



IMPROVING LIVES THROUGH  
AGRICULTURAL RESEARCH

HQ/013/13

# R & D *in* AGRICULTURE



ISSUE 7  
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## A Bulletin on Information Resources



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*Improving Lives Through Agricultural Research*

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## ***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
- Fruits & vegetables
- Small ruminants

#### ***Thematic Areas***

- Protected agriculture
- Emerging issues (agro-energy, herbals, organics)
- 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 (2011/2013) 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:*** Biannual

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## COMMODITIES: ROOTS & TUBERS

### **CARDI/CFC/EU project - Increased Production of Roots and Tuber Crops in the Caribbean through the Introduction of Improved Marketing and Production Technologies**

Caribbean Agricultural Research and Development Institute / Common Fund for Commodities / European Union (CARDI/CFC/EU) project reports:

#### **Complementing on-going value-added initiatives through improvement of infrastructure and training in elements of food safety**

Sharon Jones, Lloyd Johnson, Gregory Robin, Alexander Benn and Helen Kennedy  
2013. Dominica: Caribbean Agricultural Research and Development Institute  
(Technical report. PSC# DO/026/12)

*Available on CARDI Website* <http://www.cardi.org/cfc-rt/files/downloads/2013/09/Publ-7-Complementing-on-going-VA-initiatives-Jones-et-al.pdf>

#### **Development of quality planting material of roots and tubers in the Caribbean Region**

Cyril Roberts and Bradley Georges  
2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute  
(Technical report. PSC# HQ/025/12)

*Available on CARDI Website* <http://www.cardi.org/cfc-rt/files/downloads/2013/10/Publ-6-Planting-Material-CR-BG1.pdf>

#### **Production, productivity, quality standards and product mixes of Roots and Tubers Crops in the CFC-funded project**

Sharon Jones, Greg Robin, Jerome Garry, Lloyd Johnson and Alexander Benn  
2013. Dominica: Caribbean Agricultural Research and Development Institute  
(Technical report. PSC# DO/029/12)

*Available on CARDI Website* <http://www.cardi.org/cfc-rt/files/downloads/2013/09/Publ-9-Production-Productivity-RT-Jones-et-al.pdf>

#### **Technical bulletin: Part 1: Food safety standards for food security in the CARICOM region; Part 2: Food safety training modules**

H Kennedy  
2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute  
(Technical report. PSC# HQ/030/12)

*Available on CARDI Website* <http://www.cardi.org/cfc-rt/files/downloads/2013/08/Food-Safety-Standards-and-Training-Modules-Kennedy.pdf>

#### **Tech-packs for training in on-farm post-harvest, packing and, grading systems of root and tuber crops**

Ayoub Mohammed and Lennox Sealy  
2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute  
(Technical report. PSC# HQ/027/12)

*Available on CARDI Website* <http://www.cardi.org/cfc-rt/files/downloads/2013/10/Publ-8-RT-PH-systems-Ayoub-Sealy.pdf>

**These CARDI/CFC/EU) project reports also available at**

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**Tel:** 1-868- 645-1205-7. **Fax:** 1-868-645-1208. **Email:** [infocentre@cardi.org](mailto:infocentre@cardi.org)

## **GENERAL:**

### **Monitoring the composition and evolution of the research networks of the CGIAR Research Program on Roots, Tubers and Bananas**

J Ekboir, G.B Canto and C. Sette

2013. Rome, Italy: Institutional Learning and Change Initiative

(Series on Monitoring Research Networks No. 01)

[http://www.rtb.cgiar.org/publication/monitoring-the-composition-and-evolution-of-the-research-networks-of-the-cgiar-research-program-on-roots-tubers-and-bananas/wppa\\_open/](http://www.rtb.cgiar.org/publication/monitoring-the-composition-and-evolution-of-the-research-networks-of-the-cgiar-research-program-on-roots-tubers-and-bananas/wppa_open/)

### **RTBMaps**

CGIAR Research Program on Roots, Tubers and Bananas

**RTBMaps Website:** <http://www.rtb.cgiar.org/RTBMaps/>

- Roots, tubers and bananas data related to crop distribution, indicators on poverty and food-security and some production constraints
- Web-based GIS (Geographic Information Systems) interactive tool to help researchers visualize and analyze data
- 25 map layers
- Collaboration of the International Center for Tropical Agriculture (CIAT), Bioversity International, the International Potato Center (CIP) and the International Institute of Tropical Agriculture (IITA)

## **CASSAVA:**

### **Cassava (*Manihot esculenta* Crantz)/wheat flour composite muffins: effects on quality and sensory characteristics**

Dennise Riley-Mitchell, Neela Badrie, Janelle Yarde

2012. Trop. Agric. (Trinidad) Vol. 89 No. 2 April 2012: 104-112

#### Abstract

In the midst of high wheat grain prices, the use of cassava flour for bakery products is being promoted though the very low protein content of cassava is of some concern. The objectives were to evaluate the physico-chemical and sensory characteristics of muffins baked from high quality wheat/cassava/soy composite flours. The M Mex 59 cassava tubers were processed into flour. Three composite flour blends were prepared with 40%, 50% and 60% cassava flour and 10% soy flour. Physico-chemical analysis and sensory evaluation by focus group and hedonic scoring were conducted on muffins from each of the composite flour blends and 100% wheat flour as the control muffin. The protein content, moisture, ash, texture, muffin height and colour of the muffins were measured. Results showed that the protein content of the composite flour was significantly affected by the addition of cassava flour and soy flour. Muffin colour progressively darkened as cassava flour level increased. Changes in the muffin height were not significantly different ( $P>0.05$ ). Increasing cassava flour levels resulted in a reduction of the hardness (mm/3 sec) of the muffins from 9.00 to 14.57 with substitution of 50% of cassava flour. From the focus group evaluation, the muffins from composite blend 50% wheat/40% cassava/ 10% soy were most preferred and were significantly different for taste ( $P<0.01$ ) and aftertaste ( $P<0.05$ ).

**Keywords:** wheat/cassava/soy composite flour, muffins, hedonic scoring.

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## **SWEET POTATO:**

### **Water-deficit tolerant identification in sweet potato genotypes (*Ipomoea batatas* (L.) Lam.) in vegetative developmental stage using multivariate physiological indices**

Suravoot Yooyongwech, Cattarin Theerawitaya, Thapanee Samphumphuang, Suriyan Cha-um.  
2013. *Scientia Horticulturae*, Volume 162: 242-251

#### Abstract

Sweet potato (*Ipomoea batatas* [L.] Lam.) is one of three main storage root crops of global importance after potato and cassava. It serves as the primary source of carbohydrate for the world population in developing countries. Sweet potato has been reported as drought sensitive, especially in the rain fed region with extended drought condition. Some cultivars might be more tolerant to drought stress compared to others. We investigated the physiological and morphological responses and storage root yield attributes of 6 sweet potato genotypes (cvs. Manphuang and Mankorat, PROC 65-3, Banyang 9, Tainung 57 and Japanese yellow) to water deficit stress (15% SWC) with an aim to classify the water deficit tolerance using the relationship between free proline and osmotic adjustments. Osmotic potential ( $\Psi_s$ ), chlorophyll b (Chl<sub>b</sub>), maximum quantum yield of PSII ( $F_v/F_m$ ), plant height and number of leaves in sweet potato cv. PROC 65-3 grown under water deficit condition (15% SWC) were better than those in other cultivars. The yield reduction, growth inhibition, free proline enrichment, osmotic potential maintaining, chlorophyll degradation, chlorophyll fluorescence diminution, net photosynthetic rate ( $P_n$ ), stomatal conductance ( $g_s$ ) and transpiration rate ( $E$ ) reduction in water deficit stressed plants were subjected to Ward's cluster analysis. Mankorat, PROC 65-3 and Japanese Yellow were classified as water deficit tolerance whereas Manphuang, Banyang 9 and Tainung 57 genotypes were evaluated as water deficit sensitive. The study concludes that free proline accumulation may play a key role as major osmotic adjustment in sweet potato and negative correlated with osmotic potential of leaf tissues when plants subjected to water deficit.

<http://www.sciencedirect.com/science/article/pii/S0304423813004044>

### **Arbuscular mycorrhizal associations and its influence on phenotypic and growth characters of sweet potato genotypes under varied soil phosphorus availability**

V. S. Harikumar\* and V. P. Potty

\*Department of Post Graduate Studies & Research in Botany, Sanatana Dharma College (University of Kerala), Alappuzha-688 003, Kerala, India

2012. *Trop. Agric. (Trinidad)* Vol. 89 No. 4 Oct 2012: 216-228

#### Abstract

Arbuscular mycorrhizal (AM) associations and their influence on phenotypic and growth characters of sweet potato (*Ipomoea batatas* (L.) Lam.) genotypes under varied soil phosphorus (P) availability were examined through a field trial. The study was conducted at the Central Tuber Crops Research Institute, Thiruvananthapuram, India in an acidic laterite (Oxisol) soil. Two fields with and without P fertilization were chosen to yield a wide range of plant characters and AM colonization levels. Sweet potato germplasm comprising 257 indigenous and exotic accessions was evaluated for AM colonization and plant phenotypic/growth characters under two levels of P availability. To study the AM composition and structure in relation to soil P level, the frequency of occurrence (%), relative abundance (%), species richness and diversity index were calculated. Frequency of root colonization by AM, intensity of colonization and AM spore density in soil around roots (rhizosphere) differed between genotypes and within genotypes grown in soils with different levels of available P. Intensity of root colonization by AM increased in parallel with increasing frequency of root colonization irrespective of soil P level. AM spore density in the rhizosphere increased with increasing frequency of root colonization at a level between 26-50% in low P soil, while spore density in high P soils was positively correlated with frequency of colonization between 0-25%. AM communities associated with the sweet potato genotypes consisted of eight species in genera *Acaulospora* (1), *Gigaspora* (3) and *Glomus* (4). Among the various AM fungal isolates, *Glomus microcarpum* was most abundant in both types of soil. Frequency of occurrence, relative abundance, species richness and diversity index of AM fungi were higher in low P soils than in high P soils. In general a higher frequency of colonization and intensity of colonization showed a positive influence on most plant characters in lower P levels only. In low P soil, there was no relationship between root characters and spore density in the rhizosphere, whereas in high P soil, root growth was positively correlated with higher spore density. Frequency of colonization by AM, intensity of colonization, spore density and community diversity in the rhizosphere of sweet potato genotypes are substantially altered by soil P

availability. We conclude that the variation in the magnitude of growth response of the genotypes could be related to the changes in population of specific AM fungi in root and soil.

**Keywords:** AM fungi; phenotypic and growth characters; soil P; sweet potato genotypes

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## COMMODITIES: CEREALS AND GRAIN LEGUMES

### MAIZE:

#### **Narrow genetic base of cultivated germplasm of two cereals grown in Trinidad and Tobago**

Harjit Singh Rekhi, University of the West Indies, St. Augustine, Trinidad and Tobago

Paper to be presented at ASA, CSSA and SSSA International Annual Meetings, Wednesday, November 6, 2013: 2:35 PM

#### Abstract

Rice and Corn are the two cereals grown in Trinidad and Tobago. In this country, the genetic variability in the cultivated germplasm of these two cereal crops is extremely low. In case of rice, the availability of germplasm for irrigated rice in the Caribbean and Latin American countries became extremely low when CIAT (International Centre for Tropical Agriculture) changed its mandate from irrigated rice to upland rice. The cultivated germplasm in this country includes only two old varieties 'Orizyca 1' and 'Orizyca 8', four recently introduced varieties developed by Guyana Rice Development Board (GRDB), namely 'GRDB 9', 'GRDB 10', 'GRDB 11' and 'GRDB 12', and a few unlabelled lines available with local farmers having small land holdings. In order to revitalize rice cultivation in this country, there is need to introduce improved rice germplasm from CGIAR (Consultative Group on International Agricultural Research) institutes. A program has been initiated to obtain rice nurseries from the International Rice Research Institute (IRRI), Philippines for testing at the Centeno Research Centre and other locations in the country. While efforts will be made to identify agronomically superior lines with resistance to diseases and pests for immediate use, the contrasting genotypes identified for yield contributing characters, disease and pest resistance, and quality traits shall be used to make crosses for developing populations for molecular mapping/tagging. In case of corn, only two open pollinated varieties, one of field corn and other of white sweet corn, are currently available. In this case also, corn germplasm shall be obtained from the International Maize and Wheat Improvement Centre (CIMMYT), Mexico to test for yield contributing characters, high water use efficiency, disease and pest resistance and quality characters suitable for processing. Availability of corn with suitable processing quality characters can go a long way to boost processing industry in this country.

<http://scisoc.confex.com/scisoc/2013am/webprogram/Paper78136.html>

#### **CIMMYT releases 22 new maize inbred lines for the tropics and subtropics**

2013. CIMMYT, Thursday, 05 September 2013.

#### Full Article

CIMMYT is pleased to announce the release of 22 new CIMMYT maize lines (CMLs). The CMLs were developed at various breeding locations of CIMMYT Global Maize Program by multi-disciplinary teams of scientists. These lines are adapted to the tropical/subtropical maize production environments targeted by CIMMYT and the partner institutions. CMLs are freely available to both public and private sector breeders worldwide under CIMMYT's standard material transfer agreement ([SMTA](#)).

Prior to their release, the CMLs are intensively evaluated for per se performance (especially under abiotic and biotic stresses) and performance in hybrid combinations (combining ability). Release of a CML does not guarantee high combining ability or per se performance in all environments; rather, it indicates that the line is promising or useful as a hybrid component or as a parent for pedigree breeding for one or more target mega-environments. The descriptions of the lines include heterotic group classification, along with information on their specific combining ability with widely-used CIMMYT lines. Instances where CMLs within a given heterotic group have good combining ability with other lines from the same heterotic group are also cited; the resulting hybrids may be useful either as single-cross products or as female parents of three-way or double-cross hybrids. Some of the new releases and previously-released CMLs have already been used as parents of successful hybrids or improved open pollinated varieties

(OPVs) by public and private sector institutions. A brief description of each of the 22 new CMLs is presented below (the information in parentheses for each CML is the line code).

Further details about the lines are provided in [CML540-561 Details](#). A limited quantity of seed of the CMLs can be obtained by sending a request to the [CIMMYT Germplasm Bank](#).

**Note: Article has brief description of each variety. Several are drought tolerant**

<http://www.cimmyt.org/en/what-we-do/maize-research/item/cimmyt-releases-22-new-maize-inbred-lines-for-the-tropics-and-subtropics>

## **Release of 22 new CIMMYT maize lines: CMLs 540 to 561**

Brenna Goth

2013. CIMMYT Blog, 6 September, 2013

[Full Article](#)

CIMMYT is pleased to announce the release of 22 new CIMMYT maize lines (CMLs). Developed through repeated cycles of selection and self-pollination of single plants, inbred lines are the building blocks of maize genetics and breeding. These lines can be crossed to produce high-yielding hybrids or open pollinated maize varieties. The lines were developed at various breeding locations of CIMMYT Global Maize Program by multi-disciplinary teams of scientists. These lines are adapted to tropical/subtropical maize production environments targeted by CIMMYT and the partner institutions. CMLs are freely available to both public and private sector breeders worldwide under CIMMYT's standard material transfer agreement ([SMTA](#)).

Prior to their release, CMLs are intensively evaluated for per se performance (especially under abiotic and biotic stresses) and performance in hybrid combinations (combining ability). The descriptions accompanying the released lines include heterotic group classification and information on their specific combining ability with some widely-used CIMMYT lines. Instances where CMLs within a given heterotic group have good combining ability with other lines from the same heterotic group are also cited; the resulting hybrids may be useful either as single-cross products or as female parents of three-way or double-cross hybrids. Nine of the CMLs in the list have already proven their mettle as parental lines of commercial maize cultivars in sub-Saharan Africa. For example, CML541 and CM542 are among the constituent lines of ZM309, an improved, early-maturing, drought tolerant open-pollinated variety widely used for commercial cultivation in several African countries (see "[ZM 309 gets presidential nod in Malawi](#)"). Seven other CMLs (CML544 to CML548, CML558 and CML561) have been used as parental lines of commercial hybrids in sub-Saharan Africa. To obtain small amounts of seed of the newly released CMLs, send a request to the [CIMMYT Germplasm Bank](#).

**Website** <http://blog.cimmyt.org/?p=11078>

## **Tropicalized maize haploid inducer lines - now available.**

CIMMYT

2012. 20 July

[Full Article](#)

### **Tropicalized maize haploid inducers for doubled haploid-based breeding**

The doubled haploid (DH) technology enables rapid development of completely homozygous maize lines and offers significant opportunities for fast-track development and release of elite cultivars. Besides simplified logistics and reduced costs, use of DH lines in conjunction with molecular markers significantly improves genetic gains and breeding efficiency. DH lines also are valuable tools in marker-trait association studies, molecular marker-assisted or genomic selection-based breeding, and functional genomics.

Generating DH lines involves four major steps: (1) *In vivo* haploid induction; (2) haploid seed identification using morphological markers; (3) chromosome doubling of putative haploids; and (4) generating D1 (DH) seed from D0 seedlings. *In vivo* haploid induction is achieved by crossing a specially developed maize genetic stock called an "inducer" (as male) with a source population (as female) from which homozygous DH lines are developed.

### ***What are tropicalized haploid inducers?***

Adoption of DH technology by public maize breeding programs and small- and medium-scale enterprise (SME) seed companies, especially in developing countries, is limited by the lack of inducers adapted to the tropical/subtropical conditions. The CIMMYT Global Maize Program, in collaboration with the Institute of Plant Breeding, Seed Science and Population Genetics of the University of Hohenheim (UHo) now has tropical haploid inducers for sharing with the interested institutions under the terms outlined below.

The tropically adapted inducer lines (TAILs) developed by CIMMYT and UHo showed high haploid induction capacity (~8-10%) and better agronomic performance than temperate inducers, in trials at two CIMMYT experiment



stations in Mexico. A haploid inducer hybrid developed using these TAILs revealed heterosis for plant vigor and pollen production under tropical conditions, while maintaining similar haploid induction rates (~8-10%). CIMMYT and UHo decided to share the seed and grant authorization for use of one of the tropicalized haploid inducer lines (one of the parents of a hybrid inducer) and the hybrid inducer to interested applicants, after signing of the relevant material transfer agreement (MTA) and with restrictions to protect the intellectual property rights of both institutions for the inducer lines.

#### ***Process of indenting for the tropicalized haploid inducers***

Interested applicants should send a letter of intent or an expression of interest in the tropicalized haploid inducers. CIMMYT may seek more information, if required, and will share the relevant MTA template for signing by applicants. The general guidelines to obtain inducers for research use and commercial use are as follows.

#### ***For research use by publicly-funded national agricultural research systems***

Publicly-funded institutions interested in access to the haploid inducers for specific purposes (e.g., to develop DH lines for breeding programs) may send a letter of intent or expression of interest to CIMMYT. For eligible institutions, the haploid inducers will be provided free-of-charge by CIMMYT and UHo, after signing of a **Research Use MTA**. Commercial use of the inducers by institutions or others should be in accordance with a separate license agreement for commercial use (as given below).

#### ***For commercial use***

Applicants may access the inducers for commercial use pursuant to signing of a **Material Transfer and License Agreement** with CIMMYT and UHo. Applicants shall pay UHo a one-time licence fee of USD 25,000 for provision of seed of two haploid inducers; these include one of the parents of a tropicalized haploid inducer hybrid and the haploid inducer hybrid itself. If applicants wish to access the other parent of the haploid inducer hybrid, an additional one-time licence fee of \$10,000 will be payable to UHo.

#### ***Acknowledgments***

Generous support for joint research on doubled haploids by [CIMMYT](#) and the [University of Hohenheim](#) has come from [the Bill & Melinda Gates Foundation](#); [the Howard G. Buffett Foundation](#); [SAGARPA](#), the Mexican Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food.; [USAID](#) (US Agency for International Development); Dr. Dr. h. c. Herrmann Eiselen and [the Foundation fiat panis](#), Ulm, Germany; the Tiberius Services AG, Stuttgart, Germany; [Vilmorin Seed Company](#); [DTMA](#) (Drought Tolerant Maize for Africa) project.; [MAIZE](#) CGIAR Research Program; and the International Maize Improvement Consortium (IMIC) project under [MasAgro](#) (Sustainable Modernization of Traditional Agriculture).

#### ***For further details, please contact:***

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Dr. Vijay Chaikam, DH Specialist, Global Maize Program, CIMMYT ( [v.chaikam@cgiar.org](mailto:v.chaikam@cgiar.org))

**Website** <http://www.cimmyt.org/en/what-we-do/maize-research/item/now-available-tropicalized-maize-haploid-inducer-lines>

## **SORGHUM:**

### **Whole genome sequencing reveals untapped genetic potential in Africa's indigenous cereal crop sorghum**

Mace E S, Tai S, Gilding E K, Li Y, Prentis P J, Bian L, Campbell B C, Hu W, Innes D J, Han X, Cruickshank A, Dai C, Frère C, Zhang H, Hunt C H, Wang X, Shatte T, Wang M, Su Z, Li J, Lin X, Godwin I D, Jordan D R, Wang J

2013. Nature Communications. 27 August 2013

#### **Abstract**

Sorghum is a food and feed cereal crop adapted to heat and drought and a staple for 500 million of the world's poorest people. Its small diploid genome and phenotypic diversity make it an ideal C<sub>4</sub> grass model as a complement to C<sub>3</sub> rice. Here we present high coverage (16–45 ×) resequenced genomes of 44 sorghum lines representing the primary gene pool and spanning dimensions of geographic origin, end-use and taxonomic group. We also report the first resequenced genome of *S. propinquum*, identifying 8 M high-quality SNPs, 1.9 M indels and specific gene loss and gain events in *S. bicolor*. We observe strong racial structure and a complex domestication history involving at least two distinct domestication events. These assembled genomes enable the leveraging of existing cereal functional

genomics data against the novel diversity available in sorghum, providing an unmatched resource for the genetic improvement of sorghum and other grass species.

**Keywords:** Biological sciences; Genetics; Plant sciences

**Free copy of article available:** <http://www.nature.com/ncomms/2013/130827/ncomms3320/full/ncomms3320.html>

## COMMODITIES: HOT PEPPERS

### Effect of the genotype, developmental stage and medium composition on the *in vitro* culture efficiency of immature zygotic embryos from genus *Capsicum*

J.P. Manzur, C. Penella, A. Rodríguez-Burruezo

2013. *Scientia Horticulturae* 161:181-187

#### Abstract

A new reliable *in vitro* technique for immature embryos of *Capsicum* spp. was developed. A collection of 10 accessions, encompassing the five cultivated species of *Capsicum*, and four media formulations, combining different levels of sucrose (40 g/L vs. 80 g/L) and MS salts ( $\frac{1}{2} \times$  MS vs.  $1 \times$  MS), were evaluated. In addition, the four main embryo stages (*i.e.* globular, heart, torpedo, early cotyledonary) were also considered. Thus, almost 2000 embryos were excised, cultured, and evaluated for germination in the present experiment. Genotype (G), media composition (M), and developmental stage (S) contributed significantly to culture efficiency.  $G \times S$  and  $S \times M$  interactions were also significant, although their contribution was lower than individual main factors. *C. annuum* accession Piquillo, *C. frutescens* B-144 and, particularly, *C. pubescens* B-61 showed the highest *in vitro* germination rates, while *C. chinense* and *C. baccatum* accessions showed, in general, the lowest responses. In most cases, the more advanced the embryo stage the higher the culture efficiency. However, for the first time in *Capsicum* globular embryos from most genotypes were germinated *in vitro* and also relatively high rates were achieved for heart embryos. Finally, the medium with the lowest levels of both sucrose (40 g/L) and MS ( $\frac{1}{2} \times$  MS) enabled, in most genotypes and stages of development, the highest *in vitro* germination rates. In fact, this medium allowed rates of up to 25% in globular embryos. These results provide useful information to those breeders interested on the applications of embryo culture in *Capsicum* peppers (*e.g.* shortening breeding cycles, perhaps rescue of interspecific embryos).

**Keywords:** *Capsicum* peppers; *In vitro* culture; Embryo stage; Genotypic diversity; Sucrose; Mineral salts

<http://www.sciencedirect.com/science/article/pii/S030442381300335X>

### Fruit trait variation in a Caribbean germplasm collection of aromatic hot peppers (*Capsicum chinense* Jacq.)

Sarah M. Bharath, Christian Cilas, and Pathmanathan Umaharan

2013. *HortScience* 48:531-538

#### Abstract

Aromatic hot peppers (*Capsicum chinense* Jacq.) are an important agricultural commodity for many small-scale farmers in the Caribbean because it is a commercially viable crop and one that is integral to the cuisines of the region. The large variation in fruit shape, size, color, pungency, and aroma of this species facilitates a diverse range of uses. Using 264 accessions from a Caribbean germplasm collection (representing primarily the Caribbean Basin, Central and South America), this study investigated 1) morphological variation in 13 fruit descriptors of agro-economic importance; and 2) morphological groups based on geographic origin. All 13 fruit descriptors showed significant variation. Fruit color [immature (six states) and mature (12 states)] was the most diverse qualitative fruit trait. Among the quantitative traits, fruit weight and fruit width showed the highest broad-sense heritability (0.81), and fruit weight was highly correlated with fruit width and placenta size. Cluster analysis revealed four main clusters, which did not show a clear separation of accessions based on major geographic regions, but there was a highly significant association ( $P < 0.0001$ ) between geographic subgroups and the clusters to which they were assigned. Most accessions of the Northern Caribbean (particularly the Bahamas and Puerto Rico) separated quite distinctly from most accessions of the Southern Caribbean and clustered with most accessions of Central and South America. Accessions of the Southern Caribbean (Lesser Antilles, Trinidad & Tobago) were substantially more similar to each other than they were to most accessions of Central and South America, thereby suggesting genetic differences between accessions of the Southern Caribbean islands and the mainland populations. Collectively, the results show that this germplasm collection contains useful accessions with desired fruit quality traits and a level of genetic variation that can be used to encourage its active conservation and use for further evaluation trials and crop

improvement as well as guide ongoing complementary germplasm introductions to augment the collection's diversity.

**Keywords:** Germplasm evaluation, conservation, fruit diversity, morphological descriptors, Trinidad and Tobago  
<http://hortsci.ashspublications.org/content/48/5/531.abstract>

### **Gall midges (Cecidomyiidae) attacking horticultural crops in the Caribbean region and South America**

[Goldsmith, J.](#); [Castillo, J.](#); [Clarke-Harris, D.](#)

2013. CABI

In [Potential invasive pests of agricultural crops](#) Editor [Peña, J. E.](#), pp. 240-250

[CABI Invasive Species Series No.3](#)

#### Abstract

Gall midges are a major problem of horticultural crops (tomatoes, potatoes, asparagus, pepper) in the Caribbean region and in South America. This chapter describes the hot pepper (*Capsicum chinense*) gall midge (HPGM) classified as *Contarinia* spp., undetermined species, and *Prodiplosis longifila*. Information is given on their distribution, biology, life history, host range, seasonality, damage, sampling and monitoring techniques, rearing, and control (including chemical, biological and quarantine methods).

<http://www.cabdirect.org/abstracts/20133231099.html>

### **Genetic variability and diversity study on Bhot jolokia (*Capsicum chinense* Jacq)**

[Hazarika, R.](#); [Neog, B.](#); [Yadav, R. N. S.](#); [Tripathi, S. B.](#)

2013. [Electronic Journal of Plant Breeding](#) 4(1):1101-1107

#### Abstract

Thirty Bhot jolokia (*Capsicum chinense* Jacq) accessions from three different states of north east region were evaluated in a thorough field exploration with enough geographical representation to assess genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (h<sup>2</sup>%) and genetic advance (GA). Higher GCV and PCV were observed for plant height, fruits per plant, fruit weight, fruit length, fruit width and number of seeds per fruit. High heritability coupled with high genetic advance observed for these characters imply the potential for crop improvement through selection. Using the SPSS (version 13.0) software, cluster analysis was performed based on maximum and minimum Euclidian dissimilarity distances which separate the thirty accessions of *C. chinense* into six distinct clusters with distinct morphological variation between the clusters.

<http://www.cabdirect.org/abstracts/20133138377.html;jsessionid=96D7BB1F58838BCE6FD099AC8B0DC7EB>

### ***In vitro* plantlet regeneration from cotyledon segments of *Capsicum chinense* Jacq. cv. Naga King Chili, and determination of capsaicin content in fruits of *in vitro* propagated plants by High Performance Liquid Chromatography**

[Mechuselie Kehie](#), [Suman Kumaria](#), [Pramod Tandon](#)

2013. [Scientia Horticulturae](#) 164:1-8

#### Abstract

An *in vitro* plantlet regeneration system has been developed from cotyledon segments of *Capsicum chinense* Jacq. cv. Naga King Chili, a very pungent chili species of India. Rosette-like structures (RLS) were induced on the explants which on transfer to medium containing indole-3-acetic acid (IAA) resulted in multiple shoots in course of time. Agar-based Murashige and Skoog (MS) medium fortified with 18.16 µM thidiazuron (TDZ) was found to be the most suitable medium for RLS induction and shoot formation. Maximum number of multiple shoots (9.5 ± 0.39) and roots (8.6 ± 0.50), and root length (2.4 ± 0.02 cm) were obtained from rosette-like structures in medium containing 5.70 µM IAA. Combined effect of putrescine (Put) (5.6 µM) and TDZ (4.54 µM) mediated direct multiple shoot (5.8 ± 0.44) induction. The *in vitro* rooted plantlets were transferred to glass house for hardening and acclimatization, wherein 90% survival was recorded. The hardened plantlets, thus developed were established in soil and bore normal fruits after 4 months of transfer. The capsaicin content in matured fruits of *in vitro* propagated plants was found to be 0.05236 g/g d wt (837,760 Scoville Heat Units, SHU), where as *in vivo* raised plantlets yielded 0.0545 g/g d wt (872,000 SHU) respectively.

**Keywords:** Capsaicin; *Capsicum*; Cotyledon; Naga King Chili; Putrescine; Scoville Heat Units

<http://www.sciencedirect.com/science/article/pii/S0304423813004275>

## Responses of chilli thrips (Thysanoptera: Thripidae) to *Capsicum* cultivars in choice tests in the greenhouse and laboratory and relative benefits of protecting these cultivars with spinetoram

Cliff G. Martin and Dakshina R. Seal

2013. Florida Entomologist 96:560–571

### Abstract

Since the chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) poses a considerable threat to production of peppers in the Western Hemisphere, it is important to determine the relative vulnerability of different cultivars of *Capsicum annuum* L. and *C. chinense* Jacquin. In addition it is important to determine the relative benefits to the productivity of these cultivars of controlling the chilli thrips with insecticides. Therefore the effects of the chilli thrips on 11 pepper cultivars (*Capsicum* spp.; Solanales: Solanaceae) were tested in greenhouse and laboratory environments. When data for spinetoram-treated and untreated plants of each cultivar were pooled, the number of pedicels, number of flowers, and total (pedicels + flowers + fruit) differed between cultivars, and 'Astry' and 'Cheyenne' had the highest counts of these organs, while 'Hot Habanero Orange' and 'Hot Fatalli' had the least. When cultivars were pooled for spinetoram-treated separately from untreated plants, spinetoram was found to have increased the numbers of pedicels and total counted plant organs. For spinetoram-treated plants, 'Hot San Ardo' had the greatest canopy volume and 'Hot Fatalli' the smallest, whereas 'Fresno 6022' had the most fruits and 'Hot Fatalli' had the least. Based on comparing canopy volume and number of fruits of spinetoram-treated and untreated plants, 'Numex Big Jim' was found to have been benefitted the least by spinetoram application, whereas 'Fresno 6022', 'Hot Tormenta', 'Cheyenne', 'Astry', and '**Jamaican Yellow**' were benefitted the most. A greenhouse choice test indicated 'Fresno 6022', 'Hot Tormenta', 'Hot Fatalli', 'Hot San Ardo', 'Hot Habanero Orange', 'Numex Big Jim', and 'Jamaican Yellow' each had fewer larvae per plant than 'Astry'. In a choice of cultivars in laboratory Petri dishes, larvae per leaf disk were most abundant on 'Agriset 4108', 'Red Devil Cayenne', 'Numex Big Jim', 'Astry', and '**Jamaican Yellow**' and least abundant on 'Hot Fatalli'. 'Hot Fatalli' attracted the fewest thrips and seemed to be the least susceptible cultivar in the 3 experiments, though it had the smallest plant size and lowest yields. Spinetoram improved yields of productive cultivars like 'Fresno 6022', which may be more feasible to grow than 'Hot Fatalli'.

<http://www.bioone.org/doi/abs/10.1653/024.096.0222>

<http://www.bioone.org/doi/pdf/10.1653/024.096.0222>

## Seedling protection and field practices for management of insect vectors and viral diseases of hot pepper (*Capsicum chinense* Jacq.) in Uganda

J Karungi<sup>a</sup>, T Obua<sup>b</sup>, S Kyamanywa<sup>a</sup>, C N Mortensen<sup>b</sup> & M Erbaugh<sup>c</sup>

2013. International Journal of Pest Management 59:103-110

### Abstract

The focus of this study was on nursery and field management of seed and insect vectors of viruses on hot pepper. Seedlings raised from hypochlorite-treated seeds under a net tunnel nursery were compared with seedlings raised from untreated seeds in an open nursery. The two groups of seedlings were used to evaluate field practices in a split plot randomized controlled block design: (i) weekly foliar applications with dimethoate; (ii) close plant spacing of 60 cm × 50 cm; (iii) 1.5-m high net perimeter screen; (iv) transparent plastic mulch; (v) untreated control. Whiteflies were the vectors most affected by the treatments, showing 28%, 38%, 43% and 36% reductions in occurrence by seedling protection, net screens, transparent plastic mulch and close plant spacing, respectively. Aphids were only responsive to close plant spacing and chemical treatments, with a reduction in incidence of up to 43% by the former. The lowest virus disease incidence (12%) was on plants raised unprotected in the nursery but grown under the close plant spacing in the field. Plants from protected seedlings had a marginally higher fruit yield (2.1 kg/plant) compared with plants from unprotected seedlings (1.7 kg/plant)

**Keywords:** aphids, close spacing, netting barriers, plastic mulch, thrips, whiteflies

<http://www.tandfonline.com/doi/full/10.1080/09670874.2013.772260#.UqYUtPUndGM>

## Volatile profile and sensory quality of new varieties of *Capsicum chinense* pepper

Deborah dos Santos Garruti<sup>I,\*</sup>; Nayra de Oliveira Frederico Pinto<sup>II</sup>; Victor Costa Castro Alves<sup>III</sup>; Maria Flávia Azevedo da Penha<sup>II</sup>; Eric de Castro Tobaruela<sup>III</sup>; Ídila Maria da Silva Araújo<sup>I</sup>

2013. Ciênc. Tecnol. Aliment., Campinas, / Food Science and Technology (Campinas) 33(Supl. 1): 102-108

### Abstract

The objective of this study was to compare the sensory quality and the volatile compound profile of new varieties of *Capsicum chinense* pepper (CNPH 4080 a strain of Cumari-do-Pará' and BRS Seriema) with a known commercial

variety (Biquinho). Volatiles were isolated from the headspace of fresh fruit by SPME and identified by GC-MS. Pickled peppers were produced for sensory evaluation. Aroma descriptors were evaluated by Check-All-That-Apply (CATA) method, and the frequency data were submitted to Correspondence Analysis. Flavor acceptance was assessed by hedonic scale and analyzed by ANOVA. BRS Seriema showed the richest volatile profile, with 55 identified compounds, and up to 40% were compounds with sweet aroma notes. CNPH 4080 showed similar volatile profile to that of Biquinho pepper, but it had higher amounts of pepper-like and green-note compounds. The samples did not differ in terms of flavor acceptance, but they showed differences in aroma quality confirming the differences found in the volatile profiles. The *C. chinense* varieties developed by Embrapa proved to be more aromatic than Biquinho variety, and were well accepted by the judges.

**Keywords:** flavor analysis; HS-SPME/GC-MS; check-all-that-apply (CATA), Brazil

**English** <http://www.scielo.br/pdf/cta/v33s1/v33s1a16.pdf>

[http://www.scielo.br/scielo.php?pid=S0101-20612013000500016&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S0101-20612013000500016&script=sci_arttext)

## COMMODITIES: FRUITS & VEGETABLES

### **AMF-induced tolerance to drought stress in citrus: a review**

Qiang-Sheng Wu, A.K. Srivastava, Ying-Ning Zou

2013. *Scientia Horticulturae* 164: 77-87

#### Abstract

Citrus is one of the most widely cultivated fruit crops, whose rhizosphere inhabits a class of beneficial fungi, popularly known as arbuscular mycorrhizal fungi (AMF). Different species of AMF viz., *Acaulospora*, *Entrophospora*, *Gigaspora*, *Glomus*, *Pacispora*, *Sclerocystis*, and *Scutellospora* have been observed to colonize citrus roots for the formation of arbuscular mycorrhizal (AM) symbiosis, where both the symbiotic partners are mutually benefited (up to 20% of photosynthetic carbohydrates from the host plant is diverted toward the growth of AM, in the exchange of water and nutrient uptake from the fungal partner to the host plant). AM symbiosis can usually confer better plant growth, higher nutrient uptake, greater tolerance to abiotic and biotic stresses, and soil structure improvement in the host plant. Meanwhile, AM-inoculated citrus plants have shown greater tolerance to drought stress (DS). Drought stress strongly restricted both the development of non-AM-citrus and the mycorrhizal development of AM-citrus, but AM colonization produced a positive effect on plant growth and photosynthesis, even under DS. This review provides an overview of possible mechanisms involved in DS tolerance through improved water and nutrient uptake (especially P nutrition) using extraradical hyphal growth; effective spatial configuration of root system; elevated concentration of tetramine spermine; osmotic adjustment through non-structural carbohydrates, K<sup>+</sup>, Ca<sup>2+</sup>, and Mg<sup>2+</sup>, but not proline; scavenging reactive oxygen species through antioxidant enzymes and antioxidants; and glomalin-bound soil structural improvements, besides, some new exciting perspectives including water transport by mycorrhizal hyphae and molecular analysis are suggested.

**Keywords:** Antioxidants, Citrus, Glomalin, Mycorrhiza, Nutrient uptake, Osmotic adjustment

<http://www.sciencedirect.com/science/article/pii/S030442381300469X>

### **Automatic image analysis and spot classification for detection of fruit fly infestation in hyperspectral images of mangoes**

Ronald P. Haff, Sirinnapa Saranwong, Warunee Thanapase, Athit Janhiran, Sumaporn Kasemsumran, Sumio Kawano

2013. *Postharvest Biology and Technology* 86:23-28

#### Abstract

Fruit fly infestation of mangoes is a major concern for growers and exporters, leading to requirements for quarantine treatments such as vapor heat treatment or irradiation and subsequent reduction in quality and consumer acceptance. An on-line method for detection and removal of infested fruit would thus benefit producers and consumers. An algorithm has been developed to identify spots generated in hyperspectral images of mangoes infested with fruit fly larvae. The algorithm incorporates background removal, application of a Gaussian blur, thresholding, and particle count analysis to identify locations of infestations. Each of the four algorithm steps involves adjustable parameters which were iteratively tested to find the optimal combination for detection in terms of false positive and false negative results. For algorithm parameters selected to minimize false negative results, a false negative error rate of 1.0% was achieved with 11.1% false positive error and 6.0% overall error in heavily infested samples. For the same sample set, the lowest overall error rate achieved was 2.0%, with 1.0% false positive and 3.0% false negative. For samples with lower infestation rates, the error rates were much higher, the lowest overall error being 12.3%. This

therefore demonstrates the feasibility of hyperspectral imaging for fruit fly detection while highlighting the need for technology with improved resolution and signal to noise ratio to allow detection of single larvae.

**Keywords:** Mango, Fruit fly, Insect detection, NIR imaging, Hyperspectral, Image processing  
<http://www.sciencedirect.com/science/article/pii/S0925521413001592>

### **Differential response of two pineapple cultivars (*Ananas comosus* (L.) Merr.) to SAR and ISR inducers against the nematode *Rotylenchulus reniformis***

Alain Soler, Paul-Alex Marie-Alphonsine, Claudine Corbion, Patrick Quénéhervé  
2013. Crop Protection 54: 48-54

#### Abstract

We hypothesized that inducing systemic resistances can contribute to the control of the nematode *Rotylenchulus reniformis* in pineapple. In greenhouse experiments conducted in Martinique, the pineapple cultivars Smooth Cayenne and MD-2 were treated with methyljasmonate (JAME) and salicylic acid (SA), elicitors of induced systemic resistance (ISR) and systemic acquired resistance (SAR). The efficacy of the elicitors was tested by inoculating plantlets grown in individual pots with a monospecific population of *R. reniformis* reared on *Vigna unguiculata*. The final nematode populations, 45 days after inoculation on MD-2 treated with JAME were reduced by 67.0% ( $p = 0.006$ ). Nematode populations on MD-2 plants treated with SA were reduced by 55.8% ( $p = 0.016$ ). Nematode populations on SC were not reduced by the elicitors. In a second experiment, using split-root systems, JAME was applied to MD-2 plantlets and enzymatic activities involved in plant defense and stress responses were monitored for 14 h after treatment. Additional pots were inoculated with nematodes 24 h after JAME treatment and examined ten days later. Transient stress was observed along with an increase in enzymatic response after inoculation with nematodes. These results showed that the MD-2 was primed through an ISR by JAME. The question now arises whether ISR can be specifically induced only in certain pineapple cultivars. Results are discussed from the perspective of introducing new strategies to manage pineapple nematodes.

**Keywords:** Systemic resistance, Methyljasmonate, Salicylic acid, *Rotylenchulus reniformis*, Pineapple  
<http://www.sciencedirect.com/science/article/pii/S0261219413001919>

### **Effect of pre-harvest calcium chloride applications on fruit calcium level and post-harvest anthracnose disease of papaya**

Babak Madani, Mahmud Tengku Muda Mohamed, Alan R. Biggs, Jugah Kadir, Yahya Awang, Amin Tayebimeigooni, Taha Roodbar Shojaei  
2014. Crop Protection 55: 55-60

#### Abstract

Anthracnose disease of papaya, caused by *Colletotrichum gloeosporioides* Penz, can cause extensive postharvest losses. The goal of this research was to use pre-harvest calcium applications to reduce anthracnose disease. Six pre-harvest foliar calcium sprays were applied biweekly to papaya trees in experimental orchards at Universiti Putra Malaysia. Additional in vitro and in vivo tests were carried out to test the effect of calcium on fruit calcium content, spore germination, mycelial growth and disease severity. Calcium chloride at 1%, 1.5% and 2.0% concentrations significantly decreased spore germination. Calcium content of papaya fruit was significantly increased by calcium sprays at a concentration of 2.0% in 2012 and 2013. In vivo studies showed that increasing calcium content in fruit by calcium sprays at 1.5 and 2.0% concentrations significantly reduced anthracnose incidence of fruits during five weeks storage at  $12 \pm 2$  °C, and delayed initiation of disease symptoms by four weeks.

**Keywords:** Papaya, Anthracnose, Calcium, Disease incidence, Disease severity  
<http://www.sciencedirect.com/science/article/pii/S0261219413002421>

### **Using electrolyzed oxidizing water combined with an ultrasonic wave on the postharvest diseases control of pineapple fruit cv. 'Phu Lae'**

S. Khayankarn, J. Uthaibutra, S. Setha, K. Whangchai  
2013. Crop Protection 54: 43-47

#### Abstract

The effects of ultrasound (US) and electrolyzed oxidizing (EO) water on postharvest decay of pineapple cv. Phu Lae were investigated using *Fusarium* sp. isolated from pineapple fruits. The effect of EO water and US irradiation on *in vitro* growth inhibition of *Fusarium* sp. was studied. Spore suspensions were treated EO water with free chlorine at 100, 200 and 300 ppm and different frequencies of 108, 400, 700 KHz and 1 MHz US irradiation for 0, 10, 30 and 60 min and incubated at 27 °C for 48 h. The study showed that all treatments of EO water totally inhibited the spore germination of the fungus. Additionally, US irradiation of 1 MHz for 60 min was the most effective to suppress the spore germination when compared with the control. When the fruits inoculated with *Fusarium* sp. were washed in

EO water at 100 ppm and US irradiation or combination of US and EO water significantly inhibited the decay incidence and prolonged the shelf life of the pineapple for 20 days. Treatments had no effect on fruit quality (weight loss percentage, total soluble solids, titratable acidity, pH, and ascorbic acid). The potential for EO water in combination with US in pineapple handling systems is high, due to marked synergistic effects against fungal decay of decrowned pineapple fruit during storage.

**Keywords:** *Ananas comosus* (L.) Merr cv. Phu Lae; Electrolyzed water; *Fusarium* sp.; Ultrasonic wave  
<http://www.sciencedirect.com/science/article/pii/S0261219413001762>

## COMMODITIES: CROPS – PESTS & DISEASES

### **BLACK SIGATOKA:**

#### **Evaluation of banana hybrids for tolerance to black leaf streak (*Mycosphaerella fijiensis* Morelet) in Puerto Rico**

B.M. Irish, R. Goenaga, C. Rios, J. Chavarria-Carvajal, R. Ploetz  
2013. Crop Protection 54: 229-238

##### Abstract

In Puerto Rico, bananas (including plantains) are important agricultural commodities; their combined production totaled over 158,000 tons in 2011. Black leaf streak (BLS) and Sigatoka leaf spot diseases, caused by *Mycosphaerella fijiensis* and *Mycosphaerella musicola*, respectively, are responsible for significant losses of this crop, due to the high susceptibility of the most important cultivars. Diploid, triploid and tetraploid hybrids were introduced from international breeding programs for evaluation in Isabela, Puerto Rico. Accessions were established in the field in a randomized complete block design and were evaluated over two cropping cycles (2007–2010) for response to BLS and agronomic traits. Significant differences ( $P = 0.05$ ) in BLS severity were observed among accessions throughout both crop cycles and were most pronounced at harvest. When averaged across production cycles, severity indices at harvest ranged from very resistant (20% of the leaf surface affected) for 'FHIA 02' to extremely susceptible (97%) for 'Grand Nain'. Yield attributes varied widely among the accessions, including mean bunch weights (6.9–41.0 kg), numbers of hands per bunch (6.6–13.4), and the numbers of fruit per bunch (57.0–239.2). Several accessions, mainly from the Fundación Hondureña de Investigación Agrícola (FHIA), were BLS resistant and had short pseudostems, and large bunches. They could potentially replace susceptible cultivars in commercial production or play roles in a nascent organic market.

**Keywords:** *Musa*; Sigatoka; *Mycosphaerella fijiensis*; Germplasm; Breeding; Traits  
<http://www.sciencedirect.com/science/article/pii/S0261219413002299>

### **CITRUS GREENING DISEASE:**

#### **Gene Regulatory Networks Elucidating Huanglongbing Disease Mechanisms**

Federico Martinelli, Russell L. Reagan, Sandra L. Uratsu, My L. Phu, Ute Albrecht, Weixiang Zhao, Cristina E. Davis, Kim D. Bowman, Abhaya M. Dandekar  
2013. PLoS ONE 8(9): e74256. doi:10.1371/journal.pone.0074256

##### Abstract

Next-generation sequencing was exploited to gain deeper insight into the response to infection by *Candidatus liberibacter asiaticus* (CaLas), especially the immune dysregulation and metabolic dysfunction caused by source-sink disruption. Previous fruit transcriptome data were compared with additional RNA-Seq data in three tissues: immature fruit, and young and mature leaves. Four categories of orchard trees were studied: symptomatic, asymptomatic, apparently healthy, and healthy. Principal component analysis found distinct expression patterns between immature and mature fruits and leaf samples for all four categories of trees. A predicted protein – protein interaction network identified HLB-regulated genes for sugar transporters playing key roles in the overall plant responses. Gene set and pathway enrichment analyses highlight the role of sucrose and starch metabolism in disease symptom development in all tissues. HLB-regulated genes (glucose-phosphate-transporter, invertase, starch-related genes) would likely determine the source-sink relationship disruption. In infected leaves, transcriptomic changes

were observed for light reactions genes (downregulation), sucrose metabolism (upregulation), and starch biosynthesis (upregulation). In parallel, symptomatic fruits over-expressed genes involved in photosynthesis, sucrose and raffinose metabolism, and downregulated starch biosynthesis. We visualized gene networks between tissues inducing a source-sink shift. CaLas alters the hormone crosstalk, resulting in weak and ineffective tissue-specific plant immune responses necessary for bacterial clearance. Accordingly, expression of WRKYs (including WRKY70) was higher in fruits than in leaves. Systemic acquired responses were inadequately activated in young leaves, generally considered the sites where most new infections occur.

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0074256>

## **COFFEE BERRY BORER (*Hypothenemus hampei*).**

### **Field-cage evaluation of the parasitoid *Phymastichus coffea* as a natural enemy of the coffee berry borer, *Hypothenemus hampei***

Francisco Infante, Alfredo Castillo, Jeanneth Pérez, Fernando E. Vega

2013. Biological Control 67:446–450

#### Abstract

*Phymastichus coffea* LaSalle (Hymenoptera: Eulophidae) is an African parasitoid that has been imported to Mexico and other Latin American countries for the biological control of the coffee berry borer, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae). As a part of the evaluation of this natural enemy in Mexico, we conducted a series of parasitoid inclusion cage experiments to evaluate parasitism rates under different parasitoid:borer ratios (1:5, 1:10, 1:15, 1:20 and 1:30) using entomological sleeves. The presence of *P. coffea* inside the sleeves did not affect avoid the perforation of coffee berries by the borers, but damages to berries were significantly diminished. Borers that did not enter coffee berries were more susceptible to be parasitized by *P. coffea* than borers that entered inside berries (i.e., borers that perforated the endosperm). The treatment resulting in the highest level of parasitism was the 1:5 parasitoid:borer ratio, which had 79% parasitism when borers were outside berries. In general, the highest percentage of parasitism occurred when the highest proportion of parasitoids was used. The 1:5 and 1:10 parasitoid:borer ratio resulted in the highest parasitism. The use of *P. coffea* resulted in a 2.2 - 3.1 fold lower coffee berry borer damage to the seeds weight, showing the beneficial effect of this natural enemy. The weight of coffee seeds significantly decreased in treatments where no parasitoids were used (control) and in treatments with the highest number of borers. All treatments that received parasitoids to control the coffee berry borer had a higher seed weight than the control. Our studies indicate that *P. coffea* has a strong potential to become an effective biological control agent against the coffee berry borer.

**Keywords:** *Hypothenemus*; Coffee berry borer; *Phymastichus*; Eulophidae, inclusion cages; Biological control; Mexico

<http://www.sciencedirect.com/science/article/pii/S1049964413002296>

## **COFFEE RUST (*Hemileia vastatrix*):**

### **The coffee rust (*Hemileia vastatrix*): Some biological and epidemiological aspects**

Jacques Avelino

2013. USAID Agrilinks. April 11, 2013

*This seminar is part of the "Emerging Plant Diseases" series.*

Coffee Leaf Rust, also known as “La roya,” is devastating coffee crops and farmer incomes in Central America and the Caribbean. The United States is engaged with the governments in the region, other international organizations, private coffee companies, universities and coffee institutes to identify ways to alleviate the situation and combat this outbreak. Coffee Rust first originated in Kenya in the 1860s and was later observed in Southeast Asia and spread into Latin America in Brazil in the late 1960s and early 1970s. By the mid to late 1980s coffee rust had spread throughout the Americas. The disease has slowly reemerged and is causing severe outbreaks in the region. States of emergency have been declared in every Central American coffee growing country, Peru and the Dominican Republic. Official estimates for the 2013-2014 growing season have predicted losses of \$500 million USD with 50% or the regions coffee sector affected. In this seminar, coffee rust expert and plant pathologist Jacques Avelino discusses the biology of the pathogen and methods for disease management.

<http://agrilinks.org/library/coffee-rust-hemileia-vastatrix-some-biological-and-epidemiological-aspects>



## COMMODITIES: LIVESTOCK

### **Guidelines for innovation platforms: facilitation, monitoring and evaluation**

Pali, P. and Swaans, K.

2013. Nairobi, Kenya: International Livestock Research Institute (ILRI)

ILRI Manual 8.

<http://cgspace.cgiar.org/bitstream/handle/10568/27871/ILRImanual8.pdf?sequence=4>

### **Nutritional evaluation of cassava (*Manihot esculenta* Crantz) peel meal improved by rumen filtrate fermentation on the performance of growing rabbits**

O.O. Ojebiyi, O. A. Aderinola, A. Adejobi and A.O. Ayangbenro

2012. Trop. Agric. (Trinidad) 89:181-188

Contact: Tropical Agriculture Journal, The University of the West Indies, St. Augustine, Trinidad and Tobago.  
Telephone: 868-645-3640. E-mail: [tropical.agri@sat.uwi.edu](mailto:tropical.agri@sat.uwi.edu)

## SMALL RUMINANTS:

### **Climate change adaptation for goat and sheep farming in the Pacific**

2013. Secretariat of the Pacific Community (SPC)

Factsheet

[http://www.spc.int/lrd/index.php?option=com\\_docman&Itemid=644](http://www.spc.int/lrd/index.php?option=com_docman&Itemid=644)

### **National Farm-Level Biosecurity Standard for the Goat Industry.**

2013. Canadian Food Inspection Agency

Home>Animals>Terrestrial Animals>Biosecurity>Standards and Principles>Goat Industry Webpage, Date modified: 2013-07-05

<http://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/goat-industry/eng/1367131154680/1367131213133>

## GERMPLASM

### **A prioritized crop wild relative inventory to help underpin global food security**

Holly Vincent, John Wiersema, Shelagh Kell, Hannah Fielder, Samantha Dobbie, Nora P. Castañeda-Álvarez, Luigi Guarino, Ruth Eastwood, Blanca León, Nigel Maxted.

2013. Biological Conservation 167: 265-275

#### Abstract

The potentially devastating impacts of climate change on biodiversity and food security, together with the growing world population, means taking action to conserve crop wild relative (CWR) diversity is no longer an option—it is an urgent priority. CWR are species closely related to crops, including their progenitors, which have potential to contribute traits for crop improvement. However, their utilisation is hampered by a lack of systematic conservation which in turn is due to a lack of clarity over their identity. We used gene pool and taxon group concepts to estimate CWR relatedness for 173 priority crops to create the Harlan and de Wet inventory of globally important CWR taxa. Further taxa more remotely related to crops were added if they have historically been found to have useful traits for crop improvement. The inventory contains 1667 taxa, divided between 37 families, 108 genera, 1392 species and 299 sub-specific taxa. The region with the highest number of priority CWR is western Asia with 262 taxa, followed by China with 222 and southeastern Europe with 181. Within the primary gene pool, 242 taxa were found to be under-represented in ex situ collections and the countries identified as the highest priority for further germplasm collection are China, Mexico and Brazil. The inventory database is web-enabled (<http://www.cwrdiversity.org/>)

[checklist/](#)) and can be used to facilitate in situ and ex situ conservation planning at global, regional and national levels.

<http://www.sciencedirect.com/science/article/pii/S0006320713002851>

#### **Related links**

**Crop Wild Relatives & Climate Change website** <http://www.cwrdiversity.org/>

**Crop Wild Relatives Inventory** <http://www.cwrdiversity.org/checklist/>

## **THEMATIC AREAS: AGRO-ENERGY**

### **Assessment of the biomass energy potentials and environmental benefits of *Jatropha curcas* L. in Southwest China**

Lei Liu, Dafang Zhuang, Dong Jiang, Jingying Fu

2013. Biomass and Bioenergy 56:342-350

#### Abstract

*Jatropha curcas* L. (JCL) is believed to be the most promising tree species used to produce biodiesel in China. Due to its abundant marginal land resource and good meteorological conditions, Southwest China is the major region to develop JCL. With Southwest China being taken as the study area in this paper, multi-factor comprehensive analysis is used to identify marginal land resources suitable to JCL plantation and make suitability assessment, thus obtaining their spatial distribution, suitability degree and total amount. With life cycle analysis (LCA), the life cycle net energy and greenhouse gas emission reduction capacity of marginal land resources with different suitability degrees used to produce biodiesel are investigated. Based on the research results, the life cycle model is expanded to obtain the potentiality of total net energy production and greenhouse gas emission reduction of large-scale plantation of JCL in southwest China. The results show that the area of land resources suitable and moderately suitable for JCL plantation is  $1.99 \times 10^6$  ha and  $5.57 \times 10^6$  ha, respectively. If all of these land resources are put into use, the maximum net production potential of biodiesel from JCL would be  $1.51 \times 10^8$  GJ/a, and the total greenhouse gas emission reduction capacity  $1.59 \times 10^7$  t/a in Southwest China.

**Keywords:** Marginal land; *Jatropha curcas* L.; Life cycle analysis; Net energy; Greenhouse gas emission

<http://www.sciencedirect.com/science/article/pii/S0961953413002936>

### **Biofuels and food security. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security**

HLPE

2013. Rome: FAO

[http://www.fao.org/fileadmin/user\\_upload/hlpe/hlpe\\_documents/HLPE\\_Reports/HLPE-Report-5\\_Biofuels\\_and\\_food\\_security.pdf](http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-5_Biofuels_and_food_security.pdf)

### **A framework for the study of the growth and development of castor plant**

Liv S. Severino, Dick L. Auld

2013. Industrial Crops and Products 46: 25-38

#### Abstract

A deeper understanding of the growth and development of castor plant (*Ricinus communis* L.) will be required for the transition from the low input/low yield present scenario to the desired condition of mechanically harvested with high seed yield. The objective of this review was to discuss important aspects of castor growth and development in order to propose a framework for the study of aspects that can potentially impact castor breeding and crop management. Gaps in the knowledge were emphasized. Castor has a slow and cold-sensitive germination that negatively impact crop establishment. The importance of cotyledonary leaves has been poorly studied. Leaf area is very responsive to growing conditions, and factors that influence leaf size and leaf number were discussed. Leaves play a role beyond photosynthesis, particularly on the storage of nutrients and assimilates. Remobilization of stored compounds during leaf senescence is pivotal for seed filling, and this process can impact seed yield in early maturing varieties. Studies on castor root are scarce, despite its importance for plant growth. Some physiological processes of seed development such as seed filling duration and seed growth rate play an important role in the adaptation to different environments and for increasing earliness. Seed abortion is an important mechanism of sink

adjustment to environmental conditions which can be explored for increased plasticity. Harvest index is a simple approach that historically has been very useful for increasing seed yield of many crops, and that should be used more often in castor research. Finally, modeling would be an obvious consequence of progresses in the understanding of physiological processes controlling castor plant growth and development.

**Keywords:** *Ricinus communis*; Oilseed; Seed yield; Crop physiology  
<http://www.sciencedirect.com/science/article/pii/S0926669013000290>

### **A review on the challenges for increased production of castor**

Liv Severino, et al.

2012. Agronomy Journal 104: 853-880

<http://www.neef.ufc.br/A%20review%20challenges%20increased%20production%20%20castor.pdf>

### **The status of bioenergy development in developing countries**

Irini Maltsoylou, Tatsuji Koizumi, Erika Felix

2013. Global Food Security 2:104-109

Following a period of increasing oil prices, bioenergy received a wake of renewed attention by policymakers as an alternative renewable energy strategy due to the potential for improving country level energy security, for increasing overall access to energy, stimulating rural development and for curbing greenhouse gas emissions. Nevertheless, concerns about the viability of this strategy and potential conflicts with food demand soon dampened the enthusiasm and raised a number of questions concerning environmental and social sustainability and, more specifically, food security. In reality though, with the exception of the US, Brazil and some European countries, production of modern bioenergy and more specifically liquid biofuels around the world is still limited, especially in the case of Africa where the sector is still in its infancy. The paper gives a detailed overview of production in the African, Asian and Latin American regions illustrating how the three regions of the developing world are working toward bioenergy development, the strategies and policies, and the main hurdles being encountered.

**Keywords:** Bioenergy, Biofuel, Development, Developing countries, Biofuel policy status, Renewable energy  
<http://www.sciencedirect.com/science/article/pii/S2211912413000163>

## **THEMATIC AREAS: ORGANICS**

### **Organic agriculture: African experiences in resilience and sustainability**

Raymond Auerbach, Gunnar Rundgren and Nadia El-Hage Scialabba (Eds.)

2013. FAO: Rome

#### Description

Organic Agriculture: African Experiences in Resilience and Sustainability, demonstrates that organic management can benefit people, the economy and ecosystems and that this can be achieved in Africa, where hunger and degradation stubbornly persist, despite decades of development efforts. The work presented in this volume stems from the conference on Mainstreaming Organic Agriculture in the African Development Agenda, held in Lusaka, Zambia, from 2 to 4 May 2012. Participants of this Conference shared research results confirming that organic agricultural practices increase yields, improve livelihoods and food security, conserve indigenous knowledge, plant varieties and animal breeds, as well as sociocultural development, and provide much greater resilience in times of climate extremes, such as drought and heavy rains. This publication expands on selected research presented during the Lusaka Conference. The different chapters document sustainability experiences, including: mainstreaming organic agriculture into African development approaches; community-based livestock systems combining holistic range management; indigenous ethno-veterinary practices and new understanding of customary systems of resource management; ecofunctional intensification through management of legumes, systems of rice intensification and integrated farming; and smallholders knowledge harnessed through family farmers learning groups and customized information and communication technologies.

<http://www.fao.org/docrep/018/i3294e/i3294e.pdf>

## **Organic certification, agro-ecological practices and return on investment: Evidence from pineapple producers in Ghana**

Linda Kleemann, Awudu Abdulai

2013. Ecological Economics 93: 330-341

### Abstract

The recent empirical literature on economic sustainability of certified export crops shows that certification standards that enhance yields are important for improving farm revenues and household welfare. However, limited evidence exists on the impact of organic certification on the adoption of agro-ecological practices. In this study, we use unique farm-level data from pineapple producers in Ghana to examine the impact of organic certification on the use of agro-ecological practices such as organic fertilizers, organic pest and weed control, crop rotation, and soil and water conservation, as well as how using these measures affect farm outcomes such as return on investment. Our empirical results reveal that organic certification increases agro-ecological practice use, although from a very low starting point. Using a generalized propensity score approach, we show that there is a positive, but nonlinear relationship between the intensity of agro-ecological practice use and return on investment.

**Keywords:** Organic agriculture; Certification; Agro-ecological practices; Return on investment; Impact assessment  
<http://www.sciencedirect.com/science/article/pii/S0921800913002164>

## **THEMATIC AREAS: PROTECTED AGRICULTURE**

### **GENERAL:**

#### **Protected Culture for vegetable and small fruit crops: types of structures**

Bielinski M. Santos, Gary Vallad, and Emmanuel A. Torres-Quezada

2013. UF Department of Horticultural Sciences, July 2013

This document is HS1224, one of a series of the Horticultural Sciences Department, UF/IFAS Extension. Original publication

<http://edis.ifas.ufl.edu/pdffiles/HS/HS122400.pdf>

#### **CARDI/CFC/EU project - Increased Production of Vegetables and Herbs through the Use of Protected Agriculture (PA) in the Caribbean**

Caribbean Agricultural Research and Development Institute / Common Fund for Commodities / European Union (CARDI/CFC/EU) project reports:

**CFC Protected Agriculture project documents** <http://www.cardi.org/cfc-pa/documents-for-download/?category=125>

#### **Capacity development methodology and achievements in CFC-funded projects on protected agriculture and roots & tubers in the Caribbean**

Compton L. Paul, Aurora Devers-Ramkissoon and Denise Erskine-Jones

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute (Project report. PSC # HQ/017/13)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/09/Publ-14-Training-PA-RT-Paul-Devers-Jones-for-PSC-review1.pdf>

## **Financial Aspects of Greenhouse Vegetables Production Systems in Jamaica and Trinidad & Tobago**

Govind Seepersad, Ardon Iton, Compton Paul and Janet Lawrence

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute (Technical report. PSC # HQ/014/13)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/11/Publ-20-Financial-Aspects-Greenhouses-Govind-S.pdf>

## **Market profile for cucumber in Trinidad & Tobago**

Aziz Mohammed

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute (PSC # HQ/013/13)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/11/Publ-23-Market-Profile-Cucumber-TT-Aziz-M.pdf>

## **Market profile for greenhouse vegetables in Jamaica**

Wayne Lawrence

2013. Kingston, Jamaica: Caribbean Agricultural Research and Development Institute (Project report. PSC # JA/013/13)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/09/Publ-26-Greenhouse-Market-Profile-Jamaica-W.Lawrence.pdf>

## **Market profile for sweet pepper in Trinidad and Tobago**

A Mohammed.

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/11/Publ-22-Market-Profile-Sweet-pepper-TT-Aziz-M.pdf>

## **Market profile for tomatoes in Trinidad & Tobago**

Aziz Mohammed

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute (PSC # HQ/018/13)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/09/Publ-21-Market-Profile-Tomato-TT.pdf>

## **Marketing manual for protected agriculture agri-business enterprises**

Aziz Mohammed

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/11/Publ-18-PA-MARKETING-MANUAL-Aziz-M.-Oct-2013.pdf>

## **Policies and developmental initiatives required to strengthen the Roots and Tubers (RT) and Protected Agriculture (PA) Industries in the Caribbean**

Pathleen Titus and Bradley Georges

2013. Basseterre, St Kitts and Nevis: Caribbean Agricultural Research and Development Institute (Technical report. PSC # HQ/032/12)

*Available on CARDI Website*

<http://www.cardi.org/cfc-rt/files/downloads/2013/10/Publ-11-PA-RT-VCs-Titus-BG.pdf>

### **Production, productivity and seasonal availability of greenhouse-grown vegetables in the Caribbean**

Sean Black, Telford Serge-David and Alexander Benn

2013. Kingston, Jamaica: Caribbean Agricultural Research and Development Institute

(Technical report. PSC # JA/013/12)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/08/Publ-5-Black-et-al-for-PSC-review.pdf>

### **Promoting and strengthening producer groups and value chain clusters - methodologies and results**

Robert A. Reid

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute.

(PSC # HQ/033/12)

*Available on CARDI Website*

[http://www.cardi.org/cfc-rt/files/downloads/2013/10/Publ-12-PA-RT-Groups-R.Reid\\_.pdf](http://www.cardi.org/cfc-rt/files/downloads/2013/10/Publ-12-PA-RT-Groups-R.Reid_.pdf)

### **Strengthening producer groups, marketing and market information systems within the protected agriculture industry in the Caribbean.**

Janet Lawrence, Lennox Sealy and Aziz Mohammed

2013. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute.

(Technical report. PSC # TT/034/12)

*Available on CARDI Website*

<http://www.cardi.org/cfc-pa/files/downloads/2013/10/Publ-13-Strengthening-PA-groups-MIS-JLLSAM.pdf>

### **Value chain strengthening of protected agriculture and roots and tubers industries in Jamaica through CARDI**

Nickeisha Reid, Denise Erskine-Jones, Wayne Lawrence, Dionne Clarke Harris and Lloyd Johnson

2013. Kingston, Jamaica: Caribbean Agricultural Research and Development Institute

(Technical report. PSC # JA/008/12)

*Available on CARDI Website*

<http://www.cardi.org/cfc-rt/files/downloads/2013/10/Publ-15-VC-Strengthening-PA-RT-Reid-et-al-CFCS.pdf>

### **These CARDI/CFC/EU) project reports also available at**

Caribbean Agricultural Research and Development Institute, P.O. Bag 212, Frederick Hardy Building, University of the West Indies, St. Augustine Campus, St Augustine, Trinidad and Tobago, W.I.

**Tel:** 1-868- 645-1205-7. **Fax:** 1-868-645-1208. **Email:** [infocentre@cardi.org](mailto:infocentre@cardi.org)

## **THEMATIC AREAS: SOIL AND WATER MANAGEMENT**

### **Restoring the ecological foundation for food security: a soil organic matter perspective**

Liang Wu, Kirti Avishek.

2013. UNEP

UNEP Policy Series on Ecosystem Management

Executive Summary

Food security globally is highly dependent on crop production, which has been subjected to increasing pressures emanating from both an increasing demand for food and a deteriorating health of the agricultural ecosystem. Restoration of the ecological foundation for crop production has become a necessity in our pursuit for food security. As one of the most vulnerable natural resources, soils are becoming more and more degraded or polluted by agricultural and other anthropogenic activities. Soil organic matter (SOM), due to its close correlation with soil fertility and crop production, and high potential for carbon sequestration and nutrient cycling, has gained much attention in the last few years.

In this policy paper, we argue that restoring SOM contents to optimal levels not only contributes significantly towards boosting crop production, but also improves the health of agro-ecosystems across the world. The study proposed a portfolio framework to bring all SOM-related issues together. Six categories of SOM Friendly

Ecosystem Management (SFEM) were suggested to facilitate the SOM restoration process. Policy implications of the SFEM were also discussed for better understanding of the SFEM.

*Access on the following link to get a complete version of the document.*

<http://docs.unon.org/55724ba7bd6d9fb31863707fc68e153826d77027.pdf>

## THEMATIC AREAS: NATURAL RESOURCE MANAGEMENT

### CLIMATE CHANGE:

#### **Agriculture and climate change in Jamaica: agricultural sector support analysis**

Ramasamy Selvaraju (Lead author)

2013. Rome: FAO

FAO Environment and Natural Resources Service Series, No. 20

<http://www.fao.org/docrep/018/i3417e/i3417e.pdf>

#### **An assessment of the economic and social impacts of climate change on the agriculture sector in the Caribbean**

Sharon Hutchinson, Charmaine Gomes, Dillon Alleyne, Willard Phillips

2013. Port of Spain, Trinidad and Tobago: Economic Commission for Latin America and the Caribbean (ECLAC), February 2013. Project Document. LC/CAR/L.398

Includes discussion on impact of climate change on cassava, rice and sugarcane production.

<http://www.cepal.org/portofspain/noticias/documentosdetrabajo/5/49705/Agriculture.pdf>

#### **Climate Change Adaptation for Smallholder Farmers in the Pacific**

2013. Secretariat of the Pacific Community (SPC)

##### **Fact Sheets**

[Climate Change Adaptation for bee Farming in the Pacific](#)

[Climate Change Adaptation for Pig Farming in the Pacific](#)

[Climate Change Adaptation for Chicken Farming in the Pacific](#)

[Climate Change Adaptation for Cattle Farming in the Pacific](#)

[Climate Change Adaptation for Goat and Sheep Farming in the Pacific](#)

[Policy Climate Change Factsheet](#)

*Downloadable as PDF files from:* <http://tinyurl.com/k4hhtpo>

[http://www.spc.int/lrd/index.php?option=com\\_docman&Itemid=644](http://www.spc.int/lrd/index.php?option=com_docman&Itemid=644)

#### **Climate Change Statistics eXplorer**

Organisation for Economic Co-operation and Development (OECD)

This new data visualisation tool aims to enhance transparency by bringing climate-related statistics to life and making them easier to digest. The tool allows the user to visualise over 40 data sets for over 100 developed and developing countries using animated bubble charts for the period 1990-2010

Stats given for Jamaica, Trinidad and Tobago.

*Website:* <http://webnet.oecd.org/climatechange/#story=0>

<http://www.oecd.org/env/indicators-modelling-outlooks/data-and-indicators.htm>

#### **Climate-smart agriculture sourcebook**

2013. FAO

The purpose of the sourcebook is to further elaborate the concept of Climate-Smart Agriculture (CSA) and demonstrate its potential, as well as limitations. It aims to help decision makers at a number of levels (including political administrators and natural resource managers) to understand the different options that are available for

planning, policies and investments and the practices that are suitable for making different agricultural sectors, landscapes and food systems more climate-smart.

This sourcebook is divided into three main sections,

- Section A “The Case for Climate-Smart Agriculture”
- Section B “Improved Technologies and Approaches for Sustainable Farm Management”
- Section C “Enabling frameworks”

<http://www.fao.org/docrep/018/i3325e/i3325e.pdf>

### **Crop pests and pathogens move polewards in a warming world**

Daniel P. Bebber, Mark A. T. Ramotowski & Sarah J. Gurr

2013. *Nature Climate Change* 3:985–988

#### Abstract

Global food security is threatened by the emergence and spread of crop pests and pathogens. Spread is facilitated primarily by human transportation, but there is increasing concern that climate change allows establishment in hitherto unsuitable regions. However, interactions between climate change, crops and pests are complex, and the extent to which crop pests and pathogens have altered their latitudinal ranges in response to global warming is largely unknown. Here, we demonstrate an average poleward shift of  $2.7 \pm 0.8$  km yr<sup>-1</sup> since 1960, in observations of hundreds of pests and pathogens, but with significant variation in trends among taxonomic groups. Observational bias, where developed countries at high latitudes detect pests earlier than developing countries at low latitudes, would result in an apparent shift towards the Equator. The observed positive latitudinal trends in many taxa support the hypothesis of global warming-driven pest movement.

<http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1990.html>

<http://www.readcube.com/articles/10.1038/nclimate1990>

### **Resilient livelihoods - Disaster Risk Reduction for Food and Nutrition Security Framework**

#### **Programme**

2013. FAO

Note especially the chapters on Disaster Risk Reduction (DRR) and climate change adaptation

<http://www.fao.org/docrep/015/i2540e/i2540e00.pdf>

## **OTHER AGRICULTURAL ASPECTS**

### **AGRICULTURAL DEVELOPMENT:**

#### **The State of Food Insecurity in the World 2013: the multiple dimensions of food security**

FAO, IFAD and WFP

2013: Rome, FAO

<http://www.fao.org/publications/sofi/en/>

*Full report:* <http://www.fao.org/docrep/018/i3434e/i3434e.pdf>

#### **From subsistence to profit: transforming smallholder farms**

Shenggen Fan, Joanna Brzeska, Michiel Keyzer, Alex Halsema

2013. International Food Policy Research Institute (IFPRI)

#### Main Findings

Smallholder farmers in developing countries play a key role in meeting the future food demands of a growing and increasingly rich and urbanized population. However, smallholders are not a homogeneous group that should be supported at all costs. Whereas some smallholder farmers have the potential to undertake profitable commercial activities in the agricultural sector, others should be supported in exiting agriculture and seeking nonfarm employment opportunities.

For smallholder farmers with profit potential, their ability to be successful is hampered by such challenges as climate change, price shocks, limited financing options, and inadequate access to healthy and nutritious food. By overcoming these challenges, smallholders can move from subsistence to commercially oriented agricultural



systems, increase their profits, and operate at an efficient scale—thereby helping to do their part in feeding the world's hungry.

**Policy report available at**

[http://www.ifpri.org/publication/subsistence-profit?utm\\_source=New+At+IFPRI&utm\\_campaign=60e7f8b31b-New\\_at\\_IFPRI\\_August\\_26\\_2013&utm\\_medium=email&utm\\_term=0\\_7b974d57a5-60e7f8b31b-68946154](http://www.ifpri.org/publication/subsistence-profit?utm_source=New+At+IFPRI&utm_campaign=60e7f8b31b-New_at_IFPRI_August_26_2013&utm_medium=email&utm_term=0_7b974d57a5-60e7f8b31b-68946154)

## **Profile of the small-scale farming in the Caribbean: Workshop on small-scale farming in the Caribbean**

Barbara Graham

2012. FAO

Preface

This document seeks to analyze relevant data in the Census of Agriculture of eight of the countries and recent studies in the sub-region, to generate a discussion on the situation of small scale farmers. It provides support for an objective approach to manage the heterogeneous nature of the small scale farming and to identify imperatives for prescriptions that embrace all the unique characteristics of small farmers. In this manner the document seeks to provide information to identify and upscale opportunities to intensify the contribution of on-farm activities to the well being of farm house holds. It also examines potential for small scale farming to impact national food and nutrition security, the expansion of farm related employment beyond the rural sector and with full consideration for the demands for sustainability.

<http://www.rlc.fao.org/fileadmin/templates/iniciativa/content/pdf/eventos/agric-fam-caribe-2012/profile-small-scale-farming-in-the-caribbean.pdf>

## **INTELLECTUAL PROPERTY**

### **Geography of food: reconnecting with origin in the food system**

2013. ACP-EU technical Centre for Agricultural and Rural Cooperation (CTA)

Brussels Development Briefings, 15 May 2013 at the ACP Secretariat in Brussels

<http://brusselsbriefings.net/past-briefings/linking-food-geography-and-people/>

Topics: existing global and regional frameworks for protecting geographical indications and traditional products, the Caribbean experience in protecting agrifood products, or the leverage of GI potentials in the use of underutilized species.

Includes presentation by

**John Malcolm Spence**, Senior Coordinator, Intellectual Property Issues, CARICOM Secretariat: “**The Caribbean experience in protecting agricultural and agrifood products**” <http://www.slideshare.net/brusselsbriefings/the-caribbean-experience-in-protecting-agricultural-and-agrifood-products>

## **VALUE CHAINS:**

### **Feed the Future Learning Agenda Literature Review: Expanded Markets, Value Chains and Increased Investment**

Ruth Campbell

2013. USAID/BFS. Date Published: July 10, 2013

Project: Feed the Future FEEDBACK project

The objective of this paper is to summarize available evidence on key questions for the Feed the Future Learning Agenda theme on expanded markets, value chains and increased investments, and document expert opinion on gaps in the scientific literature for this theme that are in most urgent need of attention.

[http://agrilinks.org/sites/default/files/resource/files/FTF%20FEEDBACK%20Value%20Chains%20Theme%20Lit%20Review\\_Jul1\\_2013%20\(1\).pdf](http://agrilinks.org/sites/default/files/resource/files/FTF%20FEEDBACK%20Value%20Chains%20Theme%20Lit%20Review_Jul1_2013%20(1).pdf)

## **Feed the Future Learning Agenda Annotated Bibliography: Expanded Markets, Value Chains, and Increased Investments**

Jill T. W. Bernstein

2013. USAID/BFS; Date Published: August 2, 2013

Project: Feed the Future FEEDBACK project

Compiled to address the following questions:

What types of investments in value chain market led development result in poverty reduction and improved nutrition among even the lower income quintiles in areas where value chain work is taking place?

Which kinds of investments and in which value chain functions have generated increases in income and opportunities for employment among the poorest quintile, women, and other vulnerable groups?

Have interventions in agricultural value chain development led to development of local institutions and systemic behavior change? What are effective pathways for generating that change?

What types of interventions (policy and regulatory reform; institutional strengthening; market development; public private partnerships, etc.) have attracted private sector investment in agriculture?

To what extent do different sources (domestic debt, FDI, guarantees, etc.) of investment in value chains lead to new income and employment opportunities for vulnerable populations?

What has been the impact of infrastructure interventions on poverty reduction? What is the impact when infrastructure investments are used in combination with more traditional value chain or productivity enhancing interventions?

To what extent has the expansion of intra-regional trade in staples increased market access and regional availability and reduced price fluctuations and year-to-year local shortages?

<http://agrilinks.org/library/feed-future-learning-agenda-annotated-bibliography-expanded-markets-value-chains-and>

[http://agrilinks.org/sites/default/files/resource/files/FTF%20Learning%20Agenda%20Value%20Chains%20Annotated%20Bibliography\\_July%202013.pdf](http://agrilinks.org/sites/default/files/resource/files/FTF%20Learning%20Agenda%20Value%20Chains%20Annotated%20Bibliography_July%202013.pdf)

## **AGRICULTURAL RESEARCH:**

### **Feed the Future Learning Agenda Annotated Bibliography: Improved Research & Development**

Jill T. W. Bernstein

2013. USAID/BFS; Date Published: July 30, 2013

Project: Feed the Future FEEDBACK project

This annotated bibliography is a compilation of studies that relate to the following questions from the Feed the Future Learning Agenda on Improved Research and Development:

1) What partnership mechanisms are most productive, efficient, effective and sustainable for carrying out agricultural research to positively benefit resource-poor farmers and food security?

2) Which R&D programs have had an impact on the policy or enabling environment?

**PDF available at** [http://agrilinks.org/sites/default/files/resource/files/FTF%20Learning%20Agenda%20RD%20Annotated%20Bibliography\\_July%202013.pdf](http://agrilinks.org/sites/default/files/resource/files/FTF%20Learning%20Agenda%20RD%20Annotated%20Bibliography_July%202013.pdf)



## *Our Vision*

To be the centre of excellence in the Caribbean for the provision and application of research and development in agriculture and rural enhancement.

## *Our Mission*

To contribute to the sustainable economic well being of Caribbean people by the generation and transfer of appropriate technology through research and development within the agricultural value chain.

[www.cardi.org](http://www.cardi.org)