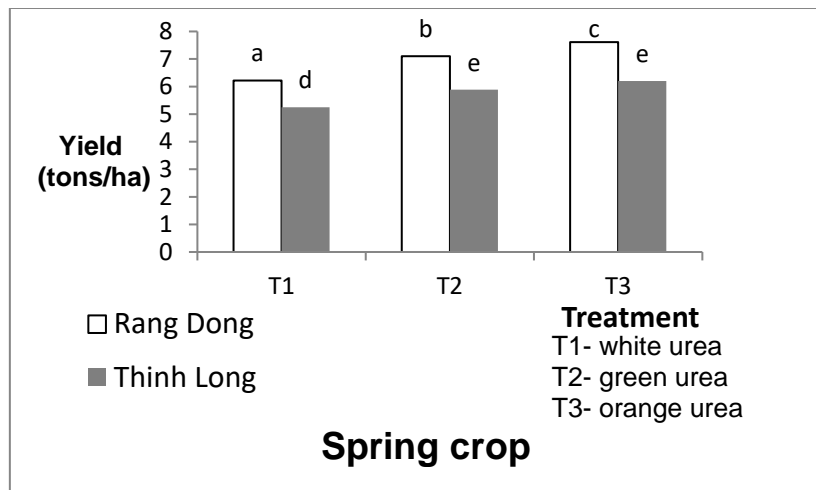


Figure 5. Grain yield of rice grown at two locations under three nitrogen regimes.

iii) Impact of organic fertilisers, compost and biochar on rice yields and methane emissions

The high cost of inorganic fertiliser prevents many farmers from applying fertiliser to rice crops in northern Vietnam. The application of compost and/or biochar could be a cheaper and more sustainable alternative to inorganic fertilisers. In addition, biochar should reduce greenhouse gas emissions compared with nitrogen fertiliser. Field experiments were undertaken to evaluate the impact of two forms of organic fertiliser, compost and biochar, on rice production, and to assess the effect of these fertilisers on methane gas emissions. Ten treatments were evaluated to test combinations of organic and inorganic fertilisers:

- T1: Control (no fertiliser)
- T2: Half standard NPK rate
- T3: Standard NPK (farmer practice)
- T4: Compost alone
- T5: Half standard NPK rate + compost
- T6: Standard NPK + compost
- T7: Biochar alone
- T8: Half standard NPK rate + biochar
- T9: Standard NPK + biochar
- T10: Standard NPK + compost + biochar

The application of compost alone (T4) and biochar alone (T7) gave the equivalent grain yield to the application of half standard NPK rate (T2). Hence individual biochar and compost treatments were equivalent to $\sim 1/2$ NPK (Figure 6). However, the combined application of compost and NPK (T6) gave the highest CH₄ and N₂O fluxes, while the application of biochar alone (T7) gave lowest CH₄ and N₂O flux rates. There was a trend for biochar to reduce methane emissions and for compost to increase methane emissions. The biochar alone treatment showed the lowest ($p < 0.05$) cumulative CH₄ emissions compared to all other treatments. The results indicated that incorporating straw compost might not reduce the GHG emissions and yield-scaled global warming potential of rice production. However, biochar has the potential to reduce the GHGs and enhance yields of rice compared with the control (Figure 6).

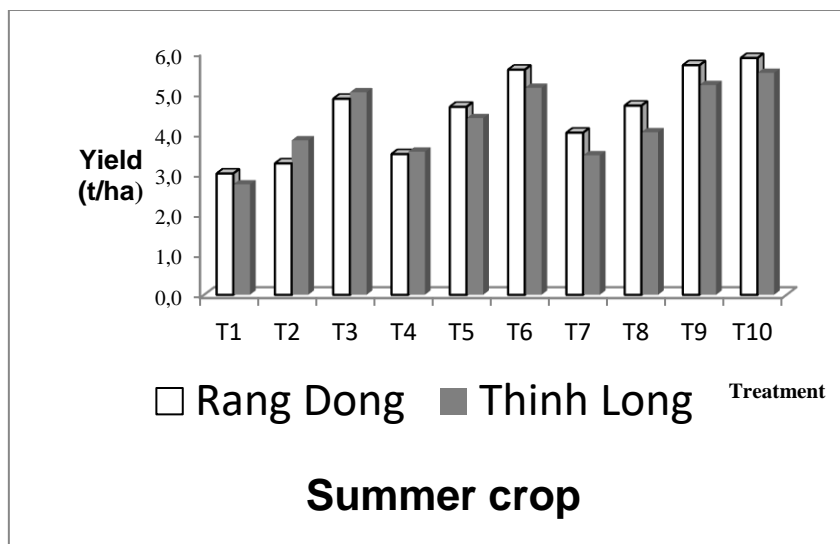


Figure 6. The grain yield of rice grown under 10 combinations of organic and inorganic fertilisers during the summer in two locations (treatments listed in the text above).

Instead of burning the straw and rice residues, farmers should be trained to produce and make use of biochar, which has co-benefits of mitigating GHG emissions and supplementing inorganic fertilisers. The combined application of biochar + green urea could be a viable option to mitigate both $\text{CH}_4\text{-C}$ and $\text{N}_2\text{O-N}$ emissions from rice paddy soils. However, long-term measurements are necessary to confirm the results of the present study which are based on data from only one cropping season. Farmers need training to produce biochar, and also initial investments to set up biochar units, either collectively or individually. Incentives to farmers using biochar should also be considered, as this will encourage farming practices that result in reduced methane emissions.



Figure 7. Instead of burning their compost after harvesting (a), farmers should be encouraged to produce biochar from the compost. Field experiments (b) indicated that biochar reduced methane emissions while compost increased methane emissions.

iv) Performance of summer ratoon crop and crop rotations in Nam Dinh province

In many districts in Nam Dinh, after two rice seasons, farmers often practice winter fallow due to unfavorable irrigation systems, especially in coastal areas. However, three crops can be grown in one year, extending the cropping season in Nam Dinh (Figure 8). The spring rice crop (Jan-Jun) can be followed by a summer rice crop (Jun-Oct) and winter crop (Oct-Dec). Winter crops include sweet potato, maize, potato and other vegetables. Field experiments were conducted to optimise the components of rice-based cropping systems in northern Vietnam, including evaluating options for the spring, summer and winter crops on two soil types.



Figure 8. Farmers in Nam Dinh want to grow three crops per year to increase food security and optimize their economic returns.

The results showed that cultivating a ratoon rice crop in summer enabled farmers to produce winter crops earlier, thereby minimising the difficulties of limited irrigation at the beginning of winter. Soybean and maize are imported every year for livestock feed. Our studies highlighted the potential to produce soybean and maize in winter on rice fields, providing sufficient irrigation water is available. Practicing a summer ratoon crop is one solution to help farmers increase their income and enlarge the area of farming winter crops in Nam Dinh. We recommend modifying the cropping system to include a summer ratoon rice crop and an early winter soybean or maize crop (e.g. *spring rice – summer ratoon – early winter crop*). The economic benefit from this system was higher than other systems tested due to the reduced costs of the summer ratoon rice crop coupled with the increased revenue of the winter soybean crop (Table 1).

Economic effects of cropping systems treatments in Thinh Long 2014

Unit: 1000 VND/ha

Cropping system	Cost				Revenue				Benefit
	Spring rice	Summer rice	Winter soybean	Total	Spring rice	Summer rice	Winter soybean	Total	
T1	28,775.6	26,950.0	-	55,725.6	40,105.0	35,490.0	-	75,595.0	19,869.4
T2	28,775.6	26,950.0	21,960.0	77,685.6	40,105.0	35,490.0	30,000.0	105,595.0	27,909.4
T3	28,775.6	10,861.6	21,960.0	61,597.2	40,105.0	26,780.0	31,500.0	98,385.0	36,787.8

Table 1. Economic effects of cropping systems treatments in Thinh Long in 2014 season (units are 1000 VND/ha). Circles highlight the lower cost and higher revenue arising from T3, relative to T1 and T2.

v) Performance of AWD rice compared with conventional paddy (Soc Trang and Tra Vinh)

Drought and salinity both limit rice yield in the Mekong Delta region of southern Vietnam. Water saving strategies are required in both the wet and dry seasons to conserve water resources.

Total water consumption of the AWD irrigation regime was lower than the continuous flooding (CF) irrigation regime, increasing the water use efficiency of AWD compared with CF. Application of AWD saved 40-50% of seed compared to CF, yet rice grain yield of AWD was the same or higher than CF. However, AWD increased EC of irrigation water in 2014 dry season in Tra Vinh, thereby reducing yields compared with CF. This suggests that AWD should not be applied before the seedling stage (20 days after sowing). The application of AWD in the wet season was difficult due to problems of water drainage as a result of continuous rainfall. Thus AWD is more relevant to apply in the dry season and in drier areas of Vietnam, where water scarcity due to prolonged droughts is becoming a serious problem.

Summary of results from Tra Vinh Province

Compared with the traditional flooded control, applications of water under the AWD irrigation regime were reduced by 1290 m³ water/ha in 2014 wet season, 1031 m³/ha in 2014-2015 dry season, and by 2988 m³/ha in 2015 wet season (corresponding to 37%, 21%, and 41%). Therefore, on average, AWD reduced water use for rice production by 33% compared with CF. Grain yield was not significantly different between AWD and CF in the two wet season experiments, but yield was 12% lower in AWD in the dry season experiment. Overall, there was no difference in grain yield between AWD and CF (5072 vs. 5227 kg/ha), yet water use was about 33% less in AWD.

Water use efficiency for grain production was consistently higher in AWD than CF (1.40 vs. 1.11 kg rice grain/m³ water), representing a 26% increase in WUE under AWD compared with CF. Applying the AWD water-saving technology directly reduced the seeding rate by about

60% (corresponding to 80 kg/ha), reduced N (by 25%) and P (by 25%), and indirectly reduced NH₃, N₂O, CO₂ and CH₄ emissions compared with traditional techniques by farmers.

However in the dry season experiment, the EC of the irrigation water was higher in AWD than CF, and this may have contributed to the lower grain yield in AWD in this season (note that EC was equivalent between both water treatments in the two wet season experiments when there was no difference in grain yield between water treatments).

Recommendation from Tra Vinh Province

- Apply new AWD water-saving technology to reduce the seeding rate by ~60%, reduce crop water use by ~33%, increase the water use efficiency for grain production by ~26%, thereby raising incomes for rice growers in the Mekong Delta.
- Overall, the varieties used in the study are suitable for irrigation using the AWD technology, although new high yielding and salt-tolerant lines should continue to be made available to farmers.
- To optimize grain yield, AWD should not be applied earlier than 20 days after sowing, as this reduces plant density. If possible, the fields should not be unfloded for more than 3 days, and a water depth of 5 cm should be maintained.

Summary from Soc Trang Province

- Application of the AWD irrigation regime generally had little impact on pH or EC of irrigation water, although there was a trend for lower pH and higher EC in AWD compared with CF in the dry season (2013/14) and early wet season (2015) crops (however this did not negatively impact grain yield).
- Application of irrigation using AWD significantly reduced the amount of water in the DS, early WS and late WS seasons, by 1920, 3467, and 545 m³ water/ha/season, respectively. This corresponds to water savings of 36.9%, 45%, and 11.5%.
- Grain yields of AWD were equivalent to CF in all seasons. Hence, water use efficiency of AWD was higher than CF by xx% (DS2013/14), 46.1% (early wet season), and 21% (late wet season).
- In addition to saving water, application of the new AWD technology also directly reduced seed rate by about 60% (corresponding to 80 kg/ha); fertilizer rates by 25% (N) and 25% (P), and indirectly reduced CH₄ compared with traditional techniques by farmers.

Recommendations

Recommend applying the new AWD water-saving technology to consistently increase the efficiency of water use for rice production. It should be noted that the success of this water-saving technology will be dependent on the timely availability of irrigation water to rice farmers.

vi) Performance of new fertiliser regime in AWD and paddy rice (Soc Trang)

Rates of nitrogen (N) fertiliser currently applied to rice fields by farmers are thought to be too high. A number of new technologies (slow-release N fertiliser, CaO placement) could be combined to improve efficiency of nutrient use. Field experiments were undertaken to a)

compare the alternate-wet-dry (AWD) irrigation method with permanent flood (control), and b) evaluate a new fertiliser regime under both irrigation methods.

Two new fertilizer regimes were tested in Soc Trang, under AWD and CF methods: a) the new urea mixed with evaporation inhibitor (Agrotain), and b) new phosphate mixed with fixed phosphate (Avail) by Fe^{2+} ; Al^{3+} ; Ca^{2+} and Mg^{2+} . Rice grain yield of the experiment with new fertilizer doses was equivalent and/or higher the control treatment which applied normal fertilizers, however, the amount of new fertilizer was 25% lower than the normal fertilizer amount, so farmers could reduce cost producing rice. New fertilizers also increased the efficiency of nitrogen and fertilizer phosphorus use, and contributed to reduce GHG emissions (NH_3 , N_2O , CO_2 and CH_4) when applied in AWD method. New fertilizers did not affect EC and pH of irrigation water.



Figure 3. Farmer-led field trial evaluations in Soc Trang

vii) Performance of drought and salt-adapted rice varieties under AWD and paddy systems.

Drought and salinity both limit rice yield in the Tra Vinh province of southern Vietnam. Water saving strategies are required in both of the wet season crops to conserve water resources (there is too little water for a dry season crop).

Five inbred rice varieties selected by Cuu Long Rice Research Institute (CLRRI) were tested under AWD and CF irrigation regimes: OM9921, OM9605, OM178, OM232, OM9577. These varieties had a short growth duration (90 – 95 days), and were adapted to the saline and drought conditions in wet seasons in Tra Vinh province. In the 2015 wet season, the grain yield of all tested varieties in AWD (5.23 tons/ha) was higher than in CF (4.99 tons/ha). Three varieties exhibited high grain yield in both tested seasons: $\text{OM9921} > \text{OM232} > \text{OM9605}$. Although these varieties had high-quality taste, more studies are required to evaluate their drought and saline tolerance under vulnerable conditions of Cuu Long River Delta due to climate change.

3.0 Table of investment options for scaling up selected adaptation measures

	Selected CSA measures	Measures needed	Stakeholder capacity	Finances	Policy	Constraints
1	Saline tolerant rice varieties.	Quality seeds with higher saline tolerance levels to be screened and made available at affordable prices.	a) Research capacity to screen large numbers of rice genotypes for salt tolerance, b) seed production systems to be financed and monitored, and c) PPP to be strengthened.	Generate climate finance through private and public sources.	Policy to support research programs to develop saline tolerant rice varieties exist. But they need to be improved and put into implementation	a) High throughput screening methods for salt tolerance may not exist, b) current prices of seeds in the market are high and not affordable, and c) lack of finance to support HTP screening methods and seed research and development.
2	Slow release nitrogen fertilisers.	Slow-release green and orange urea with higher NUE made available at affordable prices.	a) Research capacity to screen the response of key rice genotypes in key target environments throughout Vietnam, b) encourage private companies to develop even better slow-release fertilisers, and c) strengthen PPP.	Generate climate finance through private and public sources.	Develop policies that a) supports research programs that evaluate slow-release fertilisers, and b) encourages the private sector to invest in developing more efficient fertilisers.	a) Slow-release fertilisers may not be available or affordable to smallholder farmers in Vietnam, and b) the private sector may not have enough incentives to invest in this area.
3	Alternative soil fertility management measures and reducing GHG emissions.	Efficient and cost-effective methods of producing biochar from rice compost.	a) Research capacity to develop improved biochar production methods, b)	Generate climate finance through private and public sources.	Develop policies that a) supports research programs that evaluate biochar production	a) Biochar production methods may not be available or affordable to smallholder

			encourage private companies to invest in these technologies, and c) strengthen PPP.		methods, and b) encourages the private sector to invest in developing more efficient biochar production systems.	farmers in Vietnam, and b) the private sector may not have enough incentives to invest in this area.
4	Performance of summer ratoon crop and crop rotations.	a) Irrigation facilities need to be improved, and b) existing irrigation canals have to be repaired.	a) Awareness of farmers needs to be improved, and b) economic data (e.g. commodity prices) need to be available to help farmers choose which cropping options are most viable.	More investments to improve irrigation infrastructure	Develop policies that enable irrigation infrastructure to be built and maintained.	a) Farmers cannot benefit from improved rotations if irrigation infrastructure is limiting.
5	Alternate wetting and drying system of irrigation in rice.	a) Irrigation facilities need to be improved, and b) existing irrigation canals have to be repaired.	a) Awareness of farmers needs to be improved, b) skills of farmers to manage AWD may need to be improved, and c) research capacity to develop improved AWD systems.	a) More investments to improve irrigation infrastructure and b) generate climate finance through private and public sources.	a) Develop policies that enable irrigation infrastructure to be built and maintained, and b) develop policies that supports research into AWD.	a) Farmers cannot benefit from AWD if irrigation infrastructure is limiting.
6	Performance of alternative fertiliser regimes in AWD and paddy rice (Soc Trang and Tra Vinh)	a) Alternative fertiliser regimes made available at affordable prices, and b) existing irrigation canals have	a) Awareness of farmers needs to be improved, b) skills of farmers to manage AWD may need to be improved, and c) research	a) More investments to improve irrigation infrastructure and b) generate climate finance through private and	a) Develop policies that enable irrigation infrastructure to be built and maintained, and b) develop policies that supports research into improved	a) Farmers cannot benefit from AWD if irrigation infrastructure is limiting.

		to be repaired.	capacity to develop improved fertilisers for AWD systems.	public sources.	fertilisers for AWD.	
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Source: field data from ClimaViet and stakeholder workshops in Nam Dinh, Soc Trang and Tra Vinh (2014-2015)

4.0 Gender mainstreaming in scaling up and scaling out adaptation measures

A majority of rural households in Vietnam are rice farmers where men are the household heads and the landowners, and in general more educated than women. Both male and female farmers perceive the existence of climate change and variability and recognize its adverse impacts on crop production, animal husbandry, and fishing, as well as other household activities. Low crop yields, and even occasionally total crop losses are rated as the major impacts, leading to increased debt and food insecurity.

Women not only perform the same tasks as men in farming traditionally but also contribute to seed preparation, replanting, hand weeding, removing off types, drying and sacking. Our study showed that womens' workload in recent years has increased more than that of men due to climate variability and frequent extreme weather events. It was found that male farmers are more likely than female farmers to adopt technologies that can reduce vulnerability to climate change. These technologies included the use of stress-tolerant crop varieties; planting of early, medium or late varieties to avoid crop loss to variations in presence of drought/salinity; pest and disease management techniques; and development and use of crop varieties resistant to pests and diseases. Whereas, women farmers tend to be careful in adopting new technologies, This is partly due to the fact that women in general lack adequate information about how to cope with agriculture under climate variability. Given the important role of women in agriculture in Vietnam in general and rice farming in particular, rural extension should target women farmers while developing extension and capacity building programs related to agriculture adaptation and climate change. Moreover, mitigation measures should address the needs of both men and women, and ethnic people living in the areas affected by climate change.

5.0 Conclusions

Vietnam is one of the most vulnerable countries to climate change and variability associated with extreme events such as flooding, storms, droughts, increasing temperature, sea level rise and salinity that will be a continuous threat to the life and property of Vietnamese society. A majority are smallholders, highly vulnerable and without the capacity to invest much in adaptation. Thus any new adaptation or mitigation measures have to be simple, low cost, help in reducing greenhouse gases (GHGs), and easily adaptable.

For adaptation and mitigation to succeed, firstly, proper institutional structures, including inputs are needed, farmer and stakeholder capacity at the commune, district and provincial levels has to be strengthened, barriers to scaling-up reduced. Secondly, effective climate-resilient technologies have to be demonstrated on farmer fields, closely involving farmers, as demonstrated in the ClimaViet project. Third, policies have to provide enabling environments for scaling-up. The country has to prioritize short-term and long-term measures for scaling-up.

Funds from public and private sources have to be generated to support the scaling-up of promoting climate smart/resilient agriculture technologies. Active stakeholder integration is a necessary factor where the authorities, farmers, scientists, civil society and industry are working closely in the process. Knowledge transfer has to be done both through linear and non-linear extension models that will be more effective in providing timely and complete knowledge to farmers and stakeholders.

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