



Sudhir Datta's farm, where he has a farm pond and applies the broad bed and furrow (BBF) system.

## Andaman Islands farmers take on climate-adaptive solutions for agriculture

With over 500 islands, Andaman & Nicobar Islands in India face serious environmental, climatic and geological threats. Frequent cyclones, tsunamis, waterlogging, heavy rain and drought are among the challenges farmers have to cope with here. Local scientists have worked with them to find solutions that not only protect natural resources such as land and water, but also offer sustainable income for farmers and solutions to practise organic farming in tough conditions.

**By Sharada Balasubramanian**

The Andaman Islands, 1,200 kilometres east of mainland India, are known for their natural beauty. From the turquoise blue beaches to the tropical protected forests, these islands are ecologically fragile, and natural disasters are not new to them. The 2004 tsunami impacted their natural resources of soil and water. The islands have been prone to climate change and natural disasters like cyclones in the recent past. This entails issues like rising sea level, changing salinity, tides, floods and even droughts in the summer. “The reasons are not just climatic, but also geological,” A. Velmurugan, Senior Scientist at the Central Island Agricultural Research Institute (CIARI), explains. “When there was a change

in the movement of plates – a process called subduction – in Indonesia during the tsunami, the plate of Andaman shifted. There was already a fissure between north and south Andaman. As the plate went down further, agriculture was affected.” In areas where salt water should be present, it receded, and mangroves were replaced by new plants. In agricultural lands, salt water gushed in, making the soil fallow and unfit for farming.

### Exposed to the calamities

More than 4,200 hectares of agriculture land is under permanent submergence, which has

reduced the area available for agriculture in these islands.

Sudhir Datta, a farmer whose land is just ten metres from the sea, suffered heavy losses as saline water entered the farmland. “Half of my house was inside water, and my entire farmland was washed out,” he remembers. That was not the end of the story. “As there were salt deposits on my farmland, I could not cultivate paddy or anything for almost six years,” he remembers. Fellow farmer Tapan Mondal, whose farm is also close to the sea, recalls: “Before the tsunami, we had grown everything, even pulses. After that, everything was destroyed. Now, things are almost normal, although we

do not grow paddy on my land as there is a little salinity.” Paddy cannot grow in saline water, which meant that many farmers had to shift from paddy to other horticultural crops in these islands. Sanjay Saha, who used to grow paddy before the tsunami, started growing coconut trees as they tolerate saline water.

One of the main challenges for the farmers today is changes in salinity, which may fluctuate in just one single day. “Sometimes there is salinity in the morning, and it disappears in the evening,” Velmurugan says. This is because of the turn of the tide. During high tide, the salinity is flushed out. Andaman also receives high rainfall, around 3,000 mm annually. Owing to the proximity to the equator, evaporation is very high – 10 to 15 mm a day. “Due to the El Niño effect, we have also been seeing water shortage in Andaman since 2012. Although the total amount of rainfall remains the same, the number of rainy days has come down,” the scientist explains. This creates water scarcity for agriculture in the summer. Lack of rainfall during one phase and cyclones and excess rainfall during another result in losses and cause distress to the farmers. Here, early warning systems aren’t much help either. “Even if we receive early warning about cyclones, there is little we can do during natural calamities,” says Datta. “The maximum we can do is cover the crop with nets. How can we stop water from entering the land?”

Scientist Velmurugan refers to another problem that the archipelago suffers from. “Unlike in other Indian states, there are no dams, canals, or even irrigation here,” he notes. Borewells are not present, and the farmers only practise rainfed agriculture. Every technology has to revolve around rainwater harvesting.

### Climate-resilient, resource conserving technologies needed

Post-tsunami, the CIARI scientists had to work on solutions for these island farmers. The challenge was to conserve natural resources like land, water and soil here, as the ecosystem is fragile. At the same time, they had to ensure that the farmers had fresh water to farm throughout the year, and the salinity and waterlogging issues also needed to be addressed. Further, they had to look at the farmers’ crop preferences and budget, and make sure that they could earn a sustainable income as well.

The scientists did an assessment of climate change and agricultural vulnerability for the islands, and then worked to develop climate-re-



Farmer Monica Saha, who is Sanjay Saha’s mother, with her arecanut harvest.

silient, resource-conserving technologies. One of the key solutions was land shaping. This approach, with which land is modified to save water, improves drainage, enables rainwater harvesting and reduces salinity. It incorporates various techniques, and farmers were given solutions depending on their land and resource availability. “There was a need to plan agricultural activity in such a way that one looks at climate, water, land size, and then creates a window for suitable farming, which is an agro-ecological research approach,” Velmurugan explains. “In a low-lying region like Andaman, where there is no other irrigation facility, nor dams or streams, this is the best method.”

The broad bed and furrow (BBF) method has established itself as one of the most popular practices in land shaping among farmers in Andaman. Here, land is excavated and beds are raised on land to grow vegetables. The depression area (furrows) is used for rice cultivation. Fish farming can be done along with rice in these furrows. Even when there is heavy rain, the beds are safe from water logging or from salt water. Farm ponds are built on the land to store water for agricultural use in the summer. Also, fish can be reared in them for an additional income. With an investment of 150,000 rupees (approximately 2,100 US dollars) for the BBF system, scientists say that the farmers can recover the money in two years. Other solutions like fish-paddy or the three tier farming system were also tested out with farmers in the islands.

The benefits of creating ponds, furrows and bunds using land shaping methods are obvious. “If you are raising a bund, not just for one season, you can grow three crops in a year, rather than just growing one crop, which is paddy,” Velmurugan explains. “In BBF, we also make a water pond, with a certain depth to ensure that we do not hit the salty soil,” farmer Sudhir Datta says. “We create a wall around the land, so that there is height to grow vegetables. I have experienced great benefits in BBF as I grow vegetables like brinjals. The water does not stay in the land, and growing brinjals is more profitable than growing paddy.” Recently, Datta harvested almost 80 kilos of brinjal from this system. “The market rate for brinjal fluctuates,” he says. “Sometimes, it is 40 or 50 rupees. I received 120 rupees per kilo as a market price and earned profits.” Today, he grows brinjal, bottle gourd and okra, among many other vegetables.

“There is a unique feature in Andaman,” explains Tapan Biswas, another scientist at CIARI, referring to a common practice among farmers. “Sea shells are spread all over the farmland by farmers as they absorb acidity in the soil.”

### Organic farming – an option for the islands?

As the region is eco-sensitive and chemicals can easily leach into the soil and water, over 2018, the Andaman & Nicobar administra-



Two fishers in Andaman Islands.

Photos: Sharada Balasubramanian

tion concentrated on making these farmlands organic. Not all farmers welcome this. Some, like Tapan Mondal, have been heavily relying on chemicals as agricultural inputs. “Without giving any fertiliser, how will we gain any productivity?” the farmer asks. “If they want us to produce organically, they should also stop bringing vegetables from Chennai or Kolkata, as they contain chemicals. We have to deal with this slowly.”

Getting organic inputs for agriculture is indeed difficult for farmers like Tapan Mondal who do not keep any livestock. This is precisely why scientists and the Islands’ administration have been emphasising integrated farming. As the administration has blocked some essential chemical fertilisers, such as urea, NPK (nitrogen, phosphorus, potassium) and di-ammonium phosphate, the farmers have to use manure. Farmer Sanjay Saha now applies coconut leaves, husk and other plant material mixed with poultry waste on his plants. And he does mulching, as recommended by the CIARI scientists. For this purpose, a basin is formed around the palm and arecanut trees. Coir waste, farm waste, dried leaves, dried grasses, sugarcane trash, paddy straw and groundnut husk is used for mulching. However, the farmer still remains sceptical. “Chemicals should not be totally phased out, but should be removed little by little,” he states. “I was given vermicompost for practising organic agriculture; however, in heavy rains, everything got washed out. It is challenging to do farming in these islands.”

Other farmers like Sudhir Datta have already successfully been practising organic farming for quite a while. “Organic is better as chemicals act like slow poison. They harm the plants, and people can get cancer or other diseases. We should stop chemicals and become organic,” says Datta, referring above all to brinjal production, which involves a high level of chemical inputs. In Andaman Islands, up to 80 per cent of total pesticide consumption is used for vegetable crops. At one end of Datta’s farm, soil is spread out in the sun. The farmer mixes poultry waste with cow dung. “When there is no rain, I turn on the motor pump and spray some water to moisturise the mass of manure. There should be no gas left in the manure. Once the hen excreta is decomposed, we can use it with soil, and then plant vegetable seeds,” he explains, and warns that if the hen excreta is used directly, it can burn the seed or plant. “If we keep this manure for six months, or even a year, there will be no damage. The plant will get strengthened,” he adds. “The fertility of the soil on my land has increased, thanks to poultry manure.”

### The way forward

As the land area in the islands is limited and there is no scope for expansion here, the land needs to be used judiciously. The CIARI scientists are convinced that organic farming is the way to go. According to Velmurugan’s research results, published in a book titled *Organic Farming: Technologies and Strategies*, there is

good scope for the production of tropical fruits like mangosteen, durian, dragon fruit, rambutan, grapefruit, pomelo and longan as there is a high export potential for them. Also, poultry, pig and cattle can be integrated with the crop components for efficient resource recycling and stability to farm income.

Velmurugan and his colleagues believe that by applying appropriate organic production technologies for nutrient, plant protection, post-harvest operations, etc., and by capacity building, productivity in Andaman could be significantly increased. By intercropping, for example, more organic matter could be generated. Buffer crops could be grown reaching up to twice the height of the organic crop to protect it. For instance, when chilli is cultivated as the main crop, castor can be grown as a buffer crop. A simple certification process for all the organic farmers and the promotion of a specific brand name for the islands would greatly contribute to organic farming here. A further recommendation the scientists give is that policy should encourage private entrepreneurs to produce and sell quality manures. And the seed sovereignty of the farmers be ensured by establishing seed villages, seed banks and seed cooperatives to produce, store, share and supply good quality seeds. These are not available right now. Additionally, the scientists believe that farmer-to-farmer exchange is one of the best mechanisms to share farmers’ knowledge and innovations in organic agriculture, and that this should be facilitated. Also, Velmurugan maintains that financial assistance and specific crop and livestock insurance for organic farmers could instil confidence among Andaman Island farmers.

As tourism is expanding in these islands, there is a huge potential for the local farmers to produce and supply organic vegetables. Andaman’s proximity to the South East Asian countries can be an advantage in terms of exporting organic products. If the potential of the production system and market demand is properly linked with adequate policy support, organic farming will thrive in these islands. “It will reduce the burden on other markets like Chennai, from where vegetables are now being sourced. One can also save on the huge cargo costs which increase the prices of vegetables here,” says Velmurugan.

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