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The contribution of root and tuber crops to enhanced resilience to climatic shocks: the case of super-typhoon Ompong in the Philippines

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INTRODUCTION

- Extreme weather events are increasingly frequent, likely linked with climate change. In the Asia-Pacific, typhoons have become recurrent events, with devastating impacts on livelihoods, especially for rural households (HHs) who largely depend on agriculture.
- Typhoons affect food security as crops are damaged, resulting in less food available for consumption and sale. Reduced mobility and limited market access can result in further income cutback and inability to purchase other food items.
- Root and tuber crops (RTCs) are second in importance to cereals as global sources of carbohydrates. Many of the world's poorest producers and consumers depend on RTCs for food, nutrition and income. Potato, sweetpotato, and cassava rank among the top ten food crops produced in LMICs.
- RTCs are key components of agri-food systems in the Asia-Pacific, particularly in hill and coastal areas which are among the most exposed environments to climate change. They are often grown in mixed-farming systems and/or in in less productive and marginal lands.
- Sweetpotato and cassava are considered 'climate-proof' crops because of their broader adaptation to different environments, drought and heat tolerance, perennial character allowing flexible planting and harvesting times (including piece-meal harvesting), short growing-cycle (particularly sweetpotato) and in-ground storability (particularly cassava).

RATIONALE AND OBJECTIVE

Broad consensus exists on RTC contribution to the agri-food systems' resilience to long-term effects of climate change. However, there is striking paucity of evidence on how RTCs can contribute to household resilience and how these crops are used strategically to prepare, cope with, and recover from climatic shocks. This study aims at addressing this gap using, as case study, cassava and sweetpotato in the context of super-typhoon Ompong that wreaked havoc in the northern parts of the Philippines in 2018.

TYPHOON OMPONG (MANGKHUT): FACTS & FIGURES

- Landfall in North and Central Luzon: September 15, 2018.
- Strongest typhoon to hit the country since Haiyan (Yolanda) in 2013.
- 4-day rainfall with record 535mm rainfall in a single day.
- 800,000 HHs affected, 82 persons killed and 138 injured, mainly due to landslides.
- Estimated USD 493mln damage on agriculture only.

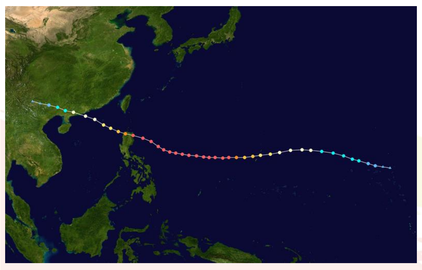
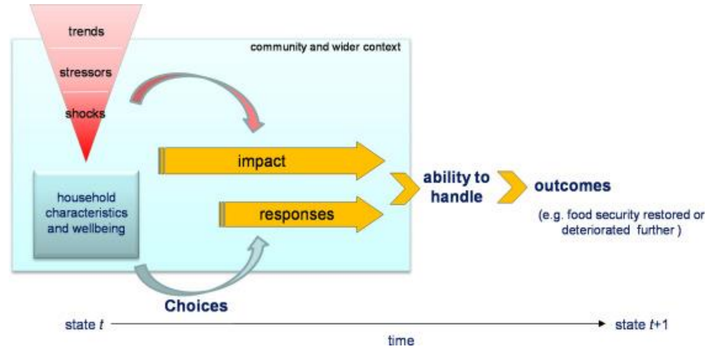


Figure 1 - Track map of Ompong. Points show 6-h intervals. Colors represent wind speeds (red is max category 5 with speed ≥252km/h). Source: Meow (2018)

Photo 1 - A field affected by typhoon with broken trees and barely damaged sweetpotato plants which still stand green and robust

CONCEPTUAL FRAMEWORK



Rather than investigating resilience as a whole, we focus on two important aspects:
(1) Resilience capacity: the attributes, characteristics, and "capitals" HHs rely on when they are hit by shock – Did RTCs contributed to enhanced HH resilience capacity?
(2) Responses which were applied in the aftermath of a shock – How RTCs influenced HH responses?

MATERIAL AND METHODS

- 423 HHs surveyed in Feb-Mar 2019 in Apayao and Kalinga provinces in the Cordillera Administrative Region (CAR) of Luzon.
- Disaster responses were estimated by using a multivariate probit model:

$$Resp\_X_{ij} = \beta_j\, Crop_{ij} + \gamma_j X_{ij} + \delta_j Tattribute_{ij} + \varepsilon_{ij}$$

- Propensity score matching (PSM) techniques used to control for endogeneity.

RESULTS

Typhoon impacts

Table 1 – Typhoon duration indices experienced by respondents

Variables	Obs.	Mean	Std. dev.	Min	Max
Strong wind and heavy rainfall (# days)	423	2.57	1.21	1	5
Field flooded (# days)	130	4.04	3.02	0.5	10
Landslides (#)	144	1.19	0.57	1	4
Reduced mobility (# days)	226	3.96	2.77	1	24

Table 2 – Crop cultivation and crop losses

Crop	Share of farmers growing crops (%)	Share of farmers reporting crop loss (%)	Crop lost among affected farmers Mean (std dev)
Rice	75	97	0.51 (0.25)
Maize	37	92	0.48 (0.28)
Banana	43	95	0.77 (0.32)
Cassava	28	18	0.15 (0.35)
Sweetpotato	39	14	0.08 (0.24)
Taro	37	19	0.12 (0.29)
Yam	6	26	0.22 (0.41)

HH responses to typhoon

- HHs applied various short and long-term responses in the first 4 weeks after Ompong.
- Only few HHs sold assets (3%), took out loans from financial institutions (6%), or ate more limited variety of foods (5%), smaller portions (2%) or fewer meals (2%).
- Luckily, most rice was already harvested. However, change in food consumption was observed.
- About 60% of HHs planted sweetpotato and 50% cassava, including farmers not growing these crops when Ompong landed. Resource-poor HHs were more likely to do so.
- HHs growing sweetpotato or cassava resorted to asking neighbors/friends for assistance significantly less than HHs who were not growing these crops.
- HHs growing sweetpotato resorted to savings for recovery significantly less than others.

Table 3 – Household responses to typhoon by crop category

Proportion of farmers adopting responses	Total (n=423)	SP-only (n=136)	C-only (n=89)	No SP & no C (n=167)	T-test	
		(1)	(2)	(3)	(1) - (3)	(2) - (3)
Consume more sweetpotato	0.376	0.838	0.112	0.126	***	
Consume more cassava	0.189	0.118	0.483	0.042	***	***
Plant sweetpotato	0.586	0.404	0.596	0.701	***	**
Plant cassava	0.489	0.412	0.517	0.508	**	
Use savings	0.234	0.169	0.269	0.275	**	
Assistance from neighbors/friends	0.267	0.213	0.236	0.323	**	*

Notes: ***statistically significant at P<0.01; **statistically significant at P<0.05; *statistically significant at P<0.1
SP: sweetpotato; C: cassava

CONCLUSIONS

- Our findings show that RTCs, through their dual characteristics of (a) being underground crops and (b) having short growing cycle, contribute to build the resilience of HHs to typhoons, allowing them to be better prepared and to bounce back faster and better.
- This is achieved through two distinct but complementary impact pathways:
  1) First, RTCs are less impacted by strong winds and heavy rainfalls than above-ground crops. The low growing habit of sweetpotato makes this crop particularly able to withstand typhoons. This means that HHs can still largely harvest undamaged food crops for own consumption, and/or sale after being hit by a typhoon. Therefore, growing RTCs contributes considerably to HH resilience capacity and, as shown by our results, can drastically reduce the need to apply other, more detrimental, responses.
  2) Second, the short cycle allows HHs who plant RTCs after a typhoon to quickly access food, thus contributing to short-term food security and longer-term recovery, particularly for the more-resource poor HHs. Less intensive management and input requirements can also play an important role in the aftermath of a shock as these characteristics allow HHs to free-up resources for the recovery process.
- Our results complement other studies, which stress the general importance of crop diversification for resilience, by suggesting a specific crop choice for designing effective agriculture interventions which can increase HH ability to cope with and recover from climatic shocks.

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