seed madagascar
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A Report for

PROJECT SAKONDRY

Building agricultural capacity to reduce food insecurity through household insect farming in southeast Madagascar: Monthly monitoring survey results

June 2022

Introduction

Madagascar, the second largest island nation in the world, has witnessed dire socioeconomic conditions in recent years. Facing the worst drought since 1981 and further exacerbated by disruptive effects of the COVID-19 pandemic, nearly 70% of its population lives below the poverty line, half of whom are undernourished (World Food Program (WFP), 2021). In Madagascar's Deep South, the long lasting impacts of chronic drought, coupled with low agricultural productivity and the socioeconomic effects of COVID-19 have led many communities to experience food insecurity and malnutrition (ACAPS, 2022). Women and children in particular are disproportionately affected and vulnerable to hunger, which often contributes to a surge in life threatening incidences of malnutrition and stunting (UN News, 2020). Additionally, in rural communities across Madagascar, livelihood opportunities are limited, with a majority of households relying directly on natural resources including subsistence farming and small-scale fisheries.

Madagascar is rich in species of edible insects, which constitute a common dietary practice in rural areas of the island. This practice, however, occurs mostly sporadically throughout specific seasons and so far with few efforts to systematically farm edible insects (Randrianandrasana & Berenbaum, 2015). Dr. Cortni Borgerson, who works in the northeast of Madagascar, has successfully implemented an insect farming project utilising s*akondry,* a local insect of the *Zanna* genus (Borgerson et al., 2021). According to her team's research, *sakondry* constitutes a valuable and viable source of macro- and micronutrients, which, compared to beef and poultry, contains more proteins, energy (kcal/100g), potassium, calcium, iron, and zinc (Borgerson et al., 2021). Furthermore, *sakondry* reside on a native, locally available edible bean plant (*Lablab Purureus*), known as *antaky*, to which they are naturally attracted. *Sakondry* farming requires considerably fewer resources such as land and water and releases fewer greenhouse gases than conventional livestock farming (Borgerson et al., 2021).

In order to increase food security and dietary diversity of rural communities, Project Sakondry targeted five communities in the Anosy region experiencing high levels of malnutrition, providing 445 households with the training, knowledge, materials, and support needed to farm *sakondry*. In addition to increasing nutrient availability through *antaky* beans and *sakondry* consumption, the project also aimed to support participants in selling excess beans and insects to provide a novel, supplementary income stream. Securing both nutrient availability and supplementary livelihoods can play a vital role in reducing dependency on food distribution whilst simultaneously increasing resilience to the impacts of climate change.

Project Sakondry identified three main objectives for the project phase implemented October 2021 to February 2022:

1. Increase engagement in insect farming in five rural communities
2. Increase availability of micro- and macronutrients, especially in the diets of women of reproductive age and children under five.
3. Improve women's capacity to generate household income through the sale of excess insects and beans.

This report covers the results of monthly monitoring conducted from November 2021 to February 2022 across five participating communities.

Methods

Project beneficiaries were selected in five communities – Ebakika, Sainte Luce, Mananara II, Tsagnoriha, and Vatambe – according to three main criteria: households experiencing high levels of food insecurity, households which were not already receiving support from SEED Madagascar support, and lastly, households that showed strongest motivation towards project participation. Additionally, because of the vulnerability of women, particularly women of childbearing age, Project Sakondry aimed to work primarily with female beneficiaries. Further information regarding beneficiary and household demographics can be found in the **Project Sakondry: Baseline and endline survey results**.

Two rounds of training sessions were delivered, with the training method varying by community. In the communities of Ebakika, Mananara II, Tsagnoriha, and Vatambe, 50 female household representatives per community received intensive, household-level training sessions. In Sainte Luce, community-wide training sessions with 245 households were conducted. The topics of the first training were *sakondry* farming, growing *antaky,* and the nutritional value of *sakondry*. The second trainings covered pest management and maintaining *antaky.*

In order to provide communities with continued support throughout the project, Community Ambassadors (CAs) were recruited from Sainte Luce and Ebakika and provided with specific training in *sakondry* farming and facilitation. These CAs aided in training delivery in Sainte Luce and Ebakika and were available throughout the project to address questions of fellow community members. Furthermore, Visual Learning Aids (VLAs) in the form of playing cards and banners were distributed and displayed in communal spaces, intended to provide accessible and lasting information on *sakondry* farming to project beneficiaries and the wider community.

In total, 445 households participated in this phase of Project Sakondry. 245 participating households were surveyed monthly between November 2021 and February 2022. This included all 50 beneficiary households in Ebakika, Mananara II, Tsagnoriha, and Vatambe, along with a subset of 45 households from Sainte Luce. Indicators measured included plant size; amount of beans harvested, eaten, and sold; presence of *sakondry*; and challenges faced while growing *antaky* and harvesting *sakondry* (see Annex I for full survey).

Results

Plant Growth

Every monitored household's *antaky* plants were measured each month, with tallies taken for number of plants less than or equal to 50cm, between 50cm-1m, between 1-2m and greater than or equal to 2m. Between November and December, over 75% of *antaky* plants were 50cm or under. By January, 29% of plants were 50cm or under and 22% of plants measured above 2 metres. By February, 70% of plants had reached 2 metres in height and above.

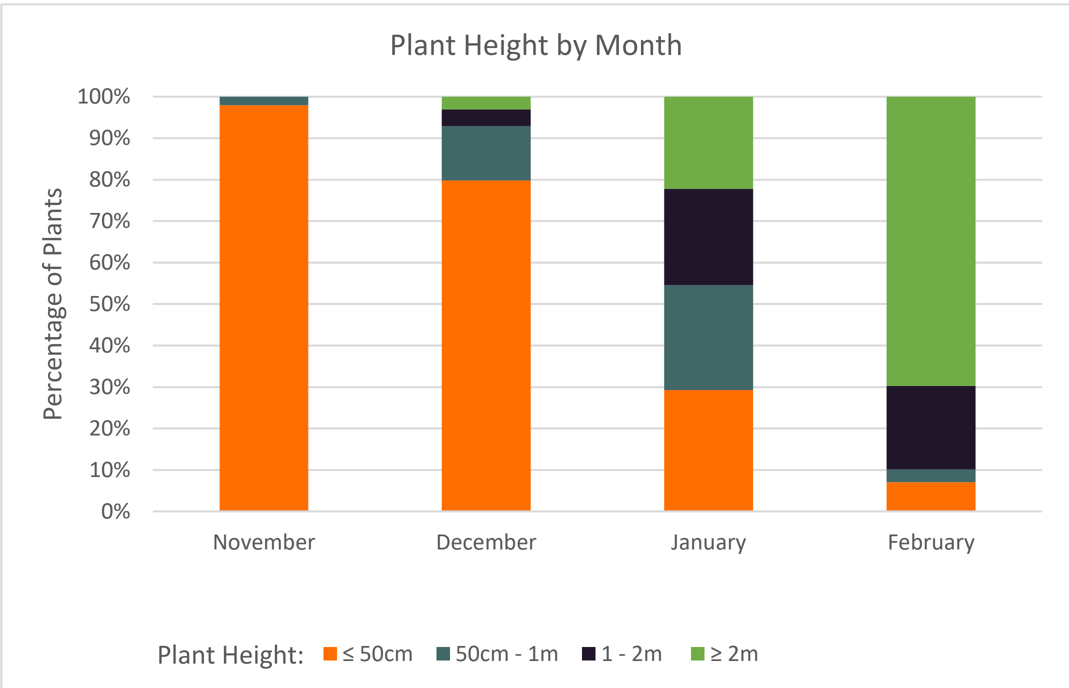

Figure 1: Percentage of all antaky *plants falling into each height category (measured as: less than or equal to 50cm, between 50cm and 1m, between 1m and 2m, greater than or equal to 2m), across all communities per month.*

On average, all communities witnessed steady growth of the *antaky* plants between November 2021 and February 2022 (Figure 1). However, slight differences appeared in growth-rates between coastal (Ebakika, Sainte Luce) and montane communities (Mananara II, Tsagnoriha, Vatambe), with the latter three communities experiencing quicker growth rates (Figure 2). In February 2022, the final month of data collection for the project period, roughly 75% of plants in Mananara II, Tsagnoriha, and Vatambe had reached a height of 2 metres and above, and approximately 25% of plants were between 1 and 2 metres. By contrast, in Sainte Luce, only 31% of plants reached 2 metres, and in Ebakika 25% of plants were still below 1 metre and 70% above 2 metres.

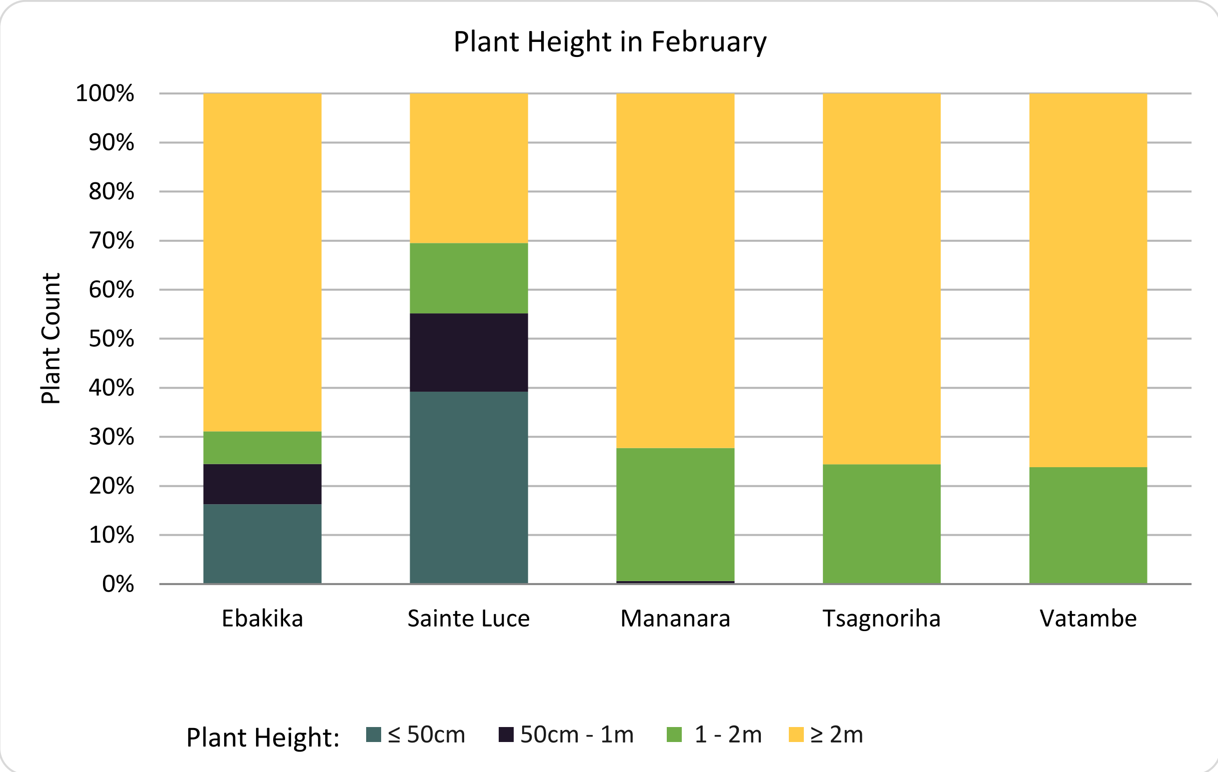

Figure 2: Percentage of antaky *plants falling into each height category (measured as: less than or equal to 50cm, between 50cm and 1m, between 1m and 2m, greater than or equal to 2m) in February (project end), disaggregated by community.*

Plant Survival

Communities planted between 800 (Sainte Luce) and 2,900 (Tsagnoriha) *antaky* seeds between November 2021 and February 2022. At project end, Ebakika and Mananara II showed higher survival rates around 86% and 82%, respectively, whereas Sainte Luce[1] and Tsagnoriha reported survival rates of 66% and 51% (Table 1).

Table 1: Number of beans planted between November 2021 and February 2022; number of antaky *plants alive and survival rates per community in February 2022.*

Plant Survival Rates as of February 2022			
Community	Total Beans Planted	Total Plants Alive in February 2022	Survival Rate
Ebakika	1,741	1,495	86%
Sainte Luce[1]	803	536	66%
Mananara II	2,671	2,201	82%
Tsagnoriha	2,874	1,459	51%
Vatambe[2]	n.a.	1,278	n.a.

[1] The data for Sainte Luce should be interpreted with care as some participants had already planted *antaky* before project start. Affected participants (n=26) were removed from the analysis to avoid skewing the results. Furthermore, it appears that in Sainte Luce, instead of differentiating between the number of planted beans and individual sprouts, some participants reported equal numbers in both questions. This misinterpretation of the questions resulted in an artificially high germination rate of *antaky* in November 2021 (98%) and affects the overall survival rate.

[2] Due to capacity issues, no monitoring was possible in Vatambe in November, therefore survival rates at project end are not available.

Bean Harvesting and Selling

Few results were available for bean harvesting, consumption, and selling. A few households reported that they successfully harvested and consumed beans since project start. In Sainte Luce, 10 households reported harvesting 63 cups of beans in total by project end. Though bean consumption was reported in other communities, no distinction was made as to whether these beans were harvested from *antaky* plants or purchased, so they have not been included in analysis. No household was able to sell significant amounts of beans from their *antaky*, with only one household selling five cups. Project beneficiaries reported that a cup of beans sold for between 1,000 and 1,300 MGA.

Presence of *Sakondry*

In spite of prolific *antaky* growth, the *antaky* plants showed little progress in attracting *sakondry.* A great majority of participants were not able to harvest any *sakondry* by project end. In January, two households, or 0.8% of project beneficiaries, reported a total of 30 insects on their *antaky* plants of which 43% were *not yet fat*, 30% were *fat*, 20% were *able to fly*, and 3% were still *eggs*. In February, 3% of project beneficiaries (seven households) reported the presence of 154 insects of which 45% were *not yet fat*, 6% were *fat*, 1% were *able to fly*, and another 12% were still inside their *eggs*.[3] All other households of the five participating communities during the first four months did not report any *sakondry* yet on the *antaky* plants.

Problems Faced While Growing *Antaky*

All communities experienced some form of challenges and problems while farming *sakondry* and growing *antaky.* The main challenges could be divided into four categories: Animal-related (green), climate-related (red), technical challenges (blue), and plant and soil problems (yellow). All communities reported similar problems, however, the results show that the challenges varied across the first four months.

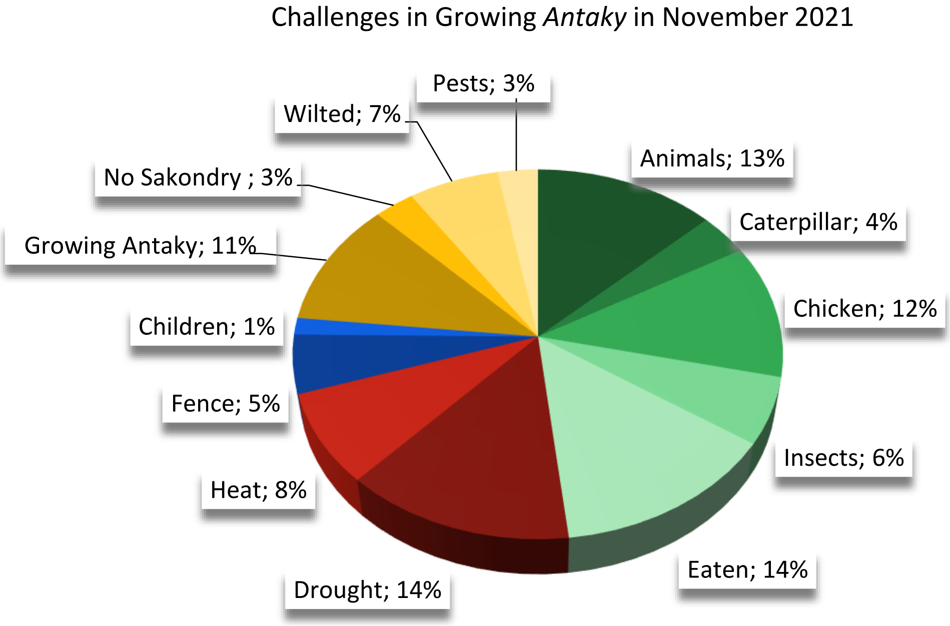

Figure 3: Challenges in growing antaky *in November 2021. Different shades of one colour denote different categories: Blue – Animals, Red – Climate-related factor, Blue – Technical challenge, Yellow – Plant and Soil problems.*

In November 2021, almost half of all participants (49%) identified animals as the main challenge. Notably, chickens seemed to cause most problems (12%), followed by insects (6%). The category "animals" (13%) includes animals which were not specified by participants in addition to animals which did not make up more than 2.5% of responses such as: pigs, ducks, geese, and snails. Similarly, insects are either not specified or include ants and grasshoppers. "Eaten" (14%) refers to project beneficiaries reporting damages to the plant by animals.

[3] A full description of the *sakondry* lifecycle can be found in Borgerson et al. (in press), with *not yet fat* referring to early instars 1-5, *fat* referring to late instar 6 (the life stage at which harvest for consumption is recommended), and *able to fly* referring to adult *sakondry.*

Additionally, in November, climate-related factors such as drought (14%) and heat (8%), made up 22% of the challenges reported. Technical challenges such as protecting the plants with a fence and having children around the plants made up 6% in November. Lastly, about one quarter of project participants (24%) lamented problems relating to plant health and soil such as difficulties in growing *antaky* (11%), the challenge of attracting *sakondry* (3%), wilted plants (7%) and pests (3%).

In December 2021, climate-related factors amounted to 64% of the challenges, increasing to 68% in January 2022. Whereas in December drought made up 55% of the challenges faced, in January, inconsistent weather (35%) and drought (15%) together with too much rain (5%) were reported as the biggest challenges. In February 2022, 33% reported inconsistent weather conditions as the main factor hampering plant growth.

The results show that animals which cause most problems changed between November 2021 and February 2022. For example, the share of participants identifying zebu as a threat to *antaky* plants increased from only 1% in December 2021 to 30% in February 2022 whereas the relative share of smaller animals such as insects, ducks, and caterpillars decreased between November 2021 and February 2022. Only chicken remained consistent between 10% and 15% across all months.

Challenges in Growing *Antaky* February 2022

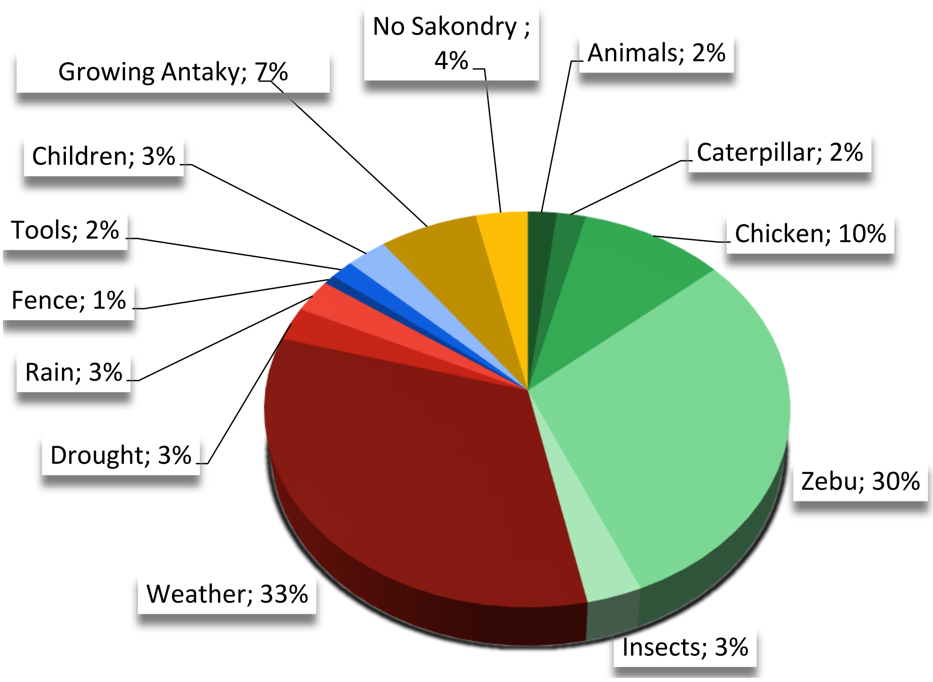

Figure 4: Challenges in growing antaky *in February 2022. Different shades of one colour denote different categories: Blue – Animals, Red – Climate-related factor, Blue – Technical challenge, Yellow – Plant and Soil problems.*

Overall Challenges in Growing *Antaky*

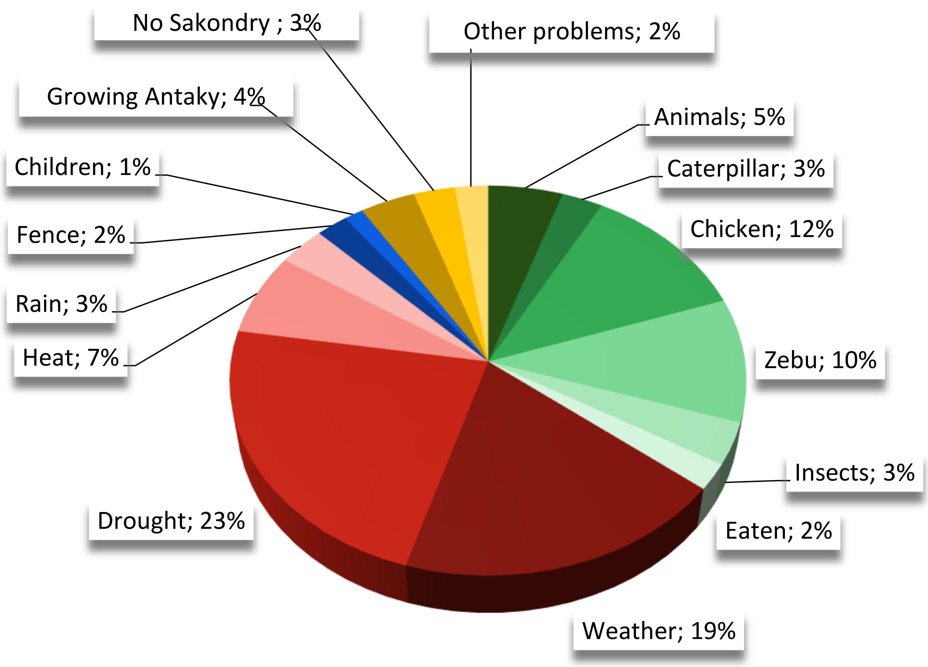

Figure 5: Overall Challenges in growing antaky *from November 2021 to February 2022. Different shades of one colour denote different categories: Blue – Animals, Red – Climate-related factor, Blue – Technical challenge, Yellow – Plant and Soil problems.*

Overall, the main problems incurred by project beneficiaries in growing *antaky* were caused by climate-related factors. Between November 2021 and February 2022, 52% claimed that drought (23%), inconsistent weather (19%), heat (7%) and rain (3%) were the biggest hurdles to growing healthy *antaky* plants. Animals made up the second largest share of challenges with 35%. The most problematic animals were chickens (12%) and zebu (10%). Another 4% of participants encountered technical difficulties in protecting the plants, due to missing tools and fences (2%) and children playing (1%). Lastly, 9% project beneficiaries struggled to maintain healthy plants and claimed that soil, lack of *sakondry,* pests, and wilted plants constituted these problems.

It is worth noting that 16% of participants between November 2021 and February 2022 did not report any challenges. This is not shown in the pie chart, however, speaks for the success that some community members experienced in growing *antaky*.

Discussion

The first four months of Project Sakondry provided valuable data to assess successes and challenges faced for *sakondry* farming. Overall, the project was well-received, and all communities expressed their wish to continue farming *sakondry* (further details on beneficiary perceptions and motivations can be found in the **Project Sakondry: Baseline and endline survey results**). Nevertheless, there were multiple challenges which prevented developing the full potential of *sakondry* farming in the five targeted communities.

Challenges and Pitfalls

All communities reported similar challenges during Project Sakondry. However, the assessment of the monthly monitoring surveys showed that problems in growing *antaky* varied between November 2021 and February 2022. The two main problems were animals and climate-related factors.

Firstly, while plants were below 50 centimetres tall, they were more susceptible to smaller animals such as insects, chicken, ducks, pigs, and snails, who ate the sprouts. These problems were primarily observed in November and December 2021. As plants grew above 1 metre, as seen in January and February 2022, larger animals such as zebu fed off of them. Additionally, a lack of materials such as fences and tools prevented project beneficiaries from protecting *antaky* plants from animals such as chicken and zebu. Pest control trainings were well received in the communities, however, not all households were able to implement pest control measures, which resulted in some plants dying. Further, pest management training focussed on insect pests such as caterpillars and snails, with treatments being applied to plants. These strategies will not have been able to address threats from larger animals.

The second main challenges were weather and climatic variations between November 2021 and February 2022. Historically, the rainy season in the region occurs from November to April, however, during the project, it did not rain until January 2022. Following a prolonged period of drought, the rainy season began with heavy rainfalls and cyclones hitting the Anosy region. Consequently, communities first identified drought (from November 2021 to December 2021) and then heavy rainfalls (from January 2022 to February 2022) as problems.

Beyond the challenges faced in growing *antaky, antaky* plants cultivated during Project Sakondry were not able to attract sufficient *sakondry* by project end to provide a consistent source of nutrients or supplementary income for rural households. There are a few possible explanations for this, all of which require further monitoring and research. First, *sakondry* might be more attracted to other types of host plants, and so are not preferentially colonising *antaky* in target communities. Another theory may be that cultivated *antaky* is too far away from natural *sakondry* colonies to effectively attract them. So far, there is limited research on *sakondry* farming in Madagascar, particularly with regards to what factors influence sakondry colonisation. Community members of Sainte Luce expressed the desire to try to grow a different host plant, which may improve *sakondry* colonisation.

Second, project implementation has been hampered by climate extremes. The intensity of drought and subsequent rainfalls had considerable negative impacts on the *sakondry* which started inhabiting the *antaky*. Therefore, participants have suggested to change the month in which beans are planted and proposed to start planting between March and April. Further monitoring spanning the whole year could provide a better contextualised understanding of plant and insect life cycles.

Successes and Opportunities

Despite the challenges that Project Sakondry faced, there were significant successes. Firstly, all communities were able to grow *antaky* plants of 2 metres and above within the first three months of the project. It appeared that in the montane communities (Mananara II, Tsagnoriha, and Vatambe), *antaky* grew quicker and higher than in the coastal communities (Ebakika and Sainte Luce). Additionally, all communities reported survival rates between 50% and 86%, which, considering drought and inconsistent weather conditions, were relatively high. Though challenges with monitoring were faced in Sainte Luce due to confusion over survey wording, resulting in artificially high survival rates for the first month and a relatively low plant count, overall, monitoring provided crucial insight into *antaky* growth, challenges, and survival.

Furthermore, a small share of participants successfully harvested and consumed both *sakondry* and *antaky* beans, demonstrating that, though on a smaller scale than anticipated, the project demonstrated effectiveness as a potential source of supplementary household food. Additionally, those households that were able to harvest the beans and *sakondry* reported high satisfaction levels, and all communities expressed their desire to continue with *sakondry* farming.

Lastly, the project contributed to the adaptation and resilience-building of local communities to climate change. With low agricultural productivity and drought driven by climate change expected to worsen in years to come, it is of vital importance to find context-specific solutions to build resilience as well as food security for rural communities. Project Sakondry actively contributes to this by opting for culturally-sensitive and contextually-appropriate solutions which can help spread the practice throughout Anosy and beyond.

Next Steps

Following feedback and advice from Community Ambassadors, project beneficiaries, and SEED team members, Project Sakondry has implemented host plant growth trials, in which alternative host plants are being tested. These trials will help identify whether *sakondry* are more attracted to some plants over others, and will also inform which potential host plants are best adapted to the local growing conditions. It is hoped that identifying an alternative host plant will enable increased *sakondry* colonisation and promote climate resilience, helping to address challenges identified during the project. Different planting seasons are also being tested, following community advice. With advice from project partner Dr. Cortni Borgerson, strategies to translocate wild *sakondry* to cultivated host plants are also being trialled, with the intention to increase *sakondry* recruitment and promote natural colonies to establish. With no formal studies on *sakondry* farming in the region yet, the next steps will be informed by research conducted by SEED, and by emerging research from nearby Andohahela National Park, where Dr. Borgerson's team has begun working.

Conclusion

The assessment of the monthly monitoring survey provided valuable insights in challenges and opportunities for further developing *sakondry* farming in the Anosy region. Survey findings suggest that severe and unpredictable weather events, including drought, are some of the greatest challenges to *sakondry* farming for the communities of Sainte Luce, Ebakika, Mananara II, Vatambe and Tsagnoriha. Additionally, domestic animals and pests were identified as major hurdles to growing healthy *antaky* plants. Therefore, to protect the plants, technical but cost-efficient solutions are required. In spite of the challenges and low levels of *sakondry* colonisation, community support remains high for Project Sakondry.

SEED intends to incorporate the learnings from the monthly monitoring surveys as well as implement recommendations provided by communities and project partner Dr. Cortni Borgerson for potential future phases of Project Sakondry. These steps include trialling new host plants, translocating *sakondry,* and planting in a different season. Learnings herein can therefore inform future *sakondry* farming projects, with key challenges and potential solutions highlighted and examined.

Acknowledgements

Special thanks to the Canadian Fund for Local Initiatives, who funded this study, and project partner Dr. Cortni Borgerson. Special thanks must also go to the households who participated in the monthly monitoring surveys.

Further Reading

SEED Madagascar (2022). A Report for Project Sakondry - Building agricultural capacity to reduce food insecurity through household insect farming in southeast Madagascar: **Baseline and endline survey results**

SEED Madagascar (2022). A Report for Project Sakondry - Building agricultural capacity to reduce food insecurity through household insect farming in southeast Madagascar: **Market research results**

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Annex I: Survey questions

Survey translated to English for this report. Survey was designed and administered in Malagasy.

1) Hamlet
2) Household name
3) How many cups of *sakondry* did you harvest last month?
4) When you harvested *sakondry*, how many of it are fat and how many cannot fly?
5) Among those you have harvested, how many can fly?
6) How many cups of *sakondry* did you eat last month?
7) How many cups of *sakondry* did you sell last month?
8) How much does a cup of *sakondry* cost?
9) What is the challenge in *sakondry* keeping?
10) How many cups of beans did you receive last month?
11) If yes, what kind of beans?
12) How many beans did you plant last month?
13) Give the name of the beans and how many (for example 5 butterbean, 2 tsasisa, 3 greenbean)
14) How many cups of beans did you harvest last month?
15) How many cups of beans did you eat last month?
16) How many cups of beans did you sell last month?
17) How much does a cup of beans cost?
18) What is the challenge in bean plantation?
19) How many feet of beans are already planted?
20) Where (land, on the fence, near the road etc.)
21) How many plants are under 50 cm?
22) How many plants are above 50 cm?
23) How many plants are 1-2 m?
24) How many plants are in total 2+ m?
25) What is your problem with bean plantation?
26) Among these plants, how many have sakondry?
27) How many are not yet fat?
28) How many are fat?
29) How many can fly?
30) How many are the *sakondry* in all of their plants?
31) Total?
32) How many lines are the eggs?
33) Problems you see with *sakondry* keeping

Annex II: Plant survival rates by month

Community	Month	Beans Planted	Individual Live Plants Counted	Survival Rate
Ebakika	November	1735	1377	79%
	December	6	1421	82%
	January	0	1589	91%
	February	0	1495	86%
	Total/Avg.	1741	Ø 1470	Ø 85%
Sainte Luce[4]	November	785	753	98%
	December	0	676	86%
	January	0	582	74%
	February	18	536	66%
	Total/Avg.	642	Ø 559	Ø 81%
Mananara II	November	1645	1310	80%
	December	895	1908	75%
	January	0	2254	89%
	February	131	2201	82%
	Total/Avg.	2671	Ø 1918	Ø 81%
Tsagnoriha	November	2380	1942	82%
	December	494	2585	90%
	January	0	1702	59%
	February	0	1459	51%
	Total/Avg.	2874	Ø 1922	Ø 70%
Vatambe[5]	November	n.a.	n.a.	n.a.
	December	48	2425	n.a.
	January	20	902	n.a.
	February	0	1278	n.a.
	Total/Avg.	68	Ø 1535	n.a.
	Total/Avg.	**8157**	**Ø 1586**	**79%**

[4] The data for Sainte Luce should be interpreted with care as some participants had already planted *antaky* before project start. Affected participants (n=26) were removed from the analysis to avoid skewing the results. Furthermore, it appears that in Sainte Luce, instead of differentiating between the number of planted beans and individual sprouts, some participants reported equal numbers in both questions. This misinterpretation of the questions resulted in an artificially high germination rate of *antaky* in November 2021 (98%) and affects the overall survival rate.

[5] Due to capacity issues, no monitoring was possible in Vatambe in November, therefore survival rates at project end are not available.