

APP Thematic Feature No. 8

Intra-ACP Agriculture Policy Programme (APP) Caribbean Action, with funding by the European Union under the 10th European Development Fund (EDF)



Intra-ACP APP Caribbean Action

Putting Green, Natural Options to the Test, as Alternatives to Reliance on Imported Agrochemicals, Offers a Timeless, Win-win Solution

In the Caribbean, today's farmer has to keep up with rising demands, more restrictions, increasing responsibilities and constant change.

With an already immense food import bill of over US \$5 billion annually and a growing population, the pressure and demand to increase local food production is great. To rise to the challenge, farmers must also overcome some unfavourable economic realities that often impose restrictions on their capacity to grow their business. These include the usual 'binding constraints' such as, inadequate access to productive resources (land, financing, labour and new technologies), fragmentation of key support services and an increasing array of standards and regulations on the inputs they use and on their practices associated with trade.

Agriculture, both globally and within the Region, also has an increased responsibility to protect the environment. A healthy environment, with good soil and adequate, unpolluted water, is vital to the success of a farming enterprise. However, with pressures to grow more, the quality of land resources available for farming has deteriorated, as decades of heavy chemical use takes its toll on productivity and ultimately, food production. Farming system viability is now inextricably tied to sustainable farming practices. And, in the pursuit of sustainability, farmers are more accepting of efforts to reduce the adverse environmental impacts of conventional farming and explore alternative solutions to expand output in both crop and livestock production.

Rising demand, more restrictions and increasing responsibilities on the farm sector have been further complicated by the impacts of climate change. Use of agricultural practices which help to reduce these impacts is an absolute necessity to ensure long-term, sustainable development. The causes and impacts, including an elevated level of risk in the sector, have been the subject of dialogue at national and regional levels, leading to a number of plans and strategies to build resilience in farming

Farming Green - Using Natural Plant Material to Stimulate Crop Growth and Enhance Animal Health

and food production systems. Drought-mitigation and environmentally sound practices need to be part of these plans and strategies. This need is illustrated by two major drought periods which have impacted the Caribbean in less than ten years.

It should therefore be no surprise that 'Green Farming' is being proactively pursued as an important part of the solution. This feature highlights 'green' farming solutions that have undergone validation trials by the Caribbean Agricultural Research and Development Institute (CARDI) under the Intra-ACP Agriculture Policy Programme (APP). The APP is an agricultural development programme supported by the European Union under the 10th European Development Fund (EDF). The preliminary results from these trials provide encouraging signs of their potential to address long-standing and common production issues, foster sustainable growth and enhance the viability of small farming systems.



Technician Paul Lucas displays Mulberry plants in CARDI nursery Barbados. (Photo: CARDI)

Natural Farming - Overview

Globally, natural farming is far from new, and well advanced in other developed country farming systems. The concept was introduced by Masanobu Fukuoka in his 1975 book called "The One Straw Revolution". Fukuoka was a Japanese farmer who believed in an ecological approach to farming long before it was in vogue. In essence, Natural Farming is simply the elimination of manufactured inputs and equipment in farming practices. According to Colin Duncan's book, "The Centrality of Agriculture: Between Humankind and the Rest of Nature," it is a closed system, one that demands no human-supplied inputs and mimics nature."

Research into natural alternative solutions by CARDI, under Component Two (C2) of the APP, while not entirely applying Fukuoka's principles, does borrow heavily from the general concepts. The research aims to validate improved practices, technologies and farming systems and improve their adoption and application by small producers in the Region. Green and natural farming practices are an important part of this objective, driving the evaluation of their use and impacts on crops and livestock prioritised under the APP. These priorities are roots and tubers, small ruminants, herbs and spices and organically produced vegetables under Protected Agriculture structures.

APP Contribution to natural farming research in the Caribbean



Sweet potato and guinea grass mulch, Experimental Plot in St. Kitts.
(Photo: CARDI)

Guinea Grass to conserve soil water

Open field farming is still widespread in the Caribbean. In fact, it is still the prevailing system for producing roots and tubers, a food group afforded priority status for food and

Implementing the Use of Guinea Grass as Mulch

Step 1: Harvest Guinea Grass before flowering/seeding because when the seeding begins, the guinea grass stem becomes more liquefied and therefore difficult to break down as mulch. There are also a higher proportion of stems to leaves after seeding, and it is the leaves that account for the bulk of the matting that forms mulch. Timing is therefore critical when harvesting the guinea grass.

Step 2: Secure sufficient amounts of grass to adequately cover the area prepared for cultivation. To provide a mat that will not break down before the cropping season is over, it is recommended to use 46 cubic meters of dried grass per hectare of prepared land.

Step 3: Apply fertilizers and any other soil treatment, especially if fertilizer will be broadcast and incorporated into the soil.

Step 4: Prepare holes for sowing seeds or for transplant.

Step 5: Arrange the dried leaves length-wise in a single direction over the prepared area, completely covering the soil. The process is to be repeated in the opposite direction, forming a mat.

Step 6: Proceed with production activities as usual.

Source: www.teca.fao.org, "Enhancing drought resistance through guinea grass mulching, Jamaica" 2008

nutrition security, agro-industrial development and import substitution strategies in the Region. Sweet Potato, as a priority commodity, has been receiving much attention under the APP, as well as other development agencies and farmers' groups in the Caribbean. While varieties in this commodity group tend to be fairly well adapted to growing conditions in the Region, there is no doubt that changes in climate have affected their productivity levels.

That is why CARDI spent the 2016 sweet potato growing season evaluating the use of guinea grass mulch as a viable and 'green' drought-mitigation strategy in St. Kitts and Nevis. Similar experiments in Jamaica by the FAO helped to guide the design and management of this trial.

The application of dried guinea grass over an area to be cultivated helps control soil erosion and weeds, increase



N3 variety of sweet potato. (Photo: CARDI)

water retention capacity in the soil and improve soil structure. Better soil moisture is good for germinating seeds and improved soil structure fosters stronger crop establishment and improved nutrient uptake. Other benefits include heat and sun protection for young plantlets and roots, reduced weed control costs and the conditions to allow for planting during dry periods, all of which can result in higher yields at reduced costs.

For the CARDI experiments, different varieties were tested under the same conditions and the control was the use of no mulch at all. The highest yields came from the mulch treated plots and amongst those plots the most successful variety was N3. These are excellent and promising results, and in light of the reality of a changing climate and higher food demands, there is a strong argument for continuing research in this area in order to produce more concrete findings.

The trial was a first for St. Kitts and Nevis, which is a particularly dry country that has been experiencing longer dry spells and lower rainfall. It was even more significant due to the abundance of Guinea grass growing in the country and the implications for also positively impacting the cost of production. Recommendations from this trial included establishing more trials of this nature with an increased number of varieties; increasing the quantity of mulch used on each plot; and carrying out experiments in different agro-ecological zones.

Natural Plant Enhancers to stimulate crop growth

Cassava has also been identified as a priority commodity in the Caribbean. This healthy, versatile tuber has excellent potential for very high yields, as proven in countries across the globe, however in the Caribbean, average yields are notably sub-par. Also, the vast opportunities for value-added products afforded by cassava are greatly hindered due to

lack of consistent supply and the commercial volumes necessary to support value-added enterprises. As a result, producers have resorted to growing cassava with minimal inputs in order to lower production costs and obtain a better return on investment.

The use of natural growth enhancers, or bio-stimulants, is a promising 'green' technology being used in cassava production to increase yields. Agconcepts.com defines bio-stimulants as "molecules that act upon and enhance certain metabolic or physiological processes within plants and soil." They are plant extracts that include different combinations of compounds, substances and micro-organisms. They can be as simple as elemental nutrients that are required to support microbial life, or more complex, like composts which require special care and equipment.

According to the European Bio-Stimulants Industry Council in their article, 'About Bio-Stimulants and the Benefits of Using Them', "Bio-Stimulants are used to foster plant growth and development throughout the crop life cycle from seed germination to plant maturity in a number of demonstrated ways, including but not limited to:

- Improving the efficiency of the plant's metabolism to induce yield increases and enhanced crop quality;
- Increasing plant tolerance to, and recovery from, abiotic stresses;
- Facilitating nutrient assimilation, translocation and use;
- Enhancing quality attributes of produce, including sugar content, colour, fruit seeding, etc;
- Rendering water use more efficient; and,
- Enhancing soil fertility, particularly by fostering the development of complementary soil micro-organisms."

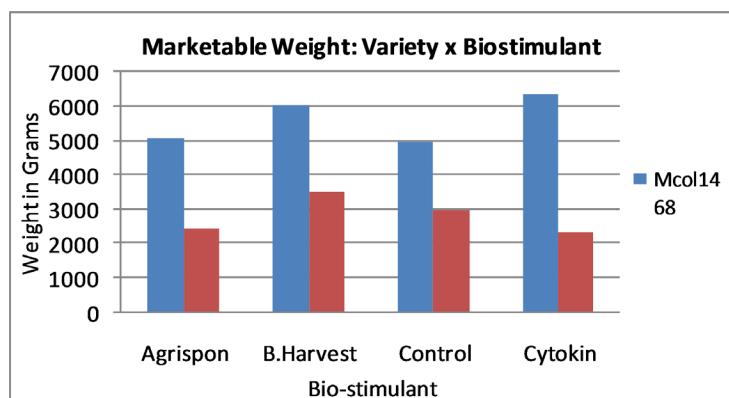
"Crop growers can obtain higher prices for their products when crop's quality is enhanced because improved quality has a positive impact on storage and conservation, which gives producers more time to choose the best moment to sell their products at advantageous prices."

Source: www.lidaplantresearch.com

Lida Plant Research also promises results from the use of bio-stimulants in their 2016 article, "Benefits of Bio-stimulants: Reasons to Believe." They say that these natural plant enhancers help to ensure that crops make full use of fertilizers, lowering input costs and eventually benefitting the customer with lower prices and higher quality foods.

They also state that, "Crop growers can obtain higher prices for their products when crop's quality is enhanced because improved quality has a positive impact on storage and conservation, which gives producers more time to choose the best moment to sell their products at advantageous prices."

CARDI and the APP wanted to validate these claims before making recommendations to farmers and therefore supported field-based trials in Grenada through 2015 and 2016. Their methodology was to plant two different varieties of cassava under four different treatments using the bio-stimulants Agrispon, Cytokin and Bountiful Harvest, and no bio-stimulant as the control.



Source: Cassava Bio-Stimulant Trial, Prepared by Nigel Raymond and Reginald Andall, November 23rd, 2016 CARDI

The clearest result was not actually seen in the use of the bio-stimulant but rather the varieties tested. The Mcol 1468 variety far outperformed the Mcol 74 variety, producing a significant difference in yields over time. Only minor gains were seen in the use of the bio-stimulants. However, what was very clear was that



Grenada Cassava bio-stimulant trial - Mcol 1468 with no bio-stimulant. (Photo: CARDI)

Mcol 1468 was more responsive to the bio-stimulants than Mcol 74. The most successful combination was Mcol1468 and Cytokin or Bountiful Harvest.

As a first time trial in Grenada, these initial results will serve as a platform for further research and validation. CARDI has indicated intention to repeat these trials as part of their research agenda.

Organic Treatments for Yellow Sigatoka Disease in Plantains and Bananas

As noted, using organic rather than chemical solutions for enhancing the growth of plants has shown promise in trials conducted elsewhere, and so has the use of organic solutions in combatting disease. Just as CARDI wanted to test claims about the benefits of bio-stimulants, CELOS, the Centre for Agricultural Research in Suriname, wanted to test claims about the benefits of using 'Timorex Gold', a new organic agent, in combatting disease.

In Suriname, almost all of the plantains and bananas in the Region are infected by Yellow Sigatoka Disease (YSD). This is a fungal disease caused by a fungal plant pathogen called *Mycosphaerella musicola*. According to the American Phytopathological Society website, www.apsnet.org, "Yellow Sigatoka leaf spot occurs throughout the world and is one of the most destructive diseases of banana. The symptoms first appear as small, light yellow spots or streaks parallel to the side vein of the leaf. Later, the spots elongate and turn brown with light gray centers. Such spots soon enlarge further; the tissue around them turns yellow and dies; and adjacent spots coalesce to form large lesions." Even more devastating is the fact that the pathogen survives in the infected banana leaves and spreads via the wind.



Grenada Cassava bio-stimulant trial - Mcol 1468 with bio-stimulant. (Photo: CARDI)

YSD reduces the leaf's photosynthetic capacity which then shrinks the potential bunch size of the fruit. It also causes early ripening. Both of these factors cause reduced yields from crops, leading to reduced profits for farmers, less local food for markets and limited options for export.

Some natural agricultural practices to combat this disease include proper drainage, weeding and fertilization, as well as reduced plant density and de-leafing. However, chemical controls are also commonly applied. The problem is, YSD is becoming resistant to many of the chemical fungicides on the market.

Timorex Gold is a natural botanical fungicide based on a plant extract called tea tree oil. It has promised to be an effective tool in integrated pest management (IPM). When reviewing the product information, it says that the product can be used alone, however, it can also be used in conjunction and rotation with chemical fungicides to reduce the chemical load which might otherwise be required.

In their planned trial, CELOS identified a group of 16 plants. Eight were to be sprayed every four weeks with 'Bravo', a chemical fungicide, and eight were to be sprayed with alternating applications of 'Bravo' and then Timorex Gold up to flowering, and then only with Timorex Gold up until harvest. Unfortunately, due to a lack of labour to prune and spray plants and the fact that they were unable to import Timorex Gold into Suriname and could only use 'Bravo' in the trial, reliable results could not be determined and the planned trial had to be abandoned. Subsequently, there was a heavy infection of the plants, from which hardly any good bunches of fruit could be harvested.



Modified pruning shears to be used on banana and plantain farms for control of YSD. (Photo: CELOS)

These experiences of CELOS, an established National Research and Development entity, bring to the fore the challenges facing small farmers in the Caribbean, namely

lack of labour and reliable access to inputs for farming. Despite these difficulties however, CELOS is determined to persevere. They are hopeful that they can work with a local company to import the natural fungicide into the country and believe that application of the same can "lead to a breakthrough" in battling YSD in plantains and bananas in Suriname based on product promises and favourable results of trials conducted elsewhere.

CELOS has also successfully introduced innovative tools and experiments to help mitigate against the spread of YSD. One such innovation is modified pruning shears with a built-in disinfecting system that sanitizes the blades every time it is used. This drastically reduces the transmission of the disease as farmers conduct important cultural practices such as pruning. It also reduces the time required for sanitizing during this operation and in so doing increases labour cost efficiency on banana and plantain farms.

Natural Forages as De-Wormers for Small Ruminants

Raising small ruminants (goats and sheep) for food and value-added products is growing in significance in the Caribbean. With a high demand and low supply of regional meat from small ruminants, this commodity holds great promise for bringing growth to the agriculture industry and economic benefit to the Region.



Collecting fecal samples. (Photo: CARDI)

A major challenge faced by small ruminant farmers is parasites. "Small ruminants are affected by many different parasites", says Dr. Donald H. Bliss in his article, 'Parasite Control for Small Ruminants Designed to Reduce Environmental Contamination.' "Each type of parasite has its own preferred location within an animal where it lives, causing specific damage to the host animal."

The most common parasite in small ruminants is the Barberpole Worm. It is a blood-sucking parasite that causes considerable blood loss and anemia, and is one of the most common causes of death in these animals. They are also very prolific, laying thousands of eggs every day, and very hard to kill.

Dr. Bliss points out that goats and sheep are more susceptible to infection by these worms because they graze closer to the ground where parasitic larvae are often more concentrated. "A pasture covered with morning dew provides an ideal time for parasite transmission to occur", he says.

There are chemical de-wormers available on the market. However these products demand a very high price. In addition to vulnerability due to dependence on imported inputs, the cost of these imported commercial preparations is an additional burden for small ruminant farmers.

There is also an increased resistance of common parasites to these de-wormers. According to the Cornell University Small Farms program, a 2010 study out of the University of Delaware examined parasites' level of resistance to four types of commercially available de-wormers. The results were very revealing.

- **Benzimidazoles** (e.g. Safeguard® or Valbazen®) were ineffective on 97% of farms tested;
- **Ivermectin** (Ivomec®) was ineffective on 79% of farms;
- **Moxidectin** (Cydectin®), essentially a more potent relative of ivermectin, was ineffective on 48% of farms; and,
- **Levamisole** (Prohibit TM), the last line of defense, was already ineffective on 27% of farms.

Evidently, alternative solutions need to be investigated. Non-chemical, or 'green' options for de-worming small ruminants, have shown promise in early trials. The application of Neem was tested by the Jamaican Ministry of Agriculture (MOA) as a substitute for chemical options and initial results were encouraging.

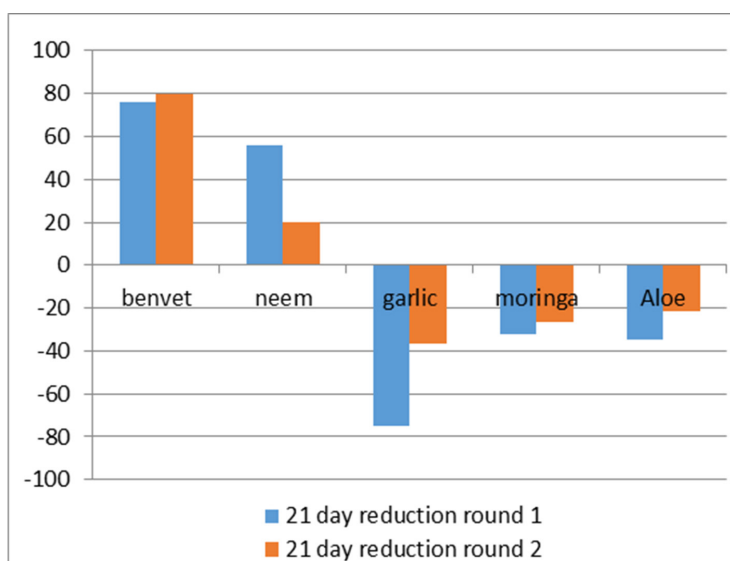
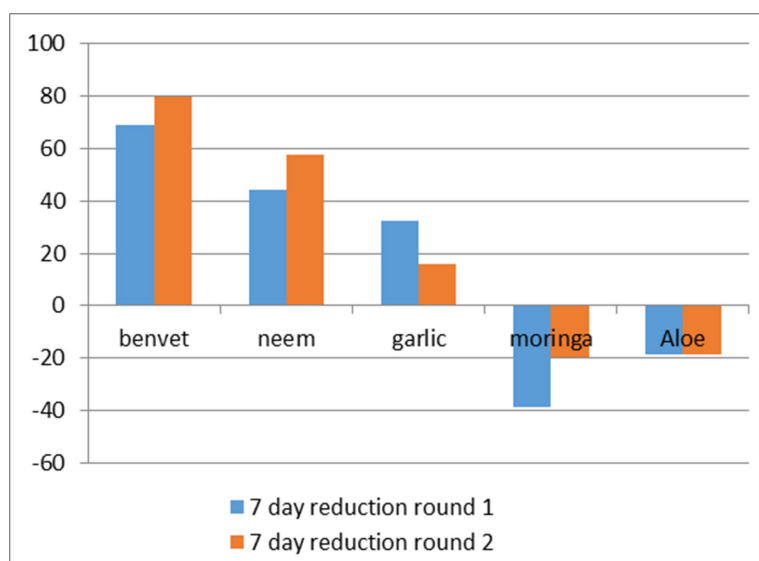
Under Component Two of the APP, CARDI saw the value in extending this research to include additional natural products. In 2016, they completed three trial phases using locally available remedies as natural de-wormers including, aloe vera, moringa, garlic and also neem. They used the commercial de-wormer Benvet®, one of the most common de-wormers in the Caribbean, as the control.

Egg Count Reduction – First Trial:

The test substances included each element on their own, as well as different mixtures of the elements. The goats in each test group received 5ml of the trial element or blend each day, and the control group was given 5ml of Benvet®. The animals were then allowed to graze as they would normally do, penned or unpenned, and in the same fields as usual.

Faecal samples were collected before the test substance was administered, and again 7 days after the goats had received the remedy (Round 1). An additional sample was collected again 21 days later (Round 2). Each time samples were tested for their worm population.

In the end, the most effective treatment over all of the trials was the commercial de-wormer (Benvet®). However, the Neem extract showed promising results, in some instances performing comparably to Benvet®. The Neem extract which was a combination of both neem and



Source: The use of traditional remedies in combating intestinal worms in Goats (Rohan Smith, Date: November 23rd, 2016, CARDI)

garlic performed the best of the mixtures. However the combination of all four natural remedies seemed to dilute the efficacy of the neem as a de-wormer and was the least effective.

Results and recommendations coming out of the trials support the argument for further studies to determine ideal preparation of neem and other potential extracts. Testing the same animals on different treatments was also suggested, as well as the completion of a cost-benefit analysis on the use of the comparable remedies to determine the impact on the cost of production.

Test Results:

- After seven days, the Neem was comparable in its effectiveness to the Benvet® treatment.
- After 21 days, the control (Benvet®) showed better results than the neem extract treatment in terms of Fecal Egg Count (FEC)
- The Neem extract showed the better control of the parasites than all other herbal remedies

While some applications show promise, continued research is definitely necessary to inform impact and cost-benefit analyses on the wider application of specific formulations of these 'green', natural and locally available elements to treat parasites in small ruminants. With the thrust to significantly expand production of small ruminants, research into holistic and effective approaches to health management of the animals in a manner which reduces the high dependence on costly imported veterinary medicines, will be central to raising productivity levels.

Mulberry Grass and other natural products as alternative sources of Animal Nutrition

Demand for meat and meat products from small ruminants in the Caribbean, is high and growing rapidly. Research shows that there is a preference for local sheep and goat meat. However, the commodity is not priced competitively. Imports, even from as far away as New Zealand, can retail for as much as 40% cheaper than locally produced commodities. High cost of imported feeds is the largest factor in the lack of competitiveness of local small ruminant products in the Region. Currently, feed costs make up 50% of the total cost of production for sheep and 25% for goats.

The important role of green leaves in supplementing animal feed is unquestionable. In the developing countries, cereal straws and grasses are fed to animals, but they cannot support full performance because of their poor nutritive value. Mulberry leaf supplementation can improve the efficiency of the whole diet."

Source: Utilization of mulberry as animal fodder in India", by R.K. Datta et al.

According to Dr. Gregorio Lagombra of the Dominican Institute of Agricultural and Forestry Research (IDIAF), "the Centre has had to invest in increased productivity of small ruminant farming systems to satisfy a tourist population of 6 million visitors a year, and a strong demand for small ruminant meat in the Dominican Republic (DR)". Raising productivity levels for small ruminant production requires not only obtaining effective feeds, but also addressing the impact of dry seasons on animal health. Shortage of good quality forage, particularly during the dry season, leads to poor nutrition and limits productivity of small ruminant production. Dr. Lagombra is adamant that the problems arising in dry season farming must be addressed and solved in advance of the season's arrival, and cannot wait until the season starts to find a solution.

To offset the high cost of imported commercial grain-based rations, small ruminant producers also depend on local forage, either through free grazing or a 'cut and carry' system for housed animals, supplemented with by-products such as crop residues. However, adequate pasture is limited, further exacerbated by drier conditions, forcing many small farmers to tether animals wherever grass and forage can be found. It is very common in the Caribbean to see herds of small ruminants grazing on grassy areas along highways and in over-grown community playing fields. Countries, such as St. Kitts and Nevis, have long recognised that these 'natural' pastures cannot fully support the nutrition needs of sheep and goats.

To address this problem, countries of the Region have been evaluating the deliberate cultivation of well-maintained pastures (or forage banks) as one alternative to improving forage yield and nutritive value. While these trials did not form part of the APP effort, there is much value in promoting these initiatives since they are critical complements to the APP-supported efforts at raising productivity in small ruminant production.

- In St. Kitts and Nevis, in 2012/2013, the Department of Agriculture experimented with Mulato II, This forage was deemed to be well adapted to Caribbean weather

conditions, easy to sow and establish, and with its deep root system, could withstand periods of dry weather and resist soil erosion. For the St. Kitts Department of Agriculture, the main objectives were to introduce new, improved forages and to find a way to store grass so that farmers will have a constant, year around source of feed for their small ruminants through production of silage. Silage is the preservation of forages in as good a nutritional state as the original material.



Making silage - compacting the chopped Mullato grass by stomping
(Photo: DoA St.Kitts)



Pelleted feed made from Mulberry CARDI Barbados. (Photo: CARDI)

- In the Dominican Republic, IDIAF has been doing dry season research to maintain animal productivity through nutrition. This research is important given the tendency for several animals to die during the dry season due to lack of adequate forage. As part of its own research agenda, IDIAF has been developing special machinery for small and medium producers to make hay and silage to secure feed during the dry season. Production of multi-nutritional blocks (traditional practice, using comprising molasses, urea, legumes and fibre, using calcium carbonate for protein) by hand and machines, a tried and true traditional practice, also continues as a strategy to combat dry season animal mortality.
- In Barbados, under the APP in January 2016, CARDI established high quality forages on its Field Station including, Mulberry, Mulato grass, Mexican sunflower and perennial peanut. Multiplication of mulberry plants were done using cuttings from established mulberry trees and distributed to farmers and farmer groups in March including, 1,000 plants to the Kendal Plantation group, 802 St. Catherine's Farm Ltd and 50 to three smaller farmers. This distribution of planting material aimed to significantly increase the protein content of the feed to the small ruminants. This was further complemented by the provision of a chipper shredder, oven and hammer and pellet mills to produce feeding blocks to demonstrate to farmers the productivity-enhancing benefits of using appropriate forages in small ruminant feeding. This was all towards the goal of finding natural, cost effective means to maximizing animal nutrition and good feeding systems.

- In Grenada, the APP supported the St. Patrick's Goat Farmers' Association through the provision of an improved Saanan buck to raise herd productivity. Support also included advice on silage making and demonstrations to farmers which highlighted that during the wet season, forage can be harvested, dried and stored and then fed to the animals during the dry season in order to maintain good nutrition.

According to I. Hernández and M. D. Sánchez of IICA, in their article, 'Small ruminant management and feeding with high quality forages in the Caribbean' (2014), Mulberry "is the best forage in terms of overall quality and potential yield if agronomic conditions are suitable." It is seen as a complete feed on its own for both sheep and goats. This can be justified by its very high nutritional value and exceptional yields when properly fertilized. Fortunately, these plants can be grown under normally challenging environmental conditions, including fallow and wastelands not fit for agriculture, and will provide even higher yields and better quality leaves if given a balanced application of fertilizer. "The most notable characteristic of mulberry foliage is its very high digestibility values. It is much superior to common forages and equivalent to commercial feed."

Mulberry should be seen as a 'green' option, leaving cereals and other cash crops for human consumption rather than forage. In this day and age, with increasing food demands from the human population, more vital agricultural land cannot be set aside for fodder production. Not only that, but getting a goat to eat mulberry grass is easy. According to Manuel D. Sánchez in his article 'Mulberry: An exceptional forage available almost worldwide!', "Small ruminants avidly consume the fresh leaves and the young stems first, even if they have never been exposed to it before. Then, if the branches are offered un-chopped, they might tear off and eat the bark. Animals initially prefer mulberry over other forages when they are offered simultaneously, and even dig through a pile of various forages to look for mulberry."

Disseminating and Moving Forward with the Results

It is ironic that with so much technology and chemical enhancements that “natural farming”, based on traditional knowledge and practices, is making a comeback as perhaps the most appropriate option to properly meet modern day demands, restrictions, responsibilities and changes in the now highly commercialised farming industry. Green farming is a little bit like fashion; what’s old is new again. And, this new trend will not only benefit the environment, but it promises excellent potential to battle common Caribbean problems. With a little more research and validation, the future of Caribbean farming could be ‘green’ and good for everyone.

Feeding and Nutritive Value of Mulberry

- Crude protein value in leaves: 15-28%, depending on growing conditions
- Crude protein in edible biomass (leaf and young stem): 12 – 14%
- Essential amino acids: 45% of total amino acids
- Ash values (minerals): Up to 25%
- Calcium: 2%
- Potassium: 2 – 3%
- Magnesium – 1%

Source: “Small ruminant management and feeding with high quality forages in the Caribbean”, IICA, I. Hernández and M. D. Sánchez, 2014

The need for more field research and validation was definitely echoed at the Regional Workshop on Dissemination of Field Trial Research Results, held in Guyana from 22-23 November 2016. The workshop disseminated the results of these and other APP-enabled field trials to stakeholders, including farmers, research agencies and extension personal across the Region. There was active discussion on some of the results and most importantly on methodologies and research designs. The overwhelming consensus was that the research was necessary and the results, thus far, look promising, particularly in use of natural remedies for pest and disease control and the production of feed and stimulants from natural materials.

In terms of lessons learned, there was a general recommendation to repeat the research, strengthening

Summary of Additional Field-based Evaluations and Validation Trials Carried Out by CARDI and Partners, Under the APP:

Name of Trial: Climate Smart evaluation of local sweet potato varieties for tolerance to water stress

Crop: Sweet Potato

Country: Antigua and Barbuda

Name of Trial: Climate Smart evaluation of planting in High Rainfall Zones during the Dry Season

Crop: Sweet potato (Beauregard variety)

Country: St. Vincent

Name of Trial: Climate Smart evaluation of local cassava varieties for tolerance to low watering regimes

Crop: Cassava

Country: Trinidad and Tobago

Name of Trial: Climate change resilience evaluation of corn cultivars to select varieties that can tolerate water stress

Crop: Corn

Country: Belize

Name of Trial: Enhancing productivity in changing climatic conditions through appropriate plant nutrition and method of application in Taro (Dasheen)

Crop: Taro/Dasheen

Country: Dominica

Name of Trial: Evaluation of organic practices in tomato production in protected environments in Constanza

Crop: Tomato

Country: Dominican Republic

research design to eliminate externalities that can skew results and conducting trials on actual farmers’ holdings to ensure that on-farm conditions are fully accounted for. CARDI confirmed that it had commenced the dialogue in this direction, both internally and through the IICA-CARDI Technical Cooperation Agreement.



IDIAF Protected Agriculture Organic Tomato Evaluation Trials using 3 varieties of tomatoes, planted from seeds. The trial seeks to determine performance of varieties using organic production methods to reduce the high use of agri-chemicals in conventional tomato production in the main producing region of Constanza.

See also:

TF#5: Changing Climate, Changing Farming Systems (October 2016)

TF#6: Are Farmers Still Planting by the Moon? (October 2016)

TF#7: 96° in the Shade: Cooling Things Down in Protected Agriculture Structures (November 2016)

This is the last in a 4-part series of Thematic Features with a focus on Innovation & Technologies for Sustainable Farming Systems, produced under the Agricultural Policy Programme (APP) Caribbean Action highlighting work under Component 2 – Applied Research and Development and Innovation in Farming Systems. The APP is funded by the European Union (EU) under the 10th European Development Fund (EDF) with the Inter-American Institute for Cooperation on Agriculture (IICA) as Executing Agency and the CARICOM Secretariat (CCS) and the Caribbean Agricultural Research and Development Institute (CARDI) as Implementing Partners.

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