Global Coral Reef Alliance
A non-profit organization for protection and sustainable management of coral reefs

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BARBUDA LIMESTONE SOIL CROP GROWTH STIMULATED BY MONTSERRAT VOLCANIC ASH

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INTRODUCTION

Soil fertility depends on the geological history of the minerals in it, climate, and their management. Oceanic islands are either limestone or volcanic, the only exception being the high granite islands in the Seychelles, an ancient small continental fragment. Most limestone islands, including all atolls, are low and flat and are much drier than the high wet volcanic islands. Volcanic islands are much more fertile, because they are wetter, and because basalt contains an ideal mixture of the nutrient elements essential for plant growth, lacking only nitrogen. In contrast limestone soils are essentially deficient in all the nutrients except for calcium, depending on small episodic mineral additions from wind-blown sea salt spray and dust. Tropical volcanic islands are famous for lush fertility and abundant forests, producing the greatest range of food crops, such as Java and Bali, but many low flat limestone islands have sparse vegetation of low diversity.

Infertile soils and dry conditions severely limit crops that can be grown on most limestone islands to a few species like coconuts and pandanus, and breadfruit, root, sorghum, and fruit crops only if there is enough rain. On many low limestone islands people live largely from fish, coconuts, and white rice, eat very few vegetables, and suffer high levels of nutrient deficiency leading to chronic illnesses such as diabetes. A simple long-lasting way to improve soil fertility will allow new foods to be grown where they now can't be, greatly improving nutrition and health of islanders. Here we show a simple and cost-effective means to do so, using ash from a high, wet, volcanic island (Montserrat) as a natural slow-release fertilizer on a low, dry, limestone island, Barbuda. Barbuda grows little food due to poor soil and dry conditions, and the population lives primarily by fishing.

MATERIALS AND METHODS

About 20 Kilograms of andesitic Montserrat volcanic ash was collected in the field in 2012 by Tom Goreau and carried by hand via plane to Antigua and boat to Barbuda, where it was given to John Mussington, Principal of the Sir McChesney George Secondary School on Barbuda. The amount was limited by overweight air charges for the bag containing the ash.

The school has an active farm training project, and the students were involved at every stage from preparation to measuring plant heights, crop yields, and flowering times. The ash was mixed with local limestone soil and mulch made from leaf compost, donkey manure, and chicken manure and divided into pots in which various crops were grown, along with control pots lacking in volcanic ash, as a student research project. Due to the small amount of volcanic ash available only 10% of volcanic ash was added to local limestone soils in the pots. Eggplants and peppers showed the largest response. Plants flowered earlier and bore more and larger fruits. Some plants, like okra and spinach grew so well they became pot-bound and died, so results were inconclusive. Results were reported by John Mussington in a chapter entitled Soil Remineralization Trials: Preliminary effects of Monserrat Volcanic Ash on Barbuda Limestone soils in the book Geotherapy: Innovative Methods of Soil Fertility Restoration, Carbon Sequestration, and Reversing CO2 Increase, 2014, T. Goreau, J. Campe, & R. Larson (editors).

The results were very promising and worth following up, but the amount of rock powder was so small it was not sufficient for field plot experiments, so the soil in the small pots was emptied out and mixed into a plot used to grow beans, pumpkins, and sweet potatoes, next to similar field, but containing no rock powder. On September 6th 2017 Barbuda was directly hit by category 5 Hurricane Irma, which arose without warning, damaged most homes on the island, and forced the evacuation of virtually the entire population of the island.

RESULTS

On March 10 2020 Tom Goreau returned to Barbuda to check the fate of Montserrat volcanic ash. Below are photographs taken of John Mussington in the school farm. The first photograph shows the plot receiving the volcanic ash on the left, and the control plot on the right. The second photograph shows the prolific growth in the ash fertilized plot. The third photograph shows the control plot in the foreground and the ash fertilized plot in the background.

A huge increase in crop biomass production is immediately obvious. Crop yields were much higher on the plot with small amounts of volcanic ash. The fertilized plot has large, tall, dark green leaves completely covering the ground, while the control plot has sparse growth with small, low, yellow leaves, low yields, and general signs of wilting and ill health.

These qualitative results show profound crop yield improvements on decade-long scales can be achieved with small amounts of material. They should be applied on a large scale on all limestone islands. We propose to seek funding to expand them on Barbuda at the earliest opportunity, and apply them in other islands.

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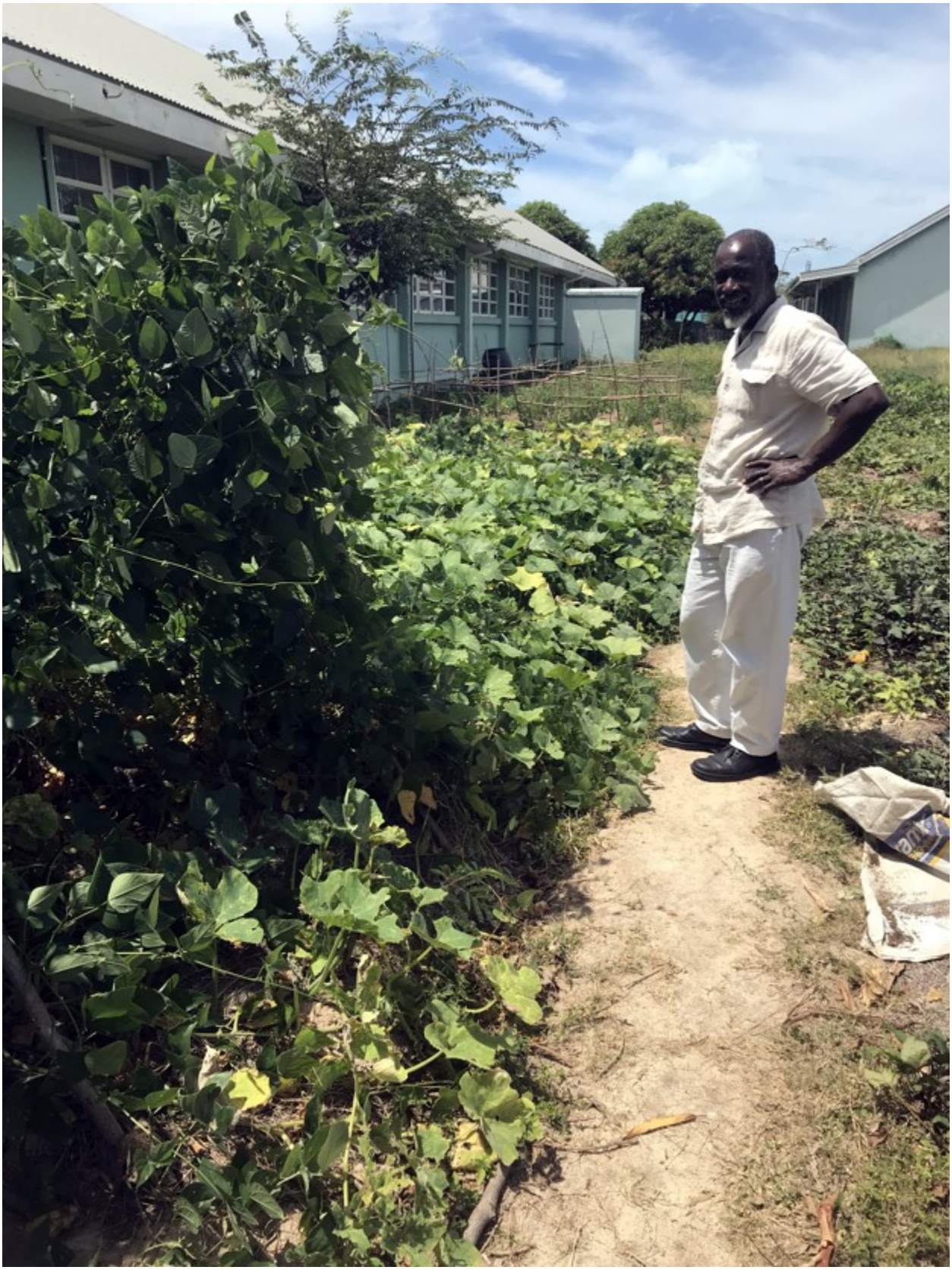

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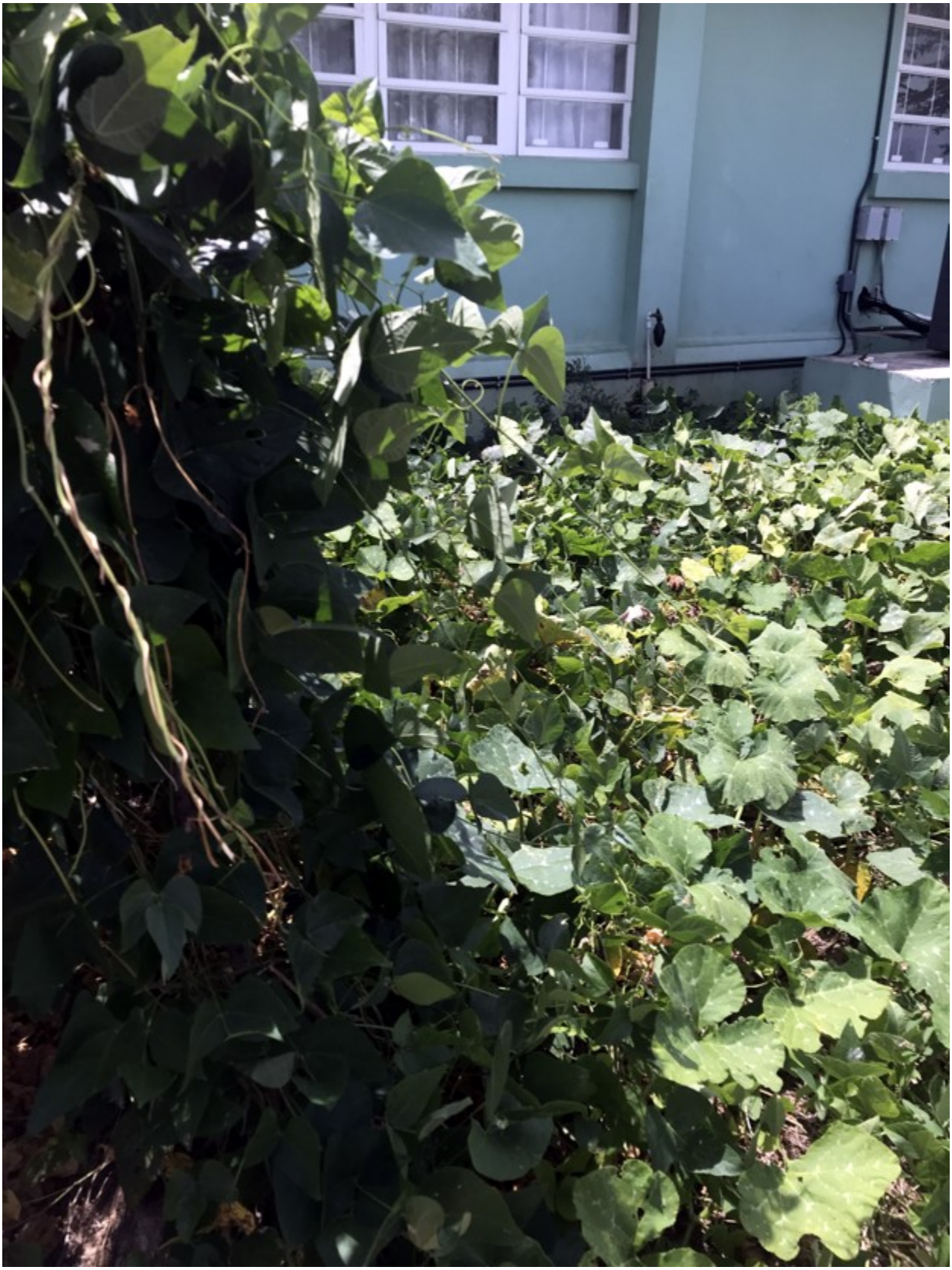

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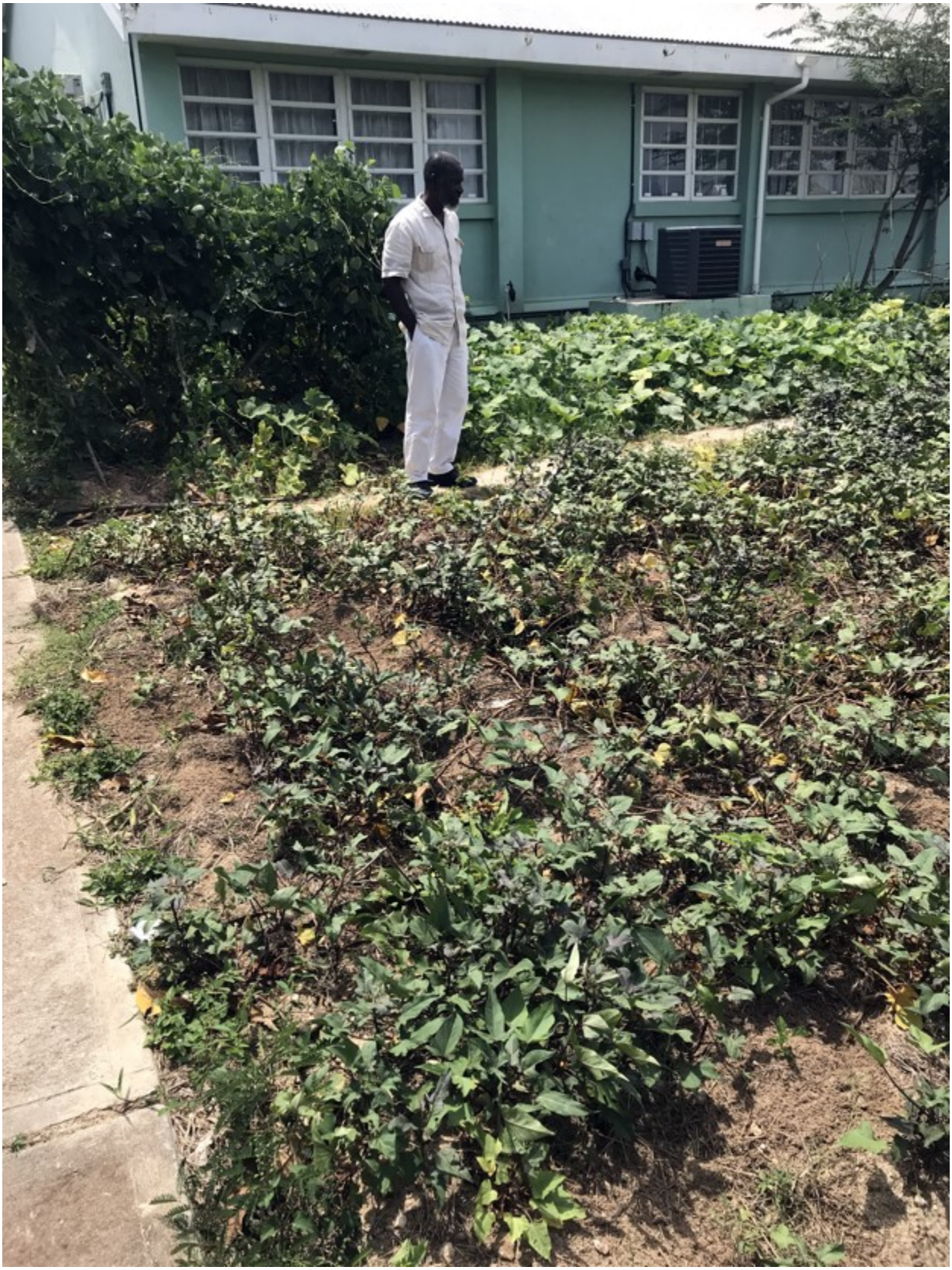

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