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# The agroecological transition of agricultural systems in the Global South

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## CHAPTER 7

# Development of agroecological horticultural systems in Réunion

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In Réunion, agriculture plays an important economic and social role, with a diversity of animal and plant production. The major crops are horticultural and sugarcane. The main pillars of Réunion's agriculture are defined in the Réunion Plan for Sustainable Development of Agriculture and Agri-Food (French acronym: PRAAD), with two main objectives: to ensure food self-sufficiency, specifically by increasing local fruit and vegetable production, and by developing agroecological cropping systems in this sector.

Pests and disease have continually blighted fruit and vegetable crops in Réunion and, from the 1980s, led to large-scale use of agrochemical protection. However, the limitations of this solution are now evident: reduced effectiveness, adverse effects on the environment, health risks, ecological imbalances. Over the past ten years, agroecological crop protection (ACP) techniques have been used on vegetable crops (Cucurbitaceae: chayote, courgette, pumpkin) and fruit crops (mango) (Deguine *et al.*, 2015, 2018). Agroecological crop protection is an ecological concept focusing on the sustainability of agroecosystems (Deguine *et al.*, 2017).

ACP brought together partners in the agricultural sector, placed producers at the centre of the project and took place before, during and after research and development projects (Gamour for Cucurbitaceae<sup>1</sup>, Biophyto for mango<sup>2</sup>). This made it possible to compare the performance of conventional horticultural cropping systems (using agrochemicals) to those based on agroecological practices. The aim of this chapter is to present the results, examine the numerous encouraging trials and to draw generically applicable lessons from them.

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1. Gamour: Agroecological management of vegetable flies in Réunion, <http://gamour.cirad.fr/site>.

2. [www.agriculture-biodiversite-oi.org/Biophyto](http://www.agriculture-biodiversite-oi.org/Biophyto).

## **THE DRIVERS OF THE AGROECOLOGICAL TRANSITION**

### **The search for alternatives to conventional agriculture**

In Réunion, the search for sustainable alternatives to conventional agriculture gained importance in the 2000s when the advantages of this approach became clear (ecological sustainability of agroecosystems, environmental and human health), though some reservations about the adoption of agroecological principles due to socio-economic factors remained. A sustainable agroecological approach was vital for Réunion's fruit and vegetable sectors, especially so for chayote and mango, which have high cultural and heritage value and are consumed locally in large quantities.

In the 2000s, significant drops in chayote production and alarming declines in cultivated acreages were observed, to the point that the disappearance of this emblematic crop seemed likely. Similarly, there were significant losses in courgette production, sometimes even total losses, leading to the decline in acreages devoted to this crop. For these crops, production was unable to meet local demand. The agronomic, phytosanitary and socio-economic deadlocks confronting these Cucurbitaceae crops thus accelerated the design and implementation of new agroecology-based farming systems. Faced with a succession of pests and diseases, mango producers have expressed their interest in agroecological production with a stated goal of improving brand image, and quality and economic performance of the agri-chain, in particular in order to access new markets (healthier products from organic farming, access to export markets).

### **Agroecosystems that are compatible with exceptional natural ecosystems**

Another driver behind the development of agroecological production of horticultural crops is the desire to co-exist with the various outstanding natural ecosystems found on the island, such as the Marine Nature Reserve or the Réunion National Park, which is a UNESCO World Heritage site and is considered a global biodiversity hotspot.

### **Regulatory developments**

The driving force behind the agroecological transition is a combination of actions, commitments and efforts by local agricultural stakeholders, ranging from the research community to public authorities. Regulatory developments have also accelerated the agroecological transition. Certain EU directives (e.g. 2009/128/EC) have played a significant role, both in reducing the number of speciality plant protection products that can be used and, in general, by providing crop protection guidelines. Similarly, in 2007, the French *Grenelle de l'environnement* led to the creation of the national Ecophyto plan (2008–2018), which aimed to halve the use of chemical pesticides; the 2012 agroecological project for France advocated the transition to new agroecological production systems and encouraged 'different ways of teaching' in the agricultural world; and the Law on the Future of Agriculture, Food and Forestry, adopted in 2014, strongly encouraged farmers to work together in economic and environmental interest groups.

## AGROECOLOGICAL PRACTICES IMPLEMENTED

### Agroecological crop protection (ACP) and its implementation on the field

The aim of this approach is to promote ecological processes by optimizing interactions between animal and plant communities and by promoting soil health. This reduces the risks of pest infestation, infection and disease outbreaks. Biodiversity and soil health are the two mainstays of agroecological crop protection. The implementation of ACP is based on three pillars: preventive measures, which are always preferred, biological pest control through conservation biological control, and habitat (and inhabitant) management via cropping and agronomic practices.

Agroecological crop protection relies on a systemic approach, incorporating larger scales of space and time, given the aboveground dispersal capabilities and survivability in the soil of certain pests and diseases. Management strategies have to look beyond the local scale and specific crop management sequences and have to be implemented at the farm or landscape level, which requires coordination between stakeholders (collective management). In addition, all stakeholders must be included in a participatory approach: farmers, of course, but also land managers, policymakers, researchers and others (experimentation, extension, training, transfer).

Application on the field involves a methodical strategy of phytosanitary and agronomic practices to manage populations of pests and their natural enemies (Deguine *et al.*, 2017). The three main priorities of this approach are to:

- promote plant biodiversity;
- promote soil health;
- prioritize biological pest control through conservation biological control.

### Agroecological practices implemented in Réunion

Practices implemented in Réunion are chronologically summarized in Table 7.1 (Deguine *et al.*, 2017).

The results of these trials, after several years of decline, are very encouraging. They are rich in lessons and have clear generic interest. The main results obtained from the Gamour and Biophyto research and development projects are presented in detail in Deguine *et al.* (2015, 2018) and are summarized below.

The reduction or elimination of insecticide and herbicide treatments has led to socio-economic changes<sup>3</sup>:

- for courgette: conventional cultivation using a pyrethroid-organophosphorus combination (several hundred grams per hectare of crop) replaced by agroecological protection consisting of a few grams of a biological insecticide on border plants;
- for chayote: the use of insecticides and herbicides completely eliminated in agroecological cultivation;

3. The farmer no longer has to spend as much time on pest control, allowing him to undertake other more enjoyable and/or useful activities.

**Table 7.1.** A methodical phytosanitary strategy for agroecological crop protection, adopted in the experiments on Cucurbitaceae and mango in Réunion.

Recommended agroecological practice <sup>(1)</sup>	Vegetable crops (Cucurbitaceae)		Fruit crops
	Chayote	Courgette	Mango
Discontinuation of conventional insecticide treatments	Yes	Yes	Yes
Discontinuation of herbicide treatments	Yes	Yes	Yes
Sanitation (augmentorium)	Yes	Yes	Yes
Permanent vegetal cover	Yes	No	Yes
Trap plants	No	Yes	Yes
Flower strips	No	No	Yes
Refuge plants	No	No	Yes
Reduction of mineral fertilization	Yes	No	No
Organic amendments	Yes	Yes	Yes
Traps	Yes	Yes	Yes
Use of adulticide baits	No	Yes	Yes
Curative measures <sup>(2)</sup>	No	No	No

Chayote and courgette are considered separately (with other field crops such as pumpkin and cucumber being clubbed with courgette) since chayote is grown on arbours and can be managed as a perennial crop. Courgette, on the other hand, is a field vegetable with a short cycle. In the table, ‘Yes’ means that the practice is recommended and ‘No’ that the practice is not recommended.

(1) Observation has to be a key aspect in the implementation of any of these practices. It must remain an ongoing and continuous activity.

(2) In these curative measures, the use of chemical pesticides is considered to be a last resort and they must be used in an optimized and targeted way, with as little impact as possible so as not to jeopardize biological controls.

– for mango: a decrease in the treatment frequency index (TFI) from 22.4 before the Biophyto project to 0.3 by the end of the project (Figure 7.1).

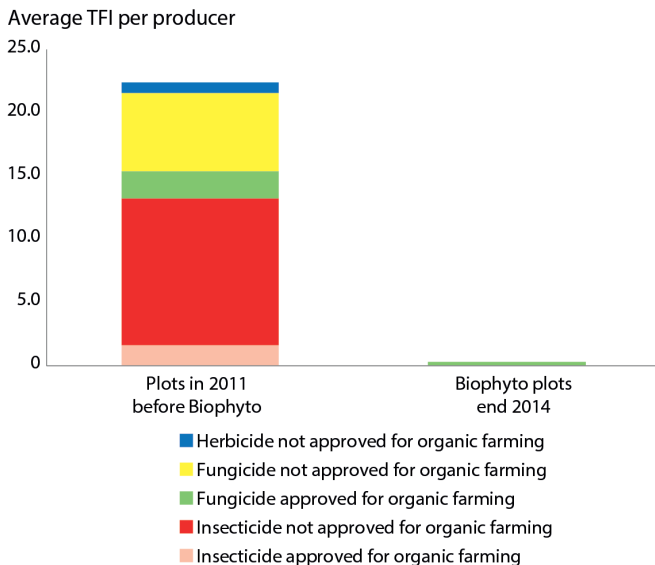
Furthermore, costs have dropped significantly: 75% savings in protection costs for courgette (Table 7.2) and chayote, and a 35% reduction in mango production costs.

Finally, according to the measurements carried out in the research and development projects, production did not decrease on the whole. Indeed, agroecological cultivation of Cucurbitaceae led to increases in production. As part of the Gamour project, over 26 courgette cropping cycles, production increased from 13.1 t/ha on agrochemical plots to 19.3 t/ha on agroecological plots (+47%). On 7.6 ha of chayote cultivated on arbours in Salazie between 2007 and 2011, annual production increased by 48% (Figure 7.2).

For mango, observations showed equivalent yields between conventional plots and Biophyto plots using agroecological protection (Gloanec *et al.*, 2016). Lower yields, while not significant, were observed in a few cases, mainly in areas susceptible to gall midge, especially in plots with high production potential (‘Cogshall’ variety which permits significant intensification). Certain organic-compatible fungicides for powdery mildew were not always applied because the prevalence of this disease was often underestimated. This may have contributed to production losses.

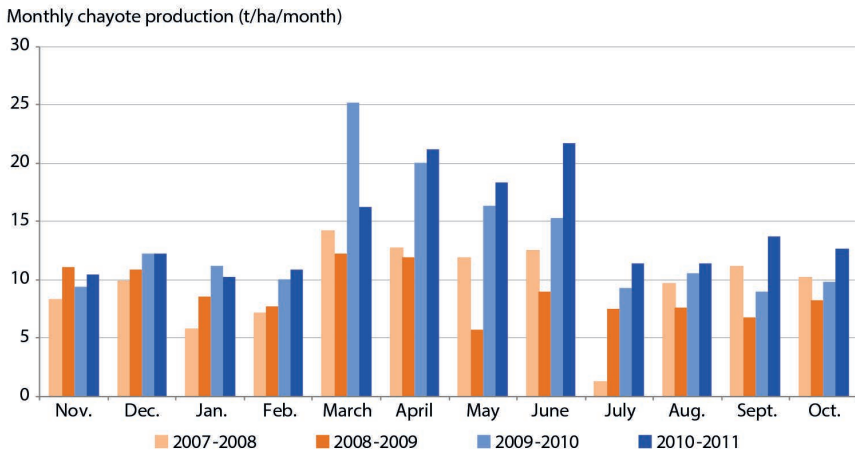
**Table 7.2.** Comparison of costs and labour time of protection between agrochemical protection and agroecological protection for courgette cultivation. Source: farmers' statements in the Gamour project area (adapted from Deguine *et al.*, 2015).

Protection	Criterion	Agrochemical protection	Agroecological protection
Characteristics	Number of insecticide applications	1.5	1
	Commercial products	Cyperfor-Danadim	Synéis-appât®
	Active substances	Cypermethrin-dimethoate	Spinosad
	Quantity of active substance applied (g/ha/treatment)	45 + 450	0.008
	Application location	Entire crop	Spot application on border plants
Labour time	Collection of damaged fruit (h/ha/week)	0	2 at the beginning and 0.25 after some weeks
	Treatment (h/ha/week)	4.5	1
	Setting traps (h/ha/3 months)	0	1
	Planting trap plants (h/cycle)	0	10
	Total time spent on protection (h/week)	4.5	4.1
Cost (€)	Per week	66	18
	Per cycle	1320	370



**Figure 7.1.** Treatment frequency index (TFI) before and after the Biophyto project.

Averages of five Biophyto farms in the Dephy mango Ecophyto network (Réunion Chamber of Agriculture, 2015), taking into account approved and unapproved organic treatments (adapted from Deguine *et al.*, 2017).



**Figure 7.2.** Monthly chayote production on a Salazie farm of 7.6 ha, in 2007 and 2008 (in orange, before the Gamour project, with agrochemical protection), and in 2009 and 2010 (in blue, during the Gamour project, with agroecological protection) (adapted from Deguine *et al.*, 2015).

Large reductions in insecticides and herbicides have had beneficial effects on both flora and fauna. In addition, it can be assumed that the treatments had a favourable impact on water quality and human health although these were not explicitly measured.

In addition, the ecology of these agroecosystems has improved, as observed in an increase in functional biodiversity. Vegetable and fruit crop experiments have made the general public (and farmers in particular), more aware of the role of biodiversity in farming. In-depth studies on mango orchards have generated new data. For instance, more than 120,000 arthropods were collected from orchards and nearly 800 morpho-species<sup>4</sup> were identified. Of these, only a few species can be considered as harmful to mango, while there were nearly 200 morpho-species of parasitoids. Furthermore, according to farmers, the discontinuation of the use of agrochemicals in chayote cultivation has brought about an increase in the number of natural pest enemies, such as arthropods (spiders) and reptiles (chameleons). In the Gamour project’s pilot area in Petite-Île, farmers mentioned that bees had returned to their courgette fields.

## TECHNICAL ACCOMPANIMENT AND SUPPORT THROUGH PUBLIC POLICIES

### Adoption of practices, productions in transition

On the whole, the pilot farmers involved in the Gamour and Biophyto research and development projects adopted agroecological practices and expressed great satisfaction, in particular because these practices proved to be more effective and less expensive than conventional ones.

The impact on the market of the growth of agroecological production is already clear for certain crops (60% of the chayote production was organic in 2017 and prices paid

4. Morpho-species are species distinguished from others only by their morphology.

to producers have increased) and will soon be for others (there has been an increase in the number of mango farmers who have joined economic or environmental interest groups and who have embraced organic farming). For the mango, the possibility of obtaining a higher market price was analysed in the Biophyto project through a market survey of 400 consumers and a survey of the production chain (from the farmer to the distributor). These surveys have not only highlighted the commercial potential of mangos produced using Biophyto techniques, but also made it possible to determine the best ways of marketing them and of deriving value from them (Técher *et al.*, 2015). It was found that affixing a small sticker to each fruit (saying, for example, 'I protect biodiversity' or 'I protect my island') makes more sense and is more locally relevant than a certification label (e.g. 'Agroecological Mango'). Moreover, the increase in organic mango production expected in the future should make it possible to target the export market in addition to the local market. Importers in the Rungis market, the wholesale market supplying Paris, have already expressed interest.

After the Gamour and Biophyto projects ended, the challenge was taken up by the agricultural organizations including producer associations and the island's Chamber of Agriculture. They have found support from public authorities in the promotion and dissemination of agroecological practices and the expansion of organic farming.

Adoption of agroecological practices by other farmers after the end of the projects varied depending on the crop. The adoption rate was very high for chayote and is currently increasing satisfactorily for mango. However, it is less satisfactory for open-field Cucurbitaceae (courgette, pumpkin, cucumber). Good and low levels of adoption have provided lessons for future production trials.

## Complementary partners and an exemplary organization

Faced with an agrochemical deadlock, the entire agricultural profession, including producers and policymakers, were amenable to the idea of joining forces in order to pursue agroecological solutions. The profession expressed a wish to test the principles of agroecological protection in a farm environment, reflecting their common desire for a change in practices.

The design, implementation and evaluation of these agroecology trials, as well as the transfer phase, proceeded very smoothly:

- the research community (CIRAD) launched this initiative and coordinated the implementation on the ground of research and development projects;
- Réunion's Chamber of Agriculture provided the technical coordination between the various partners;
- the organizations involved in experiments on crop protection and in providing support (Armeffhor technical institute, FDGDON federation<sup>5</sup>) offered their expertise to the project;
- development agencies and public authorities were instrumental in the transfer of innovations.

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5. Armeffhor: Réunion Association for the modernization of the fruit, vegetable and horticultural economy; FDGDON: Departmental Federation of Pest Control Groups in Réunion.



The territory of Réunion is fortunate in being host to an exemplary partnership that has facilitated the agroecological transition. Promoting agroecology is one of PRAAD's six strategic axes. Applied to fruit and vegetable systems, this initiative is being steered within the horticultural Network for Agricultural Innovation and Transfer (French acronym: RITA) created in Réunion to facilitate the transfer of research results to users. Alongside the RITA horticultural network is the SPAT joint technology unit (Plant Health and Agroecological Production in Tropical Areas), which, in Réunion, brings together CIRAD, ANSES (French Agency for Food, Environmental and Occupational Health and Safety), Armefflor and FDGDON. It aims to impart coherence and synergy to the research and experimentation activities of the organizations involved in or concerned by the agroecological production of horticultural crops. Finally, at the economic level, the relationships between partners working towards agroecology were facilitated by the creation of a fruit and vegetable hub, bringing together Arifel and AROPFL<sup>6</sup>.

### **An orderly and collective approach**

The collective and participatory approach involved in the agroecology experiments in Réunion was based on an orderly methodology. The approach was applied at large spatial scales, for example the 'cirque de Salazie', historical production area of the chayote in Réunion, the area of Hauts de Petite-Île known for the open-field cultivation of Cucurbitaceae, or the Saint-Gilles region, the island's main mango production basin. In addition, the trials took place in several coherent temporal phases (Table 7.3):

- a first phase for the collective sharing of the findings and for taking stock of the situation, as well as for co-designing, research and for obtaining funding for a partnership research and development project;
- a second phase, in the form of a partnership research and development project for on-field implementation by the producers of the proposed agroecological practices, with close monitoring by the other agricultural actors;
- a third phase, consisting of the transfer of practices to other producers on the island and the rollout of incentivizing public policies to support the agroecological production of crops.

In parallel with these phases, research was carried out on a continuous basis in order to provide the necessary knowledge for actions in the field: bioecology of pests and diseases, functional biodiversity, ecological and agronomic processes in cropping systems, development and efficiency of agroecological practices, etc. These research activities, consisting of description and understanding of processes and of providing management assistance, were undertaken simultaneously and interactively, so that each activity could benefit as quickly as possible from the results of other activities. In a similar manner, iterative exchanges between research activities and field practices of partners and practitioners helped improve the efficiency of research and accelerated its application.

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6. Arifel: Réunion Interprofessional Association of Fruits and Vegetables; AROPFL: Réunionese Association of Fruit and Vegetable Producer Organizations.

**Table 7.3.** Different phases of experiments of agroecological crop protection in Réunion.

Phases	Stage, content, activities	Vegetable crops (Cucurbitaceae)	Fruit crops (mango)
1. Before the research and development project	Collective sharing of the diagnosis and taking stock of the situation		
	Co-design of a research and development project		
	Search for funding for a research and development project (Special Accounts Allocated to Agricultural and Rural Development or Casdar, Ministry of Agriculture, Food and Forestry)	2007-2008	2010-2011
	Research activities (cognitive and integrative)		
2. During the research and development project	Implementation of practices on the field by farmers		
	Monitoring and assessment in partnership	2009-2011	2012-2015
	Final report and perspectives (seminar)	(Gamour)	(Biophyto)
	Research activities (cognitive and integrative)		
3. After the research and development project	Training, advice, and support for the transfer		
	Support for extension by public policies and instruments	Since 2011	Since 2015
	Research activities (cognitive and integrative)		

## Tools to help transfer and disseminate practices

Several tools to support the transfer of practices and facilitate actions on the ground of development organizations (Chamber of Agriculture, professional organizations) were developed: technical guides and DVDs, audio-visual media, identification sheets (plant bugs, fruit and vegetable flies, crop beneficials), websites, newsletter, PQUC/ACP professional qualification university certificate, proceedings of the Gamour and Biophyto project seminars, posters, etc.

When the Gamour and Biophyto projects ended, a diploma course was made available starting in 2013 for the benefit of farmers and farm support workers. Thus, a professional qualification university certificate (PQUC), entitled ‘Agroecological crop protection’, issued by the University of Réunion, co-organized by the University Institute of Technology and by the Chamber of Agriculture, is now offered by different partners (CIRAD, Armefflor, FDGDON, Chamber of Agriculture), requiring 42 hours of learning spread over six days. The training has been organized every year since 2013 and already more than 80 farmers have benefited from it. Graduates then play the role of leaders on the ground and help transfer agroecological practices to their colleagues.

## Instruments of the Ecophyto Plan

Several levers of transfer were created as part of the national Ecophyto Plan. Agroecological crop protection practices are all the more effective if they are planned and implemented at the scale of a production basin. In this perspective, two collective projects have been recognized by the public authorities. They have taken the form of two economic and environmental interest groups: the first was created in 2016 in the

mango production basin in Saint-Gilles; the second in 2017 in the Salazie chayote production basin. These groups provide technical and financial aid to farmers in these areas, so that they act with a collective agroecological purpose.

Dephy Farm Networks<sup>7</sup>, another instrument of the Ecophyto Plan, facilitate the transfer of innovations. In 2015, a Dephy network of mango farms was created. The treatment frequency indices for all the farms in the network decreased considerably (-43% from 2012 to 2015). In 2016, the network consisted of 14 farms.

Also concerning the mango, the Biophyto project led to the creation in 2015 of two agri-environmental and climate measures (AECM) to encourage producers to engage in the agroecological protection of fruit crops: Lbio 1, aiming at the insertion of biodiversity in orchards, and Couver 2, encouraging vegetal cover of perennial crops. Producers can now benefit from an annual compensatory aid of 880 €/ha or 700 €/ha depending on the AEMC they have signed up for, with a commitment period of five years. To qualify, orchards must have a total vegetal cover and a permanent layout of flowering strips with a minimum area of 500 m<sup>2</sup> for every hectare of the orchard (5%). These agri-environmental and climatic measures contribute to the popularization of agroecological practices, not only in the island's mango orchards, but also in other fruit production systems (citrus fruits, papayas, bananas, etc.).

## Promotion of and support for organic farming

The Gamour and Biophyto projects have shown that agroecological crop protection practices are compatible with organic farming. Thus, not only has the cultivation of the chayote been revived in its historical stronghold of the 'cirque de Salazie', but the organic production of this vegetable has increased considerably, too. Similarly, for the mango, agroecological practices are compatible with orchard management in organic farming: the fungicides used (to control powdery mildew) comply with the corresponding specifications. No mineral fertilization is used.

While the context and public policies encourage the development of organic farming, unexpected socio-economic reasons have also contributed to its growth. Agroecological practices, which are less expensive, have thus brought about a simplification when compared to conventional practices: discontinuation of insecticide and herbicide treatments; sanitation through the use of augmentoria; planting and maintenance of ground vegetal cover; and the recourse to organic amendments. They improve soil health and increase biodiversity at the same time.

In addition, the transfer to farmers of these agroecological systems has been supported by the government and facilitated by development partners. For example, the Chamber of Agriculture provided significant logistical and human support: an individual was responsible for implementing agroecological systems in vegetable systems, a second in charge of the promotion of organic farming, and a third responsible for ensuring the 'research-development-transfer' continuum and feedback within the framework of the Ecophyto Plan.

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7. Networks of trial farms for the demonstration, experimentation and production of references on the systems that are economical in the use of plant protection products.

In addition to investment aid, financial incentives have been offered to producers. For the chayote, compensatory aid (complementary to agri-environmental and climatic measures) makes it possible to cover the certification costs and any possible loss of production resulting from the transition to organic farming:

- aid for conversion to organic farming (from 1800 to 2700 €/ha/year during three years of conversion);
- maintenance aid (from 900 to 1800 €/ha/year).

In addition, assistance from the Programme of Options Specifically Relating to Remoteness and Insularity (POSEI) are incentives for some agri-chains, such as that of the chayote, to structure themselves. This aid is provided on the basis of marketed volume (0.50 €/kg).

The results of the agroecology trial on the chayote in Réunion had a strong impact on the development of organic farming on the island. The increase in the production of organic mango has benefited from this dynamic and the results of the Biophyto project. In 2015, the chayote represented 97% of the volume of all organically grown vegetables marketed in Réunion. In 2017, more than 60% of chayote cultivation (by area) was certified as organic. Half of the remaining areas are in the process of converting to organic farming. Today, Réunion is the overseas department of France with the biggest organic sector.

## **LESSONS LEARNT FROM AGROECOLOGY TRIALS IN RÉUNION**

The trials on agroecological crop protection in Réunion were pioneering at the national level and they were conducted on a large scale in a production environment. We recall that even though Réunion is one of the overseas departments of France, it has specific local characteristics: physical (insularity), climatic (tropical climate), agricultural (sugarcane, horticultural crops), institutional, and organizational. Agricultural actors on the island are directly supported by the Regional Council, the Departmental Council, the French State, European agencies and institutions, and they enjoy close support from partners and technical services (the research community; technical institute; FDGDON; ANSES; Chamber of Agriculture; Department of Agriculture, Food and Forests; etc.).

In spite of Réunion's specific context, the results obtained there and lessons learnt from them are of great generic interest for the design and implementation of future agroecological experiments in other contexts.

### **How to conduct agroecology trials in production environments?**

The trials in Réunion allow us make a non-exhaustive list of the conditions that are necessary – but not sufficient – for conducting large-scale agroecology experiments:

- raising awareness of and motivating agricultural actors, starting with the farmers. In Réunion, this was achieved through the action of many technical partners, each with its own means and tools;
- a phytosanitary problem of concern or interest to many actors, either because it leads to a socio-economic or environmental impasse, or because it makes it possible to take a significant step towards the adoption of agroecological practices and to access new and key markets;

- research capabilities, which will make it possible to change the scope and topics of research, with the aim of acquiring and better integrating new scientific knowledge. The studies undertaken in Réunion revealed, for example, the need to acquire knowledge in the fields of landscape ecology, organic farming, functional biodiversity (aboveground and soil), etc.;
- a synergy between research and development, in order to bring together the various partners' complementary activities in a coherent way (research, experimentation, training, teaching, advice, transfer/dissemination);
- a unifying research and development project in partnership, whose preparation and smooth running require several conditions and activities (a collective taking stock of the situation, the co-design of the programmes to be implemented, the coordination of actions by an agency in charge of transfer/dissemination);
- the adoption of a systemic and participatory approach, at appropriate spatial and temporal scales and according to updated criteria, taking into account, for example, the ecological sustainability of agroecosystems;
- support by public authorities, before and during the agroecological transition period.

### **The determinants of the adoption of agroecological practices**

The detailed analysis of the determinants of the adoption of agroecological protection innovations in Réunion is the subject of an ongoing study. We list here the main lessons learnt. It should be remembered that the adoption of agroecological protection practices for crops in the production environment can be described as good for the chayote and the mango, but only mediocre for Cucurbitaceae cultivated in open fields.

It is easier to adopt a strategy of 'investing' in agroecological practices in the case of perennial crop systems. Mango producers are motivated to adopt agroecological practices such as sanitation or permanent vegetal cover. So are chayote producers – when the chayote is cultivated in arbours and thus can be considered a perennial crop. We know that these practices are more effective, but over a time scale that is longer than the simple annual crop cycle. Producers of courgettes lack this motivation since they choose to plant a plot of this crop on the basis of very short-term reasoning (market price). Indeed, the location of the plot planted with this crop may change from one cycle to the next, and the state of health of the planted plot depends on the health status of the other neighbouring courgette plots.

When agroecological practices simplify the technical itinerary (discontinuation of insecticide and herbicide treatments), they are more readily adopted. This is the case for the chayote and the mango. Conversely, courgette cultivation is more demanding (anticipation, regular monitoring, planting of trap plants [maize borders] one month before the courgette planting) and it is thus difficult to plan or carry out additional treatments with adulticidal baits (consisting of 99.9% protein and 0.01% biological insecticide).

In addition, the typology of farmers appears to be a factor in the adoption of innovations. The producers of chayotes and mangos are clustered in production basins. They know each other and have regular exchanges and discussions. Agriculture is their core activity and they receive regular training. They are open to the idea of collective

management in the production basins (as is the case in economic and environmental interest groups) and have an ultimate aim of ecological and healthy production. Courgette producers, for their part, have a completely different profile. There are nearly 2000 of them in Réunion and, for many, agriculture is just one of their activities. These producers are quick to take advantage of changes in context (weather, market prices, timetable, etc.), with the aim of making quick profits from a crop cycle, using predictable and conventional means. These producers are often isolated and communicate little with each other and are less trained in agroecology and less open to it.

Finally, three other factors help to explain the differences in the levels of adoption between the chayote and the mango, on the one hand, and the courgette, on the other:

- the market. The chayote and the mango are consumed in large quantities domestically. Their cultivation is profitable and adopting agroecological practices, often compatible with organic farming, provides access to new, more profitable markets (short circuits, organic farming, exports). This is not the case for the courgette, whose cultivation depends above all on the market price. From one year to the next, or from one quarter to the next, depending on respective market prices, the growers may plant carrots or lettuce instead;
- the heritage value. The chayote and the mango are traditional crops, whose production is consumed daily (all year for the chayote, during the production season for mango). This is not the case with the courgette;
- the incentive to shift to organic farming. Policies that support organic farming have proven their effectiveness for the chayote. The production of this crop is expected to become 100% organic, whereas just ten years ago, the vines received insecticide treatments once or twice a week.

## **Publicising and communicating about agroecological practices in Réunion**

The development of agroecological cropping systems is being publicised as part of a film- and multimedia-based action-research programme, led by CIRAD (PVBMT joint research unit) and the University of Aix-Marseille (Laboratory of Arts Sciences Studies). This programme aims to describe, share, understand and contribute to the implementation of interdisciplinary research activities on agroecological crop protection practices in Réunion. It is situated at the interface of the ecological and agronomic sciences, social sciences and film sciences. Various audio-visual aids are being used in this innovative approach: short films, training or awareness-raising modules, television documentaries, web documentaries, etc. These media are intended for different audiences (general public, agricultural actors), thus helping to promote agroecology and to encourage societal reflections on agricultural practices in the 21st century.

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