Working Paper Series

This working paper forms part of the ACIAR Project AGB/2012/061
Improving smallholder farmer incomes through strategic market development in mango supply chains in southern Vietnam

Activity: **A2.5 Intervention feasibility analysis and validation study**

Date: June 2021

Prepared by: Dinh Huu Hoang, SCAP

Alec Zuo, The University of Adelaide

Contents

Summary

Vietnam has a mango plantation area of 105,000 hectares with an annual output of approximately 1 million tons (ranked the 13th in the world). The majority production areas are in the southern part of the country, mostly in the Mekong Delta, witnessing an everage growth rate of 6 % in plantations over the last decade. and owned by 90% smallholder farmers. However, smallholder famers who account for 90% of the growers are dealing with low income from mango production due to an estimated post-harvest loss of 40%, wastful/inappropriate fertilizing technology and price fluctuations between harvest peaks and off-seasons. This study addresses the current production pitfalls by implementing three technical on-farm interventions namely fertilization, flowering manipulation and sap-burn removal. The experiments were carried out on 12 farm households in Tien Giang and Dong Thap provinces. A qualitative impact assessment for each intervention was conducted during and after experiment and harvest, as well as along the domestic supply chains (for sap-burn removal only). We found that [to be completed when the assessments are done]

Introduction

Vietnam has a mango plantation area of 105,000 hectares with an annual output of approximately 1 million tons (ranked the 13th for its mango production in the world). The majority production areas are in the southern part of the country, mostly in the Mekong Delta.

Tien Giang and Dong Thap, the two research areas of this project, are the two major mango production provinces in the Mekong Delta (Table 1).

Table 1. Mango production in the Mekong Delta

Province	2018			2019		
	Area (ha)	Yield (ton)	Productivity (ton/ha)	Area (ha)	Yield (ton)	Productivity (ton/ha)
Đong Thap	10.168,6	105.712,0	10,4	11.395	114.581	10,1
Tien Giang	4.255,0	101.842,4	23,9	5.934	91.748	23,3
An Giang	10.246,6	136.184,9	13,3	11.178	164.523	14,7
Vinh Long	4.899,0	59.257,1	12,1	5.045	65.164	12,9
Soc Trang	2.048,0	14.055,0	6,9	2.093	21.133	10,1

Source: GSO (2020)

Currently, most of the mago plantations are under the conventional cultivation techniques. Over the last year, the extension service development has contributed to the GAP practice at both the national and global standards. The total area of GAP mango cultivation is more than 1500 hectares. It is estimated that 95% of mango area are being cultivated by smallholder farmers. Thus, the adoption of modern technologies in both cultivation and harvesting is slow. Currently, there is a great concern of overusing of fertilizers for mango cultivation in the Mekong Delta. This not only is unhelpful for farmers to obtain optimal yields but also causes extra costs for farmers, and eventually results in the lower net profit for mango farmers. Overusing of fertilizers and chemicals also the main cause of increasing amount and varieties of pests and plant diseases and pollutes the environment.

Currently post-harvest losses have different types, causes and scales with an a loss rate estimated to be up to 40%[1]. Sap burn injury is one of the major postharvest disorders that causes postharvest losses and reduces storage life and market demand of the fruit. It causes skin blemish, brownish-black to black streaks or blotches on the mango skin due to its acidic nature, and render the fruit susceptible to microbial infection. This damage is not acceptable for consumers – particularly with respect to export market and domestic super markets.

In addition, farmers are also encountering price fluctuations between the harvest peak and off-season. Many farmers have been manipulating their mango trees into producing two crops each year. The first crop is produced between March and May, and the second in December-January. Off season production is difficult to achieve due to unfavourable weather conditions during the flowering and fruit development periods. The adverse effect of climate change exacerbates plant diseases, particular at the flowering stage, causing low fruiting rates, which in turn decreases fruit yield. Flowering and fruiting processes occur at different periods within an orchard or even on the same tree. Therefore, synchronization of these processes can save costs from multiple harvests.

This activity is to undertake financial, economic & business feasibility analysis on three on-farm interventions, namely *fertilization, flowering manipulation and sap-burn removal*. Ex-post impact assessments will be conducted for each of the interventions to answer the following research questions:

- What are each of the intervetions' impacts on input cost saving, mango loss reduction, productivity increase and output quality improvement that will improve returns directly related to smallholder incomes?
- Which intervention has the most cost-effective and positive impacts on cost, losses, productivity, and quality, leading to improved price and farmer incomes?
- What are the barriers for smallerholder farmers to adopt the intervention practices and what factors can facilitate their adoption?

Method

Implementation and impact objectives will reflect the choice of research locations. The project works in areas with a very large concentration of growers and other chain participants. There is also scope for collaboration with lead firms based in other areas in South Vietnam. Such firms may offer sound opportunities for testing and promoting specific chain innovations. For this reason, selection of private sector partners in the supply chain will be largely based on opportunity, not location.

[1] Le Thi Oanh, 2009.Study on the Anthracnose fungi treatment and application of Canauba manufacture product on Cat Chu Mango, Master Thesis, Hanoi Agriculture University.

Design and data collection

The study was carried out with 12 farmers in Tien Giang and Dong Thap provinces, 4 households for each of the experiments on fertilizering, flowering and sap-burn. Each experiement was implemented on 24-30 trees.

a. Fertilizing experiment:

- Control experiment ao (conventional): farmers just do what they have been doing so far: 1 tree/1 exp, 5 rep
- Experiment a1: decrease 25% of N and P, keep K as usual : 1 tree/1 exp, 5 rep
- Experiment a2: decrease 50% of N and P, keep K as usual : 1 tree/1 exp, 5 rep
- Experiment a3: decrease 50% of N and P, keep K as usual, and supplement Ca: 1 tree/1 exp, 5 rep

Currently, as agreed between Peter and SOFRI: there will be 5 rep but in the future, can be 6 replications if needed.

b. Flowering experiment:

- Control experiment bo (TG_Hoa Loc): conventional: farmers just do what they have been doing so far (Paclobutrazol treatment): 1 tree/1 exp, 5 rep
- Experiment b1 (TG_Hoa Loc): KNO3: 1 tree/1 exp, 5 rep
- Experiment b2: (TG_Hoa Loc): Thiourea: 1 tree/1 exp, 5 rep

These experiments will be carried out in Dong Thap for both Hòa Lộc mango and Cát Chu mango. So they are: bo (DT_Hoa Loc), b1 (DT_Hoa Loc), b2 (DT_Hoa Loc) and bo (DT_Cat Chu), b1 (DT_ Cat Chu), b2 (DT_ Cat Chu). In total there will be 45 tree for flowering experiment.

c. Sapburn experiment:

- Control experiment co: conventional: farmers just do what they have been doing so far: 1 rổ (plastic basket, about 53 kg), 3 rep (equivalent to 3 baskets)
- Experiment c1: applied SIAEP1, 2.5g/liter water, then dip all the whole mango basket in the solute tank : 3 rep for 3 baskets of mango

Semi-structured in-depth interviews will be conducted to assess the three interventions. In addition, since the impacts of sap-burn intervention will be beyond the mango farms, we also interview pack houses and wholesale markets which involve in the treated mangoes trading of the supply chain.

The basic items to be collected from the in-depth interviews include the following:

- General info: area, density, cultivar, tree age
- Input (what type, when, how much/unit price): labor, fertilizer, watering, pesticides, weeding, thinning
- Process change: dormancy, flowering, fruit development, harvesting (how and to what extent)
- Output: yield, quality (size, color,), price
- Applying the intervention: usefulness (strength, pitfall), level of difficulty, extent of success of applying the intervention, whether households continue (and what need to be improved if continue), suitable to households resources (labor, financial, accumulation…), willing to introduce to other households in the commune, district? How household capacity improved after the intervention?
- Household income: percent yield/price increase/decrease (to what extend and why). Extent of income gain/loose/diversify (to what extend and why). Household bargaining power, level of overall satisfaction, perception.
- Social and environmental impact of the intervention

Information to serve the economic analysis and product/price change survey at pack-house and wholesalers along the supply chains.

- Input cost, output prices
- Prices at farmgate, 1st trader (local), 2 traders (if any), wholesalers.

Results and discussions

Impact of technical intervention for mango production in the Mekong Delta

1. **Sap-burn**

Economic impact (and cost-benefit analysis)

Social and environmental impacts

2. **Fertilizing**

Economic impact

Social and environmental impacts

3. **Flowering**

Economic impact

Social and environmental impacts

4. **Non-economic barriers for farmers to undertake the interventions**
5. **Prospects for value chain provement**

Conclusion

Insights and next steps

Key insights:

Next steps:

The research team of the project may consider the following research gaps for future research and activities:

- Current impact assessment is only at the farm-gate and the local buyer levels. We do not know how the intervention results (treated mango) are welcomed by end users i.e consumer preferences for quality of treated mango, the loss percentage during transportation and storage, shelf life (#days in the super market), how much more buyers along the supply chain are willing to pay more to farmer, which need to be investigated in the future.
- Taiwan and Australian mango varieties are popular now in Vietnam but the technical and socio-economic evaluations of domestications of these mango varieties should be studied in the future.
- When time and budget allow, it is recommended to conduct quantitative impact assessments for future interventions on larger scale.
- With already successful experiement, the next phase of the project is to scale up, promote and organize training with local Extentions Services.

References

Mazhar, M.S., M. Amin, A.U. Malik, J. Campbell and P. Johnson, 2011. Improved harvest and desapping practices affect mango fruit quality along the supply chains. Int. J. Agric. Biol., 13: 776–780

Elauria, Marilyn M.; Manilay, Alessandro A.; Abrigo, Girlie Nora A. 2016. Adoption and Socio-Economic Impacts of the Pre-Harvest Disease Management Technology for Carabao Mango in the Philippines, *Journal of Economics, Management & Agricultural Development* (JEMAD), p.1-14.

Muriithi, B. W., Diiro, G. M., Affognon, H., & Ekesi, S. (2016). Economic Impact of Integrated Pest Management Strategies for the Suppression of Mango-Infesting Fruit Fly Species in Africa. Fruit Fly Research and Development in Africa - Towards a Sustainable Management Strategy to Improve Horticulture, 755–770.

Tran Thi Kim Ba, Nguyen Bao Ve and To Tuan Nghia. 2006. Reduction of the sap burn on fruit skin in mango cultivars Cat Hoa Loc by using chemicals. Scientific Research Magazines, Can Tho University, 2006:5 68-75

Bosquez, E, S. C Figueroa, J. Dominguez, L Perez, C. Kerbel and F. Diaz-de-Leon, 2000.Sapburn control by the appication of different chemical compounds in Mexican Mango fruit with exportation quality. Acta Horticulturae 509: 687 - 694.

Lim, T. K and W. Kuppelweiser, 1993. Mango sapburn amelioration in the Northem Territory; Acta Horticulturae 341: 518 - 527.

Loveys, B. R, S. P. Robinson, J. J Brophy, and E. K. Chacko 1992. Mango Sapburn: components of fruit sap and their role in causing skin damage. Australian Journal of Plant Physiology, 19: 449 - 457.

O'Hare, T. J. 1994. The susceptibility of Thai and Australian Mango Cultivars to Sap Injury and Possible Means of Control. Development of Postharvest Handling Technology for Tropical Tree Fruits. ACIAR Proceedings No.58

Appendix 1: Checklist for collecting information for impact assessment

ACIAR project

"Improving smallholder farmer incomes through strategic market development in mango supply chains in southern Vietnam"

CHECKLIST

Intervention feasibility analysis and validation study

Date of interview: **Interview team:**

Name of Household HEAD:

Name of the interviewee and relation to household head:

Address:

Farm code (location, team, farm):

Major productions:

I General information: (this part applied for 3 experiments)

1. How many hectares of mango do you currently have? …….

2. When did you planted your mango garden?

……..

So the current age would be …….(N) Are there any difference of age classes of your mango garden? ……..

If YES, what are the other age classes?.....

3. What is the density that you planted? ……
   What was the successful rate that leads to stable growth after planting? …….

4. What is the name of seedling (cultivar) that you are planting? ……..

Are they homogenous or did you intercrop with other cultivars?

……..

……..

5. Inputs: (this part applied for 3 experiments)

……..

……..

5a. **What kind of fertilizer and chemical inputs that you invested <u>before</u> the intervention for your mango garden?**

Type of fertilizer	Kilograms	Unit cost (VND/kg)	Total amount (kg)	Total (VND)
N				
P				
K				
Ca				
Others …….				
Total for fertilizer				
Pesticides				
Herbicides				
Flowering stimulus				
Total				

5b. What kind of other inputs in addition to fertilizer and chemical that you invested before the intervention for your mango garden?

Type of inputs	Material cost	Labor cost		Total (VND)
		Unit (VND/day)	No. of days	
Fertilizer	**Already asked**			
Pesticide				
Herbicide				
Flowering stimulus				
Weeding				
Thining+Pruning				
Watering				
Fruits cover				
Harvesting				

6a. What kind of fertilizer and chemical inputs that you invested after the intervention for your mango garden?

Type of fertilizer	Kilograms	Unit cost (VND/kg)	Total amount (kg)	Total (VND)
N				
P				
K				
Ca				
Others …….				
Total for fertilizer				
Pesticides				
Herbicides				
Flowering stimulus				
Total				

6b. What kind of other inputs in addition to fertilizer and chemical that you invested after the intervention for your mango garden ?

Type of inputs	Material cost	Labor cost		Total (VND)
		Unit (VND/day)	No. of days	
Fertilizer	Already asked			
Pesticide				
Herbicide				
Flowering stimulus				
Weeding				
Thining+Pruning				
Watering				
Fruits cover				
Harvesting				

Extra questions for fertilizing experiments:

7. Do you think the conventional fertilizer application before applying the the intervention is appropriate? ……

Why ……

……..

……..

8. Do you think it is wasted/unneccessary to keep the conventional fertilizing? ……

Why……

9. Do you think we should reduce the amounts of fertilizer? ……. If yes……..

Why……

10. What kind of fertilizer can be reduce without having impact on fruit quality and quantity?

……..

……..

……..

……..

11. How much do you save/spend more from decreasing/increasing the amount of each fertilizer of the intervention to compare with the conventional fertilizing formula?

N ……

P……

K……..,

Others……

6. Process changes: (this part applied for 2 experiments of SOFRI)

12. What do you observe/to what extents about the process changes when appling SOFRI's fertilizing/flowering?

a. Dormancy…….

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

b. Flowering…….

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

c. Fruit development……

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

d. Harvesting……

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

Do you think the harvest time is different from the conventional one?.....If YES, sooner or later……

Why do you think that the harvest is sooner or later……

e. Others (may be some change in the fruiting period, longer or faster)……

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

7. Output: (this part applied for 2 experiments of SOFRI)

13. Do you observe that the following change due to SOFRI's experiment?

a. Yield of mango……

How……Increase/Decrease……..To what extent……..

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

b. Size of mango…….

How……Increase/Decrease/Stay the same……..……..To what extent……..

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

c. Color of mango……

How……Look nicer……..……..……..

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

14. How did you sell you're your mango coming from the SOFRI's experiment? …….

As normal as the conventional cultivation? Easier/more difficult.....

Why……..

Higher/lower prices?.....

Why……..

Do you think this is due to SOFRI experiment (and why?)…….

……..

For sap-burn experiment

15. How the fruits look like after the treatment? Is sap still comes out from stalk?

……..

Why do you think so……

Do you think this is resulted from the treatment by SIAP? And why?……

……..

……..

16. Did you sell treated mango easier/more difficult?

……..

……..

17. Did you sell the treated mango with higher/lower price?

……..

……..

8. Applying the intervention: (this part applied for 3 experiments of SOFRI)

18. You agreed to participate in the intervention, why do you think (the intuition behind) this intervention is important for mango farmers like yours?

……..

……..

19. What are the strengths and pitfalls (weaknesses) of this intervention?

Strenths……

Why? ……..

Weaknesses…….

Why? …….

20. Do you think that this experiment is easy/difficult/risky to implement?

Easy……

Why?.....

Difficult ……..

Why? ……..

Risky ……..

Why? ……..

21. How do you rate the level of success of this experiment (from 1-100% successfulness)?

Why……

22. Do you believe if correctly applied, the intervention will generate positive impact to the farm?

Yes……

Why and to what extent?……..

No…….

Why and to what extent?……..

23. Will you continue this experiment in the future?

Yes……..

Why? ……

No……

Why? ……..

24. Can you do it yourself for the next rotation?

……..
……..

If you can not do it, why?

……..
……..

In case you want to do the experiment again, but you can not implement, what kinds of support is needed?

……..
……..

- ☐ 1. Financial supports
- ☐ 2. Technical supports
- ☐ 3. Market Access
- ☐ 4. Community support
- ☐ 5. Other (specify)

25. Is this experiment suitable to your family condition (Labor, financial, accumulation..)

……..

……..

26. Do you think you learn tremendously (household capacity improved) after involving in this intervention?

If yes, to what extent? ……..

Any specific skill/knowledge that you mastered ……..

……..

27. Do you think the bargaining power of your family overally improved as a result of involving in this experiment?.....

……

To what extent? (Not at all, not much, relatively, very much)…….

28. Are you willing to introduce this intervention to other households in the region?.....

Why……

Part 5: House income (For all interventions)

Ask the following questions:

	29. Cost reduction/increase/stay the same *(due to decreased costs of fertilizer and time)= A*	***30.* Yield increase/decrease/stay the same = *B***		**Overall income gain/loose/stay the same =*A+B***
Increase				
To what extent?				
Why?				
Decrease				
To what extent?				
Why?				
Stay the same				
To what extent?				
Why?				

31. What is your expected income change if the intervention produce the intended outcome?

……..
……..

32. Do you think you are overally satisfy with this intervention?

Satisfy……to what extend? ……

Why?.....

Not satisfy……to what extend? ……

Why?.....

Other thinking?.....

Question for sap-burn experiment:
You know that sap-burn intervention might result in higher mango price to do reducing transportation and storing losses, mango can be kept longer in car/train or supermarkets, with this advantages:

33. Do you think that you can sell mango with higher prices?

If Yes, why……

And to what extent should you sell higher?.....

If No, why……

…….....

34. With this intervention, do you think that you can enhance your bargaining power to get higher prices?

If Yes, why……

If No, why……

Griffith Agribusiness

Griffith Asia Institute
Griffith University South Bank campus
Brisbane Queensland 4101

Email: agribusiness@griffith.edu.au

griffith.edu.au/asia-institute/our-research/agribusiness