



IMPROVING LIVES THROUGH
AGRICULTURAL RESEARCH

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R & D *in* AGRICULTURE



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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
- Bananas and Plantains
- Coconuts
- Fruits & vegetables
- Small ruminants

Thematic Areas

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

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

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

Issues of this publication are available on our website, www.cardi.org, under the Publications section.

Frequency: 3 times a year - April, August, December

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COMMODITIES: Cereals & Grain Legumes

Improving maize grain yield under drought stress and non-stress environments in Sub-Saharan Africa using marker-assisted recurrent selection.

Beyene, Y.; Fentaye Kassa Semagn; Crossa, J.; Mugo, S.N.; Atlin, G.N.; Amsal Tesfaye Tarekegne; Meisel, B.; Sehabiague, P.; Vivek, B.; Oikeh, S.O.; Alvarado, G.; Machida, L.; Olsen, M.; Prasanna, B.M.; Banziger, M.

2016. *Crop Science* 56:344-353

Abstract

In marker-assisted recurrent selection (MARS), a subset of molecular markers significantly associated with target traits of interest are used to predict the breeding value of individual plants, followed by rapid recombination and selfing. This study estimated genetic gains in grain yield (GY) using MARS in 10 biparental tropical maize (*Zea mays* L.) populations. In each population, 148 to 184 F_{2:3} (defined as C₀) progenies were derived, crossed with a single-cross tester, and evaluated under water-stressed (WS) and well-watered (WW) environments in sub-Saharan Africa (SSA). The C₀ populations were genotyped with 190 to 225 single-nucleotide polymorphism (SNP) markers. A selection index based on marker data and phenotypic data was used for selecting the best C₀ families for recombination. Individual plants from selected families were genotyped using 55 to 87 SNPs tagging specific quantitative trait loci (QTL), and the best individuals from each cycle were either intercrossed (to form C₁) or selfed (to form C₁S₁ and C₁S₂). A genetic gain study was conducted using test crosses of lines from the different cycles F₁ and founder parents. Test crosses, along with five commercial hybrid checks were evaluated under four WS and four WW environments. The overall gain for GY using MARS across the 10 populations was 105 kg ha⁻¹ yr⁻¹ under WW and 51 kg ha⁻¹ yr⁻¹ under WS. Across WW environments, GY of C₁S₂-derived hybrids were 8.7, 5.9, and 16.2% significantly greater than those of C₀, founder parents, and commercial checks, respectively. Results demonstrate the potential of MARS for increasing genetic gain under both drought and optimum environments in SSA.

<https://dl.sciencesocieties.org/publications/cs/abstracts/56/1/344>

COMMODITIES: Roots & Tubers

Cassava and sweet potato: suitability of popular Caribbean varieties for value added product development

Pathleen Titus and Janet Lawrence

2015. Caribbean Agricultural Research and Development Institute (CARDI) and Inter-American Institute for Cooperation on Agriculture (IICA). Port of Spain: IICA

Available on CARDI website <http://www.cardi.org/wp-content/uploads/downloads/2016/04/Cassava-and-sweet-potato-suitability-of-popular-Caribbean-varieties-for-value-added-product-development.pdf>

Available on IICA website <http://www.iica.int/sites/default/files/publications/files/2015/b3819e.pdf>

Cassava: production and processing

Kouakou, J., Nanga Nanga, S., Plagne-Ismaïl, C., Mazalo Pali, A., Edoh Ognakossan, K.

2016. Series: Pro-Agro English (CTA, ISF Cameroon). Publisher(s): CTA ISF

Contents

1. Description of the plant
2. Cassava production
3. Cassava harvesting
4. Storing cassava
5. Some food products based on cassava leaves

6. Cassava processing
 7. Socio-economic indicators
 8. Additional information
- http://publications.cta.int/media/publications/downloads/1889_PDF.pdf

Going forward in agriculture: the cassava pillar

Dr. Deepford of FAO, Barbados

2015. Presented at the BSTA Conference 2015 | The Barbados Society of Technologists in Agriculture
This presentation highlights the recent work and results, on-going work and challenges experienced with cassava.

<http://www.bstabarbados.org/articles/2015/03/bsta-conference-2015-the-cassava-pillar/>

- Proceedings <http://www.bstabarbados.org/articles/category/bsta-conference-2015/>

Growing cassava on sloping land - ENGLISH version

[International Center for Tropical Agriculture](#) [CIAT]

2015. Video published on Oct 22, 2015

This farmer-to-farmer video, developed through funding by the Swiss Agency for Development and Cooperation (SDC) by CIAT and Agro-Insight, explains in a clear and simple way how to cultivate and manage cassava while preventing soil erosion on sloping land. The videos are prepared to deepen farmer's understanding of the technical aspects of improved soil management, and at the same time, to prompt discussion within the local context.

<https://www.youtube.com/watch?v=JyiMD6Q0fU8>

A guide to analysing and strengthening root and tuber value chains in the Caribbean

Caribbean Agricultural Research and Development Institute [CARDI]

2014. St Augustine, Trinidad and Tobago: Caribbean Agricultural Research and Development Institute.

<http://www.cardi.org/wp-content/uploads/downloads/2015/09/RT-VC-Manual-FINAL.pdf>

Potato and sweetpotato in Africa: transforming the value chains for food and nutrition security

J Low, M Nyongesa, S Quinn, M Parker (eds.)

2015. CABI

This book addresses five major themes on sweetpotato and potato: policies for germplasm exchange, food security and trade in Africa; seed systems; breeding and disease management; post-harvest management, processing technologies and marketing systems; nutritional value and changing behaviours.

<http://www.cabi.org/bookshop/book/9781780644202>

Protecting the sweetpotato from the West Indian Sweetpotato Weevil, *Euscepes Postfasciatus*: II. Resistance evaluation of sweetpotato varieties to weevils in the field

2015. Sweet Potato Research Front, No.31 November, 2015: 2

NARO Kyushu Okinawa Agricultural Research Center (NARO/KARC)

www.naro.affrc.go.jp/publicity_report/publication/files/SPORF31.pdf

Superelongation disease in cassava: a constraint to the cassava industry in Barbados

Dr. Angela Alleyne, Lecturer in Biochemistry, UWI, Cave Hill

2015. Presented at the BSTA Conference 2015 | The Barbados Society of Technologists in Agriculture

<http://www.bstabarbados.org/wp-content/uploads/2015/03/Reemergence-of-SED-in-Barbados.pdf>

- Proceedings <http://www.bstabarbados.org/articles/category/bsta-conference-2015/>

Sweet Potato Processing

Richard Armstrong of ARMAG Farms, St. Philip, Barbados.

2015. Presented at the BSTA Conference 2015 | The Barbados Society of Technologists in Agriculture

In his presentation, Mr. Armstrong gave an overview of his sweet potato processing plant where healthy fries are produced. He also gave an indication of the challenges currently being faced in this innovative operation in Barbados.

<http://www.bstabarbados.org/articles/2015/02/bsta-conference-2015-presentation-series/>

- Proceedings <http://www.bstabarbados.org/articles/category/bsta-conference-2015/>

Towards a Marketable Sized Sweet Potato

Jacklyn Broomes and Anderson Eversley, BAMC

2015. Presented at the BSTA Conference 2015 | The Barbados Society of Technologists in Agriculture

A determination of the effect of single- and double-row planting on the yield of four sweet potato cultivars and to quantify economic feasibility of double-row planting of sweet potato as a production method within the BAMC setting.

<http://www.bstabarbados.org/articles/2015/03/bsta-conference-2015-presentation-2-towards-a-marketable-sized-sweet-potato/>

- Proceedings <http://www.bstabarbados.org/articles/category/bsta-conference-2015/>

A vacuolar Na⁺/H⁺ antiporter gene, *IbNHX2*, enhances salt and drought tolerance in transgenic sweetpotato

Bing Wang, Hong Zhai, Shaozhen He, Huan Zhang, Zhitong Ren, Dongdong Zhang, Qingchang Liu

2016. *Scientia Horticulturae* 201:153-166

Abstract

Plant vacuolar Na⁺/H⁺ antiporters (NHX) play a critical role in adaption to abiotic stresses by compartmentalizing Na⁺ into vacuoles from the cytosol. In this study, a vacuolar Na⁺/H⁺ antiporter gene, named *IbNHX2*, was isolated and characterized from salt-tolerant sweetpotato (*Ipomoea batatas* (L.) Lam.) line ND98. *IbNHX2* consisted of 542 amino acid residues with a conserved binding domain 'FFIYLLPPI' for amiloride and a cation/H⁺ exchanger domain, and shared a high amino acid identity (73.72–96.13%) with the identified vacuolar Na⁺/H⁺ antiporters in other plant species. The genomic DNA of *IbNHX2* contained 14 exons and 13 introns. Expression of *IbNHX2* was induced by abscisic acid (ABA), NaCl and polyethylene glycol (PEG). Its overexpression significantly enhanced salt and drought tolerance in the transgenic sweetpotato. An significant increase of proline content and superoxide dismutase (SOD) and photosynthesis activities and significant reduction of malonaldehyde (MDA) and H₂O₂ content were found in the transgenic sweetpotato plants. Up-regulation of the stress-responsive genes encoding pyrroline-5-carboxylate synthase (P5CS), SOD, catalase (CAT), zeaxanthineoxidase (ZEP), 9-*cis*-epoxycarotenoid dioxygenase (NCED), aldehyde oxidase (AO), late embryogenesis abundant protein (LEA), psbA and phosphoribulokinase (PRK) in the transgenic plants was also found under salt and drought stresses. The overall results demonstrate the explicit role of *IbNHX2* in conferring salt and drought tolerance of sweetpotato. The *IbNHX2* gene has the potential to be used for improving salt and drought tolerance of plants.

Keywords: Drought tolerance; *IbNHX2*; Salt tolerance; Sweetpotato; Vacuolar Na⁺/H⁺ antiporter

<http://www.sciencedirect.com/science/article/pii/S0304423816300280>

COMMODITIES: Fruits & Vegetables

CITRUS GREENING DISEASE:

Costs and benefits of frequent low-volume applications of horticultural mineral oil for management of Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae)

James A. Tansey, Moneen M. Jones, Pilar Vanaclocha, Jacqueline Robertson, Philip A. Stansly
2015. Crop Protection 76:59–67

Abstract

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae), vectors a pathogen that causes huanglongbing (HLB) in Florida citrus. The need to suppress ACP populations has resulted in greatly increased insecticide use in Florida. Horticultural mineral oils (HMOs), typically applied as 1–2% v/v aqueous emulsions at 937 L water ha⁻¹, are also used for insect pest management for citrus in Florida. Low-volume applications of other insect control products can reduce costs and application time and are effective for ACP control. The efficacy of low-volume applications of HMOs for ACP has not been tested. We initiated a three-year trial in February 2011 in a commercial Valencia orange grove in Lee County, Florida to compare low-volume (18.7 L ha⁻¹) sprays of HMO applied every two weeks to a grower standard (GS) (mixes of insecticide and HMO) and an untreated control. HMO and GS treatments significantly reduced ACP adult and nymph populations. Yields were greater for HMO-treated than untreated trees in the final study year. GS and HMO treatments reduced fruit drop in 2013. Fruit quality was generally unaffected by treatments. ACP suppression, higher yields and eventual production gains indicated that frequent, low-volume application of HMO may be a viable alternative for suppressing ACP populations.

Keywords: ACP; Greening; *Candidatus* Liberibacter asiaticus; Organic; Economic

<http://www.sciencedirect.com/science/article/pii/S026121941530051X>

Performance of 'Valencia' orange' (*Citrus sinensis* [L.] Osbeck) on 17 rootstocks in a trial severely affected by huanglongbing

Kim D. Bowman, Greg McCollum, Ute Albrecht
2016. Scientia Horticulturae 201:355–361

Abstract

'Valencia' orange (*Citrus sinensis* [L.] Osbeck) was grown on 17 rootstocks through seven years of age and the first four harvest seasons in a central Florida field trial severely affected by huanglongbing (HLB) disease. All trees in the trial had HLB symptoms and were shown by PCR to be infected with *Candidatus* Liberibacter asiaticus (Las). Large differences were noted between rootstocks for many metrics examined, including yield, fruit quality, and tree size. Highest yields in the trial were on US-942 rootstock, which was significantly more productive than trees on the common commercial rootstocks Carrizo, Kuharske, Cleopatra, and Kinkoji. Other new hybrid rootstocks also performed well in this trial strongly affected by HLB, including the rootstock US-1516, which had the second highest cumulative yield, best tree health rating, and lowest number of trees lost due to HLB damage. Comparison of tree performance in this trial with a similar trial conducted prior to the HLB epidemic, allows us to estimate that the disease resulted in a 33% reduction in yield and 21% reduction in tree growth through seven years of age. Use of a tolerant rootstock is suggested as an effective means of ameliorating crop losses to HLB.

Keywords: Sweet orange; Citrus greening; Fruit breeding

<http://www.sciencedirect.com/science/article/pii/S0304423816300206>

PDF (Open access) available at http://ac.els-cdn.com/S0304423816300206/1-s2.0-S0304423816300206-main.pdf?_tid=ef36b444-e55f-11e5-84eb-00000aab0f26&acdnat=1457463770_c20da0cad84f86bc4b69cb333105addb

DIAMONDBACK MOTH, *Plutella xylostella*:

The toxicity and physiological effect of essential oil from *Chenopodium ambrosioides* against the diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae)

Hui Wei, Jian Liu, Bing Li, Zhixiong Zhan, Yixin Chen, Houjun Tian, Shuo Lin, Xiaojun Gu

2015. Crop Protection 76:68–74

Abstract

In this study, the bioactivities of the essential oil of *Chenopodium ambrosioides* L. and its two main components, α -terpinene and *p*-cymene, were evaluated against the diamondback moth (DBM), *Plutella xylostella* (L.). The contact and fumigant toxicity of the essential oil significantly decreased as the DBM larval instar increased. The essential oil had 30-fold more potent toxicity against third-instar larvae than either α -terpinene or *p*-cymene. With respect to antifeedant activity, treatment with *C. ambrosioides* essential oil dose-dependently decreased leaf consumption by third-instar larvae, and the median antifeedant concentration (AFC₅₀) was 66.81 mg/L at 24 h and 78.24 mg/L at 48 h after the treatment. Development of pupae was also inhibited, and the median concentrations of pupae weight inhibition (PWIC₅₀) and percentage inhibition of pupation (PIC₅₀) were 176.5 mg/g leaf and 111.6 mg/g leaf, respectively. In general, contact treatment with the essential oil significantly inhibited the activities of insecticide detoxifying enzyme, including carboxylesterase and glutathione-S-transferases, whereas, fumigant exposure only altered carboxylesterase activity. At nearly all the tested concentrations, the essential oil induced the activities of superoxide dismutase, peroxidase, and catalase; however, peroxidase activity was inhibited by contact treatment. Thus, the essential oils from *C. ambrosioides* showed potential as new control products to combat field crop-infesting insect pests, and it may function as fumigant, insecticide synergist, antifeedant, or insect growth regulator.

Keywords: *Chenopodium ambrosioides*; Essential oil; *Plutella xylostella*; Toxicity; Antifeedant activity; Pupation inhibition

<http://www.sciencedirect.com/science/article/pii/S0261219415300533>

COMMODITIES: Livestock

Goat keeping: Useful management practices for smallholders.

Blauw, H., den Hertog, G., Koeslag, J.

2015. Series: Agrodoks (Agromisa, CTA). Publisher(s): Agromisa CTA

http://publications.cta.int/media/publications/downloads/1858_PDF.pdf

1. Introduction - the importance of goat keeping
2. Housing
3. Goat feeding
4. Health, diseases and parasites
5. Reproduction
6. Kid and young stock rearing
7. Milk production and slaughtering
8. Records

Livestock and the environment: What have we learned in the past decade?

Herrero, M., Wirseniuss, S., Henderson, B., Rigolot, C., Thornton, P., Havlík, P., Boer, I. de and Gerber, P.

2015. Annual Review of Environment and Resources 40:177-202

Abstract

The livestock and environment nexus has been the subject of considerable research in the past decade. With a more prosperous and urbanized population projected to grow significantly in the coming decades comes a gargantuan

appetite for livestock products. There is growing concern about how to accommodate this increase in demand with a low environmental footprint and without eroding the economic, social, and cultural benefits that livestock provide. Most of the effort has focused on sustainably intensifying livestock systems. Two things have characterized the research on livestock and the environment in the past decade: the development of increasingly disaggregated and sophisticated methods for assessing different types of environmental impacts (climate, water, nutrient cycles, biodiversity, land degradation, deforestation, etc.) and a focus on examining the technical potential of many options for reducing the environmental footprint of livestock systems. However, the economic or sociocultural feasibility of these options is seldom considered. Now is the time to move this agenda from knowledge to action, toward realizable goals. This will require a better understanding of incentives and constraints for farmers to adopt new practices and the design of novel policies to support transformative changes in the livestock sector. It will also require novel forms of engagement, interaction, and consensus building among stakeholders with enormously diverse objectives. Additionally, we have come to realize that managing the demand trajectories of livestock products must be part of the solution space, and this is an increasingly important research area for simultaneously achieving positive health and environmental outcomes.

PDF <http://www.annualreviews.org/doi/pdf/10.1146/annurev-environ-031113-093503>

<https://ccafs.cgiar.org/publications/livestock-and-environment-what-have-we-learned-past-decade#.VqfbAFIg5n8>

<http://www.annualreviews.org/doi/10.1146/annurev-environ-031113-093503>

THEMATIC AREAS: GERMLASM

Access to Seeds Index Report 2016

[Access to Seeds Foundation](#)

The Netherland: Access to Seeds Foundation

Quality seeds of improved varieties have enabled farmers in advanced agricultural systems to triple their yields. What is the seed industry, strategically placed as it is at the start of the food value chain, doing to help smallholder farmers in food insecure regions to achieve similar results?

The Access to Seeds Index aims to shine a light on this question. It assesses and benchmarks leading global field crop and vegetable seed companies on their efforts to make their products available to small holder farmers in four regions: Latin America, Western Africa, Eastern Africa, and South and Southeast Asia. A separate Regional Index has been compiled for Eastern Africa.

The findings show that seed industry as a whole is active in all countries in the scope of the Index. This is with the exception of Western Africa, where there is a clear gap. However, country-level presence is no guarantee that the industry's products are actually accessible to smallholder farmers. This report identifies opportunities as well as good practices that can inspire seed companies and their partners to go the last mile – in every sense – to the farm gate.

<http://www.accesstoseeds.org/app/uploads/2016/01/Access-to-Seeds-Index-2016-online.pdf>

Environmental characterisation to guide breeding decisions in a changing climate

Ramirez-Villegas J, Heinemann AB.

2015. CCAFS Working Paper no. 144. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Substantial evidence now exists suggesting that agricultural yields will have to increase significantly in order to meet food needs during the 21st century. One such way of increasing yields is to develop high yielding cultivars through crop improvement. This Working Paper summarises the results of a CCAFS project named Target Population of Environments (TPE). The project aimed at providing actionable information to crop breeders and, therefore, inform breeding decisions. We developed and applied a methodology for classifying crop growing environments, determining stress profiles and, finally, assessing the potential benefit of improved breeding practice. We present two contrasting case studies, one for upland rice in central Brazil and another for common beans in

Goiás (Brazil). Analyses are also currently being conducted for lowland irrigated rice in Colombia, and plans to conduct research on rice in sub-Saharan Africa. Results of the TPE project are publicly available in the form of dynamic maps and graphs at <http://www.ccafs-tpe.org>.

Keywords: Climate change adaptation; breeding; crop modelling; environmental characterisation

<https://ccafs.cgiar.org/publications/environmental-characterisation-guide-breeding-decisions-changing-climate#.Vqfb3VIg5n8>

Improving the sustainability of germplasm conservation, sharing and utilisation through effective networking - a case study

Pathmanathan Umaharan

2015. CARDI Review 16:24-33

Paper presented at the **Improving the policy framework for developing climate change agricultural systems: the role of plant genetic resources** workshop hosted by the Caribbean Agricultural Research and Development Institute (CARDI) and the Technical Centre for Agriculture and Rural Cooperation (CTA) as part of the Caribbean Week of Agriculture (CWA), Antigua and Barbuda. 13-15 October, 2012

Contents Introduction; Case study: *THEOBROMA CACAO* L.; International Cocoa Genebank, Trinidad

<http://www.cardi.org/wp-content/uploads/downloads/2016/01/CARDI-Review-Issue-16-December-2015.pdf>

THEMATIC AREAS: BIOTECHNOLOGY

FAO international symposium "The Role of Agricultural Biotechnologies in Sustainable Food Systems and Nutrition" from 15-17 February 2016, Rome

The focus is on agricultural biotechnologies that are currently available and ready to use by smallholder producers, including low-tech approaches involving artificial insemination, fermentation techniques, biofertilizers etc. up to high-tech approaches involving advanced DNA-based methodologies. While the symposium encompasses genetically modified organisms (GMOs), they are not its main focus.

- Powerpoints of presentations: <http://www.fao.org/3/a-bc787e.pdf>
<http://www.fao.org/about/meetings/agribiotechs-symposium/en/>

THEMATIC AREAS: SOIL AND WATER MANAGEMENT

Status of the World's Soil Resources Main Report

FAO and ITPS

2015. Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils, Rome, Italy

The SWSR is a reference document on the status of global soil resources that provides regional assessments of soil change. The information is based on peer-reviewed scientific literature, complemented with expert knowledge and project outputs. It provides a description and a ranking of ten major soil threats that endanger ecosystem functions, goods and services globally and in each region separately. Additionally, it describes direct and indirect pressures on soils and ways and means to combat soil degradation. The report contains a Synthesis report for policy makers that summarizes its findings, conclusions and recommendations.

<http://www.fao.org/3/a-i5199e.pdf>

- **Status of the World's Soil Resources: Technical Summary**
FAO and ITPS.

2015. Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils, Rome, Italy

This document presents a summary of the first *Status of the World's Soil Resources* report, the goal of which is to make clear the essential connections between human well-being and the soil. The report provides a benchmark against which our collective progress to conserve this essential resource can be measured. The report synthesizes the work of some 200 soil scientists from 60 countries. It provides a global perspective on the current state of the soil, its role in providing ecosystem services, and the threats to its continued contribution to these services. The specific threats considered in the report are soil erosion, compaction, acidification, contamination, sealing, salinization, waterlogging, nutrient imbalance (e.g. both nutrient deficiency and nutrient excess), and losses of soil organic carbon (SOC) and of biodiversity.

<http://www.fao.org/3/a-i5126e.pdf>

- **Status of the World's Soil Resources – Brochure.** FAO 2015 <http://www.fao.org/3/a-i5228e.pdf>

Climate change and agricultural water management in developing countries

Hoanh C, Smakhtin V, Johnston R, (Eds.)

2015. CABI Climate Change Series. Wallingford, United Kingdom: CABI

The book provides an analysis of impacts of climate change on water for agriculture, and the adaptation strategies in water management to deal with these impacts. Chapters include an assessment at global level, with details on impacts in various countries. Adaptation measures including groundwater management, water storage, small and large scale irrigation to support agriculture and aquaculture are presented. Agricultural implications of sea level rise, as a subsequent impact of climate change, are also examined.

<http://www.cabi.org/bookshop/book/9781780643663>

Forest cover change and soil erosion in Toledo's Rio Grande Watershed

S. D. Chicas, K. Omine

2015

Paper presented at The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XL-7/W3, 2015 36th International Symposium on Remote Sensing of Environment, 11–15 May 2015, Berlin, Germany

Abstract

Toledo, the southernmost district, is the hub of Belize's Mayan population, descendants of the ancient Mayan civilization. The Toledo District is primarily inhabited by Kekchi and Mopan Mayans whose subsistence needs are met by the Milpa slash-and-burn agricultural system and the extraction of forest resources. The poverty assessment in the country indicates that Toledo is the district with the highest percentage of household an individual indigence of 37.5 % and 49.7 % respectively. Forest cover change in the area can be attributed to rapid population growth among the Maya, together with increase in immigration from neighboring countries, logging, oil exploration and improvement and construction of roads. The forest cover change analysis show that from 2001 to 2011 there was a decrease of Lowland broad-leaved wet forest of 7.53 km sq, Shrubland of 4.66 km sq, and Wetland of 0.08 km sq. Forest cover change has resulted in soil erosion which is causing the deterioration of soils. The land cover types that are contributing the most to total erosion in the Rio Grande watershed are no-forest, lowland broad-leaved wet forest and submontane broad-leaved wet forest. In this study the Revised Universal Soil Loss Equation (RUSLE) was employed in a GIS platform to quantify and assess forest cover change and soil erosion. Soil erosion vulnerability maps in Toledo's Rio Grande watershed were also created. This study provides scientifically sound information in order to understand and respond effectively to the impacts of soil erosion in the study site.

Keywords: Maya, Land Use Change, Forest, Erosion, RUSLE, GIS

<http://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-7-W3/353/2015/isprsarchives-XL-7-W3-353-2015.pdf>

Identifying erosion hotspots and assessing communities' perspectives on the drivers, underlying causes and impacts of soil erosion in Toledo's Rio Grande Watershed: Belize

Santos D. Chicas, Kiyoshi Omine, Justin B. Ford

2016. *Applied Geography* 68:57-67

Abstract

Erosion in the Rio Grande watershed of Belize, Central America results in widespread ecological impacts and significant economic costs. In this study, quantitative soil loss analysis and qualitative social surveys were integrated to identify erosion vulnerable areas or hotspots, and to analyze varying perspectives between communities near and far from erosion hotspots regarding the causes of erosion. The results of the quantitative analysis suggest that erosion hotspots are located in the upper-mid reaches of the watershed near the communities of Crique Jute, Naluum Ca, San Pedro Columbia and San Miguel. The Mann–Whitney U test identified significant difference in the ranking of erosion drivers (cattle ranching, logging, and clearing of slopes) between communities. Communities far from erosion hotspots (FEH) ranked cattle ranching and logging higher than communities near erosion hotspots as the main drivers of soil erosion (NEH and FEH, mean = 79.02, 105.92, (U) = 3055, $p < 0.001$ and mean = 84.9, 100.90, (U) = 3560.5 $p < 0.05$) respectively. On the other hand, communities near erosion hotspots (NEH) ranked clearing and planting on slopes higher than communities far from erosion hotspots as the main driver of soil erosion (NEH and FEH, mean = 107.03, 81.86, (U) = 3136.5, $p < 0.001$). The logistic regression model depicted that ethnicity, distance, gender, and employment were significant in explaining the data variability on the perceived implementation of erosion prevention techniques in the watershed (2LL = 208.585, $X^2 = 49$, df = 8, $p < .001$). This research provides significant information on the drivers, underlying causes and erosion vulnerable areas that will aid stakeholders to garner community support, develop and implement sustainable soil management practices. Moreover, the study highlights the need to implement cost-effective soil erosion prevention programs and to assess the loss of soil nutrients and agriculture productivity in the study site.

Keywords: RUSLE; Maya; Erosion; Watershed; Agriculture; Management

Managing waterlogging and soil salinity with a permanent raised bed and furrow system in coastal lowlands of humid tropics

A. Velmurugan, T.P. Swarnam, S.K. Ambast, Navneet Kumar

2016. *Agricultural Water Management* 168:56-67

Abstract

Soil and water salinity, waterlogging, and a lack of good quality irrigation water are the principal constraints affecting the productivity of the coastal areas in the humid tropical region. The present study was conducted at four sites in the coastal lowlands of the Andaman Islands to assess the impact of a permanent raised bed and furrow (RBF) system on waterlogging and salinity. The RBF system improved the drainage of the raised beds, maintained a favorable soil moisture content, harvested rain water to a maximum depth of 120 cm, and prevented the entry of tidal and runoff water into the furrow. Between the years 2009 and 2014, the soil salinity in the raised beds was reduced by 85% from the initial level of 10.9 dS m⁻¹ during three distinct phases namely, the lag phase, the leaching phase and the equilibrium phase which were recognized based on their rate of reduction of salinity. Similarly significant reductions were observed in seasonal variations and in the vertical salinity gradient. Interannual variations in salinity closely followed the rainfall pattern, particularly during the dry period. The data showed significant reduction in the concentration of soluble ions (e.g., Na⁺, Ca²⁺ + Mg²⁺, Cl⁻ and SO₄²⁻). In addition, over the years the salinity and sodium toxicity in the furrow water decreased and became suitable for irrigation and fish culture. In contrast, the coastal lowlands adjoining the RBF system experienced waterlogging (5–81 cm) and high levels of salinity (3.0–9.1 dS m⁻¹), which closely corresponded with the rainfall patterns. Multiple linear regression models were developed to predict the surface soil salinity of the RBF system separately for the monsoon ($r^2 = 0.56$) and dry seasons ($r^2 = 0.63$). Waterlogging and salinity peaks in different seasons require a different management strategy, but the RBF system was effective in addressing this challenge together. The findings from this study would equally apply to other humid tropical coastal regions, provided that considerations are given to the inherent soil properties and the local hydrology.

Keywords: Coastal salinity; Waterlogging; Land shaping; Salt dynamics; Andaman Islands

<http://www.sciencedirect.com/science/article/pii/S0378377416300348?np=y#cor0005>

Soil water management systems for a drier Caribbean

Nazeer Ahmad

2015. CARDI Review 16:34-53

Paper presented at the **Climate Change Adaptation in Caribbean Agriculture** workshop hosted by the Caribbean Agricultural Research and Development Institute (CARDI) and the Technical Centre for Agriculture and Rural Cooperation (CTA) as part of the 10th Caribbean Week of Agriculture (CWA), Roseau, Dominica, 9- 15 October 2011.

Contents: Climate change with particular reference to the Caribbean; Effect of expected climate change on the soils and agricultural environment; Impact on water resources; Water availability and use in a drier Caribbean; Projections of future conditions affecting water use; Water availability and management; Water harvesting; Caribbean experience in using and maintaining irrigation water quality; Agronomic considerations in soil and water conservation and use; Policy for and management of water resources; Soil water management systems; Conclusions
<http://www.cardi.org/wp-content/uploads/downloads/2016/01/CARDI-Review-Issue-16-December-2015.pdf>

THEMATIC AREAS: NATURAL RESOURCE MANAGEMENT

CLIMATE CHANGE:

The current state of agro-meteorology prediction tools and information systems that can respond to the needs of the farming community

Adrian Trotman

2015. CARDI Review 16:2-23

An update of the paper presented at the **Improving the Policy Framework for Developing Climate Change Resilient Agriculture Systems in the Caribbean: Combating the threat of pest outbreaks under climate variability and change** workshop hosted by the Caribbean Agricultural Research and Development Institute (CARDI) and the Technical Centre for Agriculture and Rural Cooperation (CTA) as part of *the* Caribbean Week of Agriculture (CWA) 2013, October 6-7, 2013, Guyana

Introduction

This Report draws on the experiences of the Caribbean Agrometeorological Initiative (CAMI) as well as the experiences of other agrometeorological providers and users from across the globe, particularly that of a World Meteorological Organization (WMO) Expert Team in Strengthening Operational Agrometeorological Services, that is preparing a Report for that global body that will pay attention to successes across the globe, while placing some emphasis on what may be needed to close many gaps and constraints to progress.

<http://www.cardi.org/wp-content/uploads/downloads/2016/01/CARDI-Review-Issue-16-December-2015.pdf>

OTHER AGRICULTURAL ASPECTS

AGRICULTURAL DEVELOPMENT:

BSTA Conference 2015 | The Barbados Society of Technologists in Agriculture proceedings

<http://www.bstabarbados.org/articles/category/bsta-conference-2015/>

Enabling the Business of Agriculture 2016: comparing regulatory good practices

World Bank Group.

2016. Published: January 28, 2016

Building on the progress report published in November 2014, **Enabling the Business of Agriculture 2016: Comparing regulatory good practices** provides a tool for policymakers to identify and analyze legal barriers for the business of agriculture and to quantify transaction costs of dealing with government regulations. The report presents the main results for 40 countries, for the first time using indicator scores to showcase good practices among countries in different stages of agricultural development. It also presents interesting results on the relationship between efficiency and quality of regulations, discriminatory practices in the laws and whether regulatory information is accessible. Regional, income-group and country-specific trends and data observations are presented on six topics: seed, fertilizer, machinery, finance, markets and transport. The report also discusses the continued development of several topics which will be added in future reports: information and communication technology, land, water, livestock, gender and environmental sustainability. Data are current as of 31 March, 2015.

<http://eba.worldbank.org/reports>

<http://eba.worldbank.org/~media/WBG/AgriBusiness/Documents/Reports/2016/EBA16-Full-Report.pdf>

- **Enabling the Business of Agriculture webpage** <http://eba.worldbank.org/>

FAO Regional Conference for Latin America and Caribbean (LARC) 34th Session, Mexico City, Mexico, 29 February - 3 March 2016

List of Documents <http://www.fao.org/about/meetings/regional-conferences/larc34/documents/en/>

- Challenges and Perspectives for Food and Nutritional Security in Latin America and the Caribbean: from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs)
- Challenges for Transforming the Rural Sector in Latin America and the Caribbean: Rural Territorial Development, Family Farming, Social and Economic Inclusion and Innovation
- Challenges for Sustainable Use of Natural Resources, Risk Management and Climate Change Adaptation in Latin America and the Caribbean in the New Framework of Sustainable Development Goals
- Results and Priorities for FAO in the Latin America and Caribbean Region and Regional Strategic Review

- **Transformation of the rural sector in Latin America and the Caribbean (LAC)** by Deep Ford, FAO Coordinator Caribbean Region. Presented at FAO Regional Conference for Latin America and Caribbean (LARC) 34th Session, Mexico City, Mexico, 29 February - 3 March 2016
<http://www.slideshare.net/FAOoftheUN/transformation-of-the-rural-sector-in-latin-america-and-the-caribbean-lac>

FAO Regional Conference for Latin America and the Caribbean (LARC) webpage

<http://www.fao.org/about/meetings/larc34/en/>

Guyana. National Budget Speech 2016 presented by the Honourable Winston Jordan, Minister of Finance, Republic of Guyana, 29 January 2016

http://finance.gov.gy/images/uploads/documents/budget_2016_speech_website_version_3.pdf

Chapter 3 Developments in the Domestic Economy in 2015

B. Sectoral Performance, pp. 7-8 a. Agriculture, Forestry and Fishing

Chapter 4: Agenda 2016, pp. 26- 28 Production Transformation and Agricultural Diversification

Chapter 5: Targets 2016, pp. 62 A. Real Gross Domestic Product : a. Agriculture

Macroeconomics, agriculture, and food security: A guide to policy analysis in developing countries.

Díaz-Bonilla, Eugenio

2015. Washington, D.C.: International Food Policy Research Institute (IFPRI)

This book provides an introduction to policy analysis related to monetary, financial, fiscal, exchange rate, and trade policies as they affect, and are affected by, agricultural and food security issues. Its approach, based on a simplified macroeconomic consistency framework, uses empirical cases to illustrate the problems involved.

<http://dx.doi.org/10.2499/9780896298590>

State of food insecurity in the CARICOM Caribbean meeting the 2015 hunger targets: taking stock of uneven progress.

2015. Sub-regional Office for the Caribbean, Food and Agriculture Organization of the United Nations, Bridgetown, Barbados

<http://www.fao.org/3/a-i5131e.pdf>

Key findings:

1. CARICOM countries have made progress in reducing undernourishment and towards meeting the global hunger targets
2. Haiti is a special case in CARICOM and its large population and high levels of underdevelopment skews average results when presented as part of CARICOM regional indicators.
3. Food energy availability in all CARICOM countries, except Haiti, exceeds the recommended population food energy guidelines
4. Food imports, as opposed to national food production, are by far the largest source of food for CARICOM populations.
5. Food access is a key food and nutrition security problem in the Caribbean. It is linked to poverty, which has been increasing in several countries in the region. Seven of the CARICOM countries have more than 30 percent of their population falling below the national poverty levels.
6. Food utilization has been characterized by poor food choices.
7. Instability and vulnerability caused by natural and economic shocks constantly undermine efforts to advance food and nutrition security in the region.
8. Global mandates, international and regional cooperation agreements and partnerships have a role to play in reducing food security in the region
9. Improved governance and public policy are critical to achieving improved food and nutrition security
10. Inclusive and pro-poor economic growth is needed to address poverty and high levels of unemployment in CARICOM countries.

Tourism demand study a project of the Ministry of Tourism & Entertainment.

2015. Oct 2015 Jamaica: Ministry of Tourism & Entertainment

<http://mot.gov.jm/sites/default/files/Tourism%20Demand%20Study.pdf>

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AGRICULTURAL RESEARCH FOR DEVELOPMENT:

Ten principles for effective AR4D programs

Vermeulen S, Campbell B.

2015. CCAFS Info Note. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Effective agricultural research for development (AR4D) faces many challenges that are exacerbated under climate change. Effective behaviours by AR4D programs may drive the likelihood and quality of positive outcomes when working with partners. Explicit principles about effective behaviours can improve AR4D theories of change and enhance achievement of outcomes. Internal learning over four years of CCAFS implementation suggests ten principles to guide the program and explore which behaviours are most effective.

<https://ccafs.cgiar.org/publications/ten-principles-effective-ar4d-programs#.VxaF3nog5n8>