**R&D in Agriculture: a bulletin on information resources**

**AIMS AND SCOPE**

The **R&D in Agriculture: a bulletin on information resources** aims to guide CARDI staff and other agricultural stakeholders in the Caribbean Community (CARICOM) and abroad to articles, journals, books, audio-visual materials, institutions and events on the following:

**Commodities**
- Roots & tubers (cassava, sweet potatoes)
- Cereals & grain legumes
- Hot peppers
- Bananas and Plantains
- Coconuts
- Fruits & vegetables
- Small ruminants

**Thematic Areas**
- Protected agriculture
- Emerging issues (agro-energy, herbals, ICTs, organics, value chains)
- Soil & water management
- Risk management (climate change, invasive species)
- Germplasm
- Biotechnology
- Feeds and feeding systems

These are the priority commodities and thematic areas in the Medium-Term Plan (2014/2016) of the Caribbean Agricultural Research and Development Institute (CARDI). They were identified after consultation with our CARICOM member states and contribute to the implementation of the Jagdeo Initiative and the Regional Transformation Programme (RTP) for Agriculture.

Short bibliographic references to publications, brief descriptions of the research and services of relevant institutions, as well as lists of events are presented in this publication. Where possible a web address (URL) is provided so that readers may visit the webpage / website and access the full abstract, summary, document, or details for the acquisition of the resource.

Issues of this publication are available on our website, [www.cardi.org](http://www.cardi.org), under the Publications section.

**Frequency:** 3 times a year - April, August, December
# TABLE OF CONTENTS

## COMMODITIES
- Roots and Tubers 3
- Hot Peppers 4
- **Fruits & Vegetables** – Germplasm, Bananas, Black Sigatoka Disease 5
- Livestock 7

## THEMATIC AREAS
- Agro Energy 7
- Organics 8
- Soil and Water Management 9
- **Natural Resource Management - Climate Change** 10

## OTHER AGRICULTURAL ASPECTS
- Agricultural Development 10
- Agribusiness 11
Commodities: Roots and Tubers

Roots and tubers value chain development and food and nutrition security – Caribbean: Lessons for the Caribbean from the World Congress on Roots and Tuber Crops, China, 18–22 January 2016
Gregory Robin (The Caribbean Agricultural Research and Development Institute (CARDI) Rivulet, St. Vincent and the Grenadines)
2017. Technical Centre for Agricultural and Rural Cooperation (CTA); INTRA ACP Agricultural Policy Programme
Series: CTA Working Paper

Research and development activities in countries of the Caribbean Community (CARICOM)
Dr. Gregory Robin (CARDI); Dr. Vyjayanthi Lopez (FAO) and Dr. Francis Asiedu (CARDI)
Keywords: Cassava. Sweet Potato, Taro (Dasheen)

Cassava in the Caribbean region: a look at the potential of the crop to promote agricultural development and economic growth
2016. Food and Agriculture Organization of the United Nations and Clayuca Corporation and Inter American Institute for Cooperation on Agriculture, Bridgetown,
http://www.fao.org/3/a-i5974e.pdf

Yield, quality and soil health under organic vs conventional farming in taro
G. Suja, G. Byju, A.N. Jyothi, S.S. Veena, J. Sreekumar
2017. Scientia Horticulturae 218: 334–343
Abstract
Growing concerns regarding food safety, environmental degradation and human health have generated interest in alternative agricultural systems like organic farming. This study aimed to compare growth, biomass, yield, proximate composition and mineral contents of tubers, physico-chemical properties and microbial population of soil under organic vs conventional farming in taro (Colocasia esculenta (L.) Schott.). Field experiments were conducted in split plot design over five seasons at ICAR-Central Tuber Crops Research Institute, India, with three varieties (Sree Kiran, Sree Rashmi and local) in main plots and three production systems in sub plots. Organic system (10.61 t ha\(^{-1}\)) performed similar to that of conventional (11.12 t ha\(^{-1}\)), with slight yield reduction (–5%). Both elite and local varieties responded equally well to organic management, which lowered the bulk density slightly and improved the water holding capacity (+19%) and porosity (+3%) of soil. Cormel quality was better under organic management, with higher dry matter, starch, sugars, P, K, Ca and Mg contents. Organic plots showed significantly higher pH (+1.2 unit) and available P and higher soil organic C (+39%), exchangeable Ca, Mg, Fe, Mn, Zn and Cu status. On-station developed technology involving farmyard manure, green manure, neem cake, biofertilizers and ash were on-farm validated at seven locations in southern India. The yield under organic management at farm level was higher by 29 per cent. Organic farming proved to be an eco-friendly alternative to conventional farming in taro for stable yield and quality cormels as well as for maintaining soil health.
Keywords: Alternative farming; Colocasia esculenta; Varieties; Productivity; Cormel proximate composition; Soil quality; On-farm testing
An evaluation of *Sargassum* seaweed media compositions on the performance of hot pepper (*Capsicum chinense* Jacq.) seedling production

Marcus N.A. Ramdwar, Valerie A. Stoute & Brandon S. Abraham

2016. Cogent Food & Agriculture 2: 1263428  Published online: 06 Dec 2016

Abstract

There has been a massive influx of *Sargassum* in the Caribbean causing devastating consequences. The current study investigated the utilization of *Sargassum* (a mixture of the *Sargassum flutens* and *Sargassum natans* species) as a substrate formulated with imported promix. Experiments were conducted during April to May in 2016 to evaluate the performance and quality of hot pepper seedlings using *Sargassum*-promix formulations. The seedlings were visually evaluated on the 45th day after sowing by an independent panel to visually score seedling quality. At the same time, the sample mean and standard deviation were calculated for each of nine seedling physical characteristics. A one-way MANOVA analysis, with formulation ratio as the independent variable and these nine characteristics as correlated dependent variables, was carried out using SPSS V.22. Introducing *Sargassum* into the formulation caused statistically significant differences in the majority of the seedling characteristics. However, these actual differences are small and are unlikely to practically impact seedling production except with one characteristic, where the change is beneficial. The treatment formulations of *Sargassum* significantly improved the sturdiness of the seedlings. *Sargassum* can be successfully utilized to reduce the reliance on 100% imported commercial promix.

Keywords: *Sargassum*, seaweed, peat moss, promix, seedlings, sturdiness

Impact of nutrient management, soil type and location on the accumulation of capsaicin in *Capsicum chinense* (Jacq.): One of the hottest chili in the world.

Subhasish Das, K. Charan Teja, Buddhadeb Duary, Pawan Kumar Agrawal, Satya Sundar Bhattacharya


Abstract

*Capsicum chinense* (Jacq.) cv. Borbhu a highly pungent and strictly endemic landrace is found in Northeast India. Information regarding scientific cultivation of this crop is not available. In the present investigation, we formulated a few organic based integrated nutrient management schemes to standardize the pungency and hotness of the crop in two widely apart locations. Here we assess the impact of the management schemes on capsaicin accumulation in *C. chinense* grown in two types of soil (alluvial and lateritic) falling in two states of India (Assam and West Bengal). Some vital nutritional (crude protein, fibre, sugar and acid contents) and phytochemical features (β-carotene, lycopene) were also evaluated. Chilies grown in Assam soil (alluvial) exhibited significantly higher capsaicin content and pungency than those grown in the West Bengal soil. Application of vermicompost alone resulted in higher fruit yield, soluble sugar, protein, fibre, and lycopene contents in plants of Assam; whereas in West Bengal the maximum fruit yield and nutritional attributes were observed in plants grown under NPK + Vermicompost. However, vermicompost based nutrient management scheme efficiently elevated the pungency level in “Borbhut” irrespective of soil types.

Keywords: *Capsicum chinense*; Vermicompost; Capsaicin; Soil; Pungency

**GERMPLASM:**

**Tropical fruit tree biodiversity: good practices for in situ and on-farm conservation**

Bhuwon Sthapit, Hugo A.H. Lamers, V. Ramanatha Rao and Arwen Bailey (eds.)

2016. Routledge, Oxon. © 2016 Bioversity International

Farmers have developed a range of agricultural practices to sustainably use and maintain a wide diversity of crop species in many parts of the world. This book documents good practices innovated by farmers and collects key reviews on good practices from global experts, not only from the case study countries but also from Brazil, China and other parts of Asia and Latin America. A good practice for diversity is defined as a system, organization or process that, over time and space, maintains, enhances and creates crop genetic diversity, and ensures its availability to and from farmers and other users. Drawing on experiences from a UNEP-GEF project on "Conservation and Sustainable Use of Wild and Cultivated Tropical Fruit Tree Diversity for Promoting Livelihoods, Food Security and Ecosystem Services", with case studies from India, Indonesia, Malaysia and Thailand, the authors show how methods for identifying good practices are still evolving and challenges in scaling-up remain. They identify key principles effective as a strategy for mainstreaming good practice into development efforts. Few books draw principles and lessons learned from good practices. This book fills this gap by combining good practices from the research project on tropical fruit trees with chapters from external experts to broaden its scope and relevance.

http://www.bioversityinternational.org/fileadmin/user_upload/Tropical_Fruit_Tree_Diversity.pdf

**BANANAS:**

**Growth media and mycorrhizal species effect on acclimatization and nutrient uptake of banana plantlets**

İbrahim Ortas, Mazhar Rafique, Çağdas Akpınar, Yıldız Aka Kacar

2017. Scientia Horticulturae 217:55-60

Abstract

The objective of this study was to investigate the acclimatization and performance of banana (Dwarf Cavendish) in two substrates inoculated with different AM fungi (*Glomus caledonium* and *G. macrocarpum*) and assess the plantlets dependency on inoculation for phosphorus (P) and zinc (Zn) uptake along with biomass development. In addition, to investigate the role of mycorrhizal fungi in supporting acclimatization phase, a plant growth promotion study was set-up in greenhouse using micropropagated plantlets. Two growth media, as GM-I and GM-II were used accompanied by *G. caledonium* and *G. macrocarpum*. In first phase, 9 weeks acclimatization study was conducted and in second phase, acclimatized plants were propagated for 16 weeks in both inoculated and non-inoculated conditions. Plantlets acclimatization and nutrient uptake were recorded along with other parameters. Mycorrhizal inoculation significantly increased banana plantlets growth, root infection and P uptake. Plantlets inoculated with *G. caledonium* exhibited increase in shoot and root dry mass, P and Zn concentration, and root infection in the GM-I. The shoot and root dry mass, P and Zn concentration, and root infection were higher in GM-I than Konaktas soil series. Banana plantlets are mycorrhizal dependent (MD) and soil-grown banana plantlets are more MD than plants grown in the GM-I. Mycorrhizal inoculation seems to be a significant factor in decreasing mortality and increasing production of high-quality banana plantlets under micropropagation conditions.

**Keywords:** *G. caledonium*; *G. macrocarpum*; Micropropagation; Inoculation

5th ISHS-ProMusa symposium: *Agroecological approaches to promote innovative banana production systems*, 10 to 14 October 2016, Montpellier, France

2016. Organized by ProMusa and hosted by Cirad

http://www.promusa.org/article142-2016-France-symposium

http://www.promusa.org/article142-2016-France-symposium#presentations

Selected Presentations

**SESSION A: Sharing the concepts of agroecology and illustrating their usage**

S. Declerck, Université Catholique de Louvain, Belgium *Agroecology: the key role of beneficial rhizosphere microorganisms in ecosystem services*

C. Staver, Bioversity International, France *Step by step tools to identify agroecological intensification alternatives for banana cropping systems* (PDF 1.6 MB)

**SESSION B: Managing plant diversity to ensure ecosystem services**

C. Staver, Bioversity International, France *Do suckers from superior mother plants produce bigger bunches? Preliminary results for plantains* (PDF, 783 kB)

**SESSION C: Enhancing biological regulations in banana cropping systems** (field level)

C. Guillermet, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France *Experimental approaches for agroecological management of black leaf streak in dry and humid tropical conditions* (PDF, 1.2 MB)

M. Dita, Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Brazil *Management of Fusarium wilt of bananas in Minas Gerais, Brazil* (PDF, 1.1 MB)

C. Berhal, University of Liège, Belgium *Study of the volatile organic compounds in the interaction between banana plants and the fungal disease Fusarium oxysporum f.sp. cubense Tropical Race 4 (FocTR4)* (PDF 2.3 MB)

**SESSION D: Improving soil functioning through optimizing mineral and water resource use** (field level)

R.A. Segura, CORBANA, Costa Rica *Managing the interactions between soil abiotic factors to alleviate Fusarium Wilt in bananas*

**SESSION E: Processes, multi-criteria assessment of performances, and contextual factors driving stakeholder strategies** (at farm, landscape or higher levels)

S. Zanoletti, UGPBAN, France *Agroecological systems in banana production in Guadeloupe and Martinique. From pesticide reduction to improving selling prices* (PDF, 683 kB)

P. Feschet, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France *Multi-criteria assessment of innovative cropping systems in French West Indies: A step of the improvement process* (PDF, 823 kB)

J. Daniells, Queensland Government, Australia *TR4 as a driver of agroecological approaches in banana production* (PDF, 1.7 MB)
BANANAS - Black Sigatoka Disease:

Protect your Financial Future – DOH STICK ... ACT QUICK
2017. Caribbean Agricultural Research and Development Institute (CARDI) /Caribbean Development Bank (CDB)
Get to know the 6 stages of Black Sigatoka Disease, and what actions you can take to control the spread of the disease in your banana and plantain fields, #CARDICaribbean #plantains #banana #blacksigatokadisease
Poster is an output of the CARDI/CDB funded project "Development of an Integrated Disease Management Programme for Black Sigatoka Disease” in Guyana, Dominica, St. Vincent and the Grenadines and St. Lucia.

https://www.facebook.com/CARDIcaribbean/photos/a.224217567726082.1073741828.224190921062080/849380625209770/?type=3&theater

https://www.facebook.com/hashtag/blacksigatokadisease
posted on Facebook CARDIcaribbean  April 25 at 10:47am ·

COMMODITIES: Livestock

The Trinidad & Tobago dairy goat manual: breeds, milking, herd health, records
Trinidad and Tobago Goat and Sheep Society, Chaguanas (Trinidad and Tobago); IICA, Port-of-Spain (Trinidad and Tobago)
2016. IICA, Port-of-Spain (Trinidad and Tobago)
Summary
The information contained in this manual describes the important aspects of dairy goat production in Trinidad and Tobago. Its purpose is to help you and other farmers improve your production. The manual assumes that you are interested in dairy goat production but it does not assume that you know anything about rearing them. This manual provides you with some basic knowledge and technologies about various aspects of dairy goat production including but not limited to: choosing good goats, nutrition, feeding, breeding, grooming, disease control and treatment. There is a chapter which gives an example of proper record keeping tables and even includes a herd projection table for a twenty doe unit.

THEMATIC AREAS: Agro Energy

Renewable Energy: The Energy-Agriculture Challenge
2017. SPORE No. 183, December 2016 to February 2017
• pp. 19-30 Renewable Energy: The Energy-Agriculture Challenge,
• pp. 26 Jatropha: an environmentally-friendly agrofuel?
• pp. 28-30 From energy consumer to energy source by Natalie Dookie: Natural resources in the Caribbean remain largely untapped, but with biomass and biofuels there is great potential for renewable energy and opportunities for agriculture.
http://spore.cta.int/en/
Postharvest quality and composition of organically and conventionally produced fruits: A review
Asanda Mditshwa, Lembe Samukelo Magwaza, Samson Zeray Tesfay, Nokwazi Mbili
2017. Scientia Horticulturae 216:148-159
Abstract
The rapidly growing organic food market has prompted many researchers to compare numerous aspects of organically and conventionally grown foods. This review of literature provides an overview of empirical studies comparing postharvest quality of organically and conventionally produced fruits. The emphasis is on key postharvest quality parameters including physicochemical properties, postharvest storage performance, microbiological, sensory and nutritional quality. The study showed that physicochemical and nutritional properties relating to the contents of vitamins, phenolics and antioxidants are higher in organically produced fruits. It is also showed that production system has little effect on sensory quality. The better taste of organic produce as perceived by consumers is only due to the ‘halo effect’ of the organic label. The differences identified could be largely attributed to the different fertilization systems between organically and conventionally managed soils. The microbial contamination due to improper use of manure and compost in organically managed soils is a major concern in organic fruits. High levels of pesticide residues and nitrates in conventionally grown fruits is also a cause of concern. Several important problems in organic fruits are yet to be addressed, bacterial and fungal contamination of organic fruits warrants more intensive research. Future research should also investigate the effect of production system on storage potential.
Keywords: Farming systems; Organic; Conventional; Shelf-life; Fruits; Quality

What is this thing called organic? – How organic farming is codified in regulations
Verena Seufert, Navin Ramankutty, Tabea Mayerhofer
2017. Food Policy 68:10-20
Abstract
Organic farming is one of the fastest growing sectors of world agriculture. Although it represents only 1% of world agricultural area, organic is one of the most recognized food labels and most people in developed countries consume some amount of organic food today. There is a wide range of interpretations of what organic means by different actors in the sector. Here we examine eight different organic regulations from across the world to understand how they have codified the large diversity of ideas inherent in organic agriculture. Our analysis shows that organic practices and regulations do not differ substantially between countries – across the board organic regulations define organic mainly in terms of ‘natural’ vs. ‘artificial’ substances that are allowed (or not) as inputs. This interpretation of organic as “chemical-free” farming, largely void of broader environmental principles, does not fully incorporate the original ideas of organic theoreticians who conceived it as a holistic farming system aimed primarily at improving soil health, thereby leading to improved animal, human, and societal health. This narrow focus of organic regulations can be explained by the interest of organic consumers who predominantly buy organic because they believe it is healthier and more nutritious due to the absence of harmful substances. Organic regulations need to place more emphasis on environmental best practices in order to ensure that organic agriculture can contribute to sustainability objectives.
Keywords: Organic agriculture; Organic policy; Sustainability; Content analysis
The new Caribbean Nitrogen Index to assess nitrogen dynamics in vegetable production systems in southwestern Puerto Rico
Miguel Oliveras-Berrocales, David Sotomayor-Ramírez, Jorge A. Delgado, Luis R. Pérez-Alegria

Abstract
Nutrient loss from agricultural fields is one of the main factors influencing surface- and ground-water quality. Typical fertilizer nitrogen (N) consumption rates in vegetable production systems and horticultural crops in Puerto Rico fluctuate between 112 and 253 kg N/ha. The nitrogen use efficiency of vegetable crops is low, increasing the potential for nitrogen losses and high residual soil nitrate content. Quantification of residual soil N and N losses to the environment can be a difficult task. Simulation models such as the USDA-ARS N Index can be used to identify the relative magnitude of varying N-loss pathways and to identify best management practices. Field studies were conducted to quantify residual soil N and crop N removal, and to validate the Nitrogen Index in onion, tropical pumpkin and tomato production systems in the Lajas Valley in southwestern Puerto Rico. Relationships between observed and simulated values were determined to examine the capability of the model for evaluating N losses. There was good correlation between observed and predicted values for residual soil N ($r=0.88$) and crop N removal ($r=0.99$) ($p<0.05$). In the production systems evaluated, the N volatilization losses ranged from 1 to 4 kg N/ha, the denitrification losses ranged from 18 to 46 kg N/ha, the leaching losses ranged from 155 to 779 kg N/ha, and the residual soil nitrate ranged from 64 to 401 kg N/ha. The N use efficiency ranged from 15% to 39%. The results obtained showed that the Nitrogen Index tool can be a useful tool for evaluating N transformations in vegetable production systems of Puerto Rico's semi-arid zone.

Keywords: Nitrogen index; Nitrogen management; Residual soil N; Crop N removal

Beyond “More Crop per Drop”: evolving thinking on agricultural water productivity
Giordano Meredith; Turral, H.; Scheierling, S. M.; Treguer, D. O.; McCormick, Peter G.

Series: IWMI Research Report 169

Abstract
This Research Report chronicles the evolution of thinking on water productivity in the research agenda of IWMI and in the broader irrigation literature over the past 20 years. It describes the origins of the concept and the methodological developments, its operationalization through applied research, and some lessons learned over the two decades of research. This report further highlights how a focus on agricultural water productivity has brought greater attention to critical water scarcity issues, and the role of agricultural water management in supporting broader development objectives such as increasing agricultural production, reducing agricultural water use, raising farm-level incomes, and alleviating poverty and inequity. Yet, reliance on a single-factor productivity metric, such as agricultural water productivity defined as “crop per drop,” in multi-factor and multi-output production processes can mask the complexity of agricultural systems as well as the trade-offs required to achieve desired outcomes. The findings from this retrospective underscore the limitations of single-factor productivity metrics while also highlighting opportunities to support more comprehensive approaches to address water scarcity concerns and, ultimately, achieve the broader development objectives.

CLIMATE CHANGE:

Trinidad & Tobago: assessing the impact of climate change on cocoa and tomato
Eitzinger A; Farrell A; Rhiney K; Carmona S; van Loosen I; Taylor M.
2015. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia
CIAT Policy Brief No. 27
https://cgspace.cgiar.org/bitstream/handle/10568/70143/CIAT_%20IMPACT%20OF%20CLIMATE%20ON%20COCOA%20AND%20TOMATO.pdf?sequence=1

Key messages

- By 2050, Trinidad & Tobago is expected to show a significant reduction in the area suitable for growing tomato. Alternative crops such as cassava, sweet potato, and yam are good diversification alternatives.

- The cocoa crop is expected to be more resilient to climatic changes; nonetheless, as a high value perennial crop, precautions should be taken to ensure plantations have access to irrigation during infrequent, severe dry periods.

- By 2050, the climate suitability of all of the crops analysed is expected to increase in the upland areas and surrounding mountain ranges. As these areas are mainly forested, there is a risk of agricultural encroachment into protected forest areas.

- There is great potential to reduce possible negative impacts of climatic changes through targeted policy recommendations (outlined below).

OTHER AGRICULTURAL ASPECTS

AGRICULTURAL DEVELOPMENT:

2017 Global Food Policy Report: the impact of urbanization
International Food Policy Research Institute.

Table of Contents
Chapter 1 Food policy in 2016-2017: Food security and nutrition in an urbanizing world [Download]
Chapter 2 Smallholders and urbanization: Strengthening rural-urban linkages to end hunger and malnutrition [Download]
Chapter 3 Food security and nutrition: Growing cities, new challenges [Download]
Chapter 4 Changing diets: Urbanization and the nutrition transition [Download]
Chapter 5 Agricultural value chains: How cities reshape food systems [Download]
Chapter 6 Governance: Informal food markets in Africa’s cities [Download]
Regional Developments [Download]
AGRIBUSINESS:

How an ICT knowledge platform can support agribusiness in the Caribbean region
Boyera, S.; Lopes Ramos, I.
2016. Technical Centre for Agricultural and Rural Cooperation (CTA)
CTA Working Paper 16/09

Market study for fresh produce: St. Lucia, Grenada, Dominica and St. Vincent & The Grenadines.
Arnold Babwah & Associates
2016. January 22nd, 2016. WUSC CARIBBEAN Commissioned report
Output of the Promotion of Regional Opportunities for Produce through Enterprises and Linkages (PROPEL) project