INNOVACIONES PARA UNA PRODUCCIÓN SUSTENTABLE DE CAÑA DE AZÚCAR

Seminario Virtual "Innovación y Valor Agregado en el Sector Azucarero del MERCOSUR"

Dr. Mario Melgar, CENGICAÑA
www.cengicana.org
27 de mayo de 2021

Gujarat. expectations maximized.

Vibrant GUJARAT 2015
11-13 Jan
The Global Business Hub | 7th Global Summit

50 Disruptive Technologies

In Concurrence With

GLOBAL TRADE SHOW-15

Jointly Organized by

iNDEXTb

Tecnologías disruptivas

Innovaciones que generan la desaparición de productos o servicios que hasta entonces eran utilizados por la sociedad.

Ejemplos: Computadora personal, telefonía móvil, fotografía digital, dispositivos de memoria.

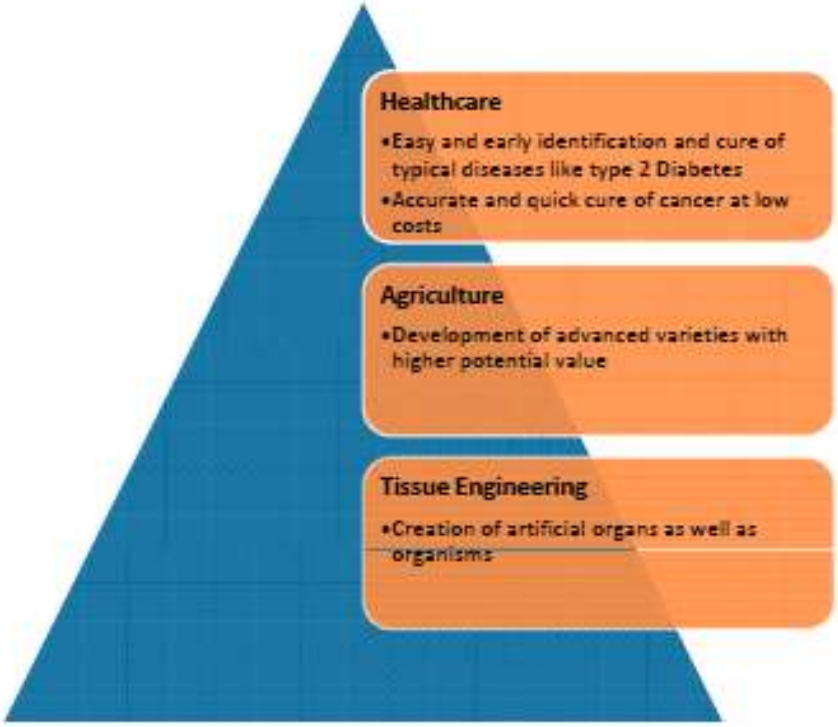
Disruptivo: Aquello que produce una ruptura brusca.

Que genera un cambio muy importante o determinante.

#8: NEXT GENERATION GENOMICS

CONCEPT: DNA sequencing technologies, big data analytics and technologies with ability to **modify organisms** altogether are known as **next generation genomics;** these could power rapid acceleration in the field of **biology** as well as **health care.** This technology allows **manipulation of genes** for **innovative disease treatments** and new types of **genetically engineered products.**

INDUSTRY APPLICATION



CURRENT STAGE:

- Next-generation genomics could have a potential economic impact of **USD 700 Billion to USD 1.6 Trillion per year by 2025**
- Advanced genomics may offer tremendous potential to develop **personalized treatments for cardiovascular diseases**
- Next generation sequencing represents newer and cheaper methods for sequencing or decoding DNA
- Technical challenges include **sequencing samples of low quality and/or quantity, reliable identification of structural and copy number variation and assessment of intratumour heterogeneity**

Source: McKinsey & Company, British Journal of Cancer

Source: Peter Haasnoot, 2014. The Speed of Technological Change, Sam Houd.

#20: PRECISION AGRICULTURE

CONCEPT: An agriculture management and optimization technique, which makes use of sensors, Global Positioning System (GPS), big data and predictive analytics to collect real – time data, and processes it to understand spatial and temporal variations across a single field or multiple fields, or even variations in humidity, soil quality and crop maturity, thus giving a holistic overview of the impacts of current agriculture methods being used, and to make relevant modifications in the same, as per the data collected. Pictures of the fields are also taken using satellite imagery or Unmanned Aerial Vehicles (UAV), which combined with GPS and sensor – recorded data, precisely pinpoint the current crop status of any location in the field.

INDUSTRY APPLICATION

Agriculture

- Increasing populations and demands for food are making it necessary to optimize and improve current crop production techniques, to ensure constant high yields; precision agriculture can help in forecasting crop outputs and thus making relevant modifications to boost these outputs

Current Stage:

- Precision agriculture technologies currently require expensive and robust IT infrastructure and monitoring resources
- Venture Capital funds focused on agriculture technology are being established to promote precision agriculture
- Cleantech startups related to food and agriculture reportedly experienced the biggest growth during the Q4 of 2013
- Weather forecasting and modeling, cloud computing, data analytics and data management systems related to food and agriculture will also witness growth in conjunction with precision agriculture

Source: Forbes, IBM, Cleantech Group, Michigan State University

#13: AUTONOMOUS AND NEAR AUTONOMOUS VEHICLES

CONCEPT: This includes vehicles which can be **manipulated with little or no human intervention.** This technology includes **on-board systems** which continuously **transmit information** about vehicle status and location and this information **allows real time monitoring** as well as **maneuvering** if needed by **remote operator.**

INDUSTRY APPLICATION

- **Logistics** • Long distance transport of goods
  - •Deliveries of products from retail outlets to users using drones
- **Defense** • Unmanned Vehicles
  - •Automated Aircrafts
- **Automotive** • Automatically driven vehicles
- **Aerospace** • Automated Space crafts

CURRENT STAGE:

- 01The potential economic impact of autonomous cars and trucks could be USD 200 Billion to USD 1.9 Trillion per year by 2025
- Currently, we have autonomous vehicles, although still in experimental and development stage, the technology is entering consumer market with systems such as improved cruise control, automated parking, low speed autonomous driving, which in turn could lead to a full autonomy in driving
- Benefits of this technology include reduced accidents, traffic reduction, higher safe speeds, cost reduction, time savings etc

Source: McKinsey & Company, Commonwealth Scientific and Industrial Research Organization

Roaches, Mosquitoes and Birds: The Coming Micro-Drone Revolution

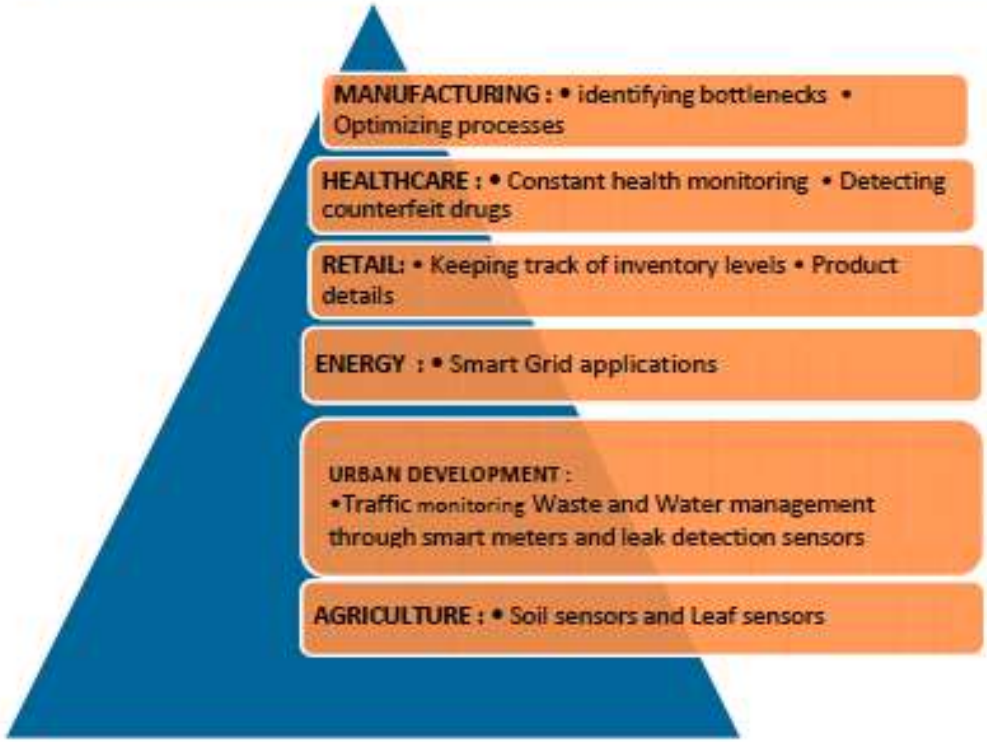
Posted: 04/17/2013 12:48 pm

Fuente: Van Geest, Yuri. 2013. Singularity-Exponential. Disruptive Emerging Technologies. www.Slideshare.

#2: THE INTERNET OF THINGS

CONCEPT: The Internet of Things (IoT) is a concept of **embedding every object or living being with sensors or actuators** and **generating their virtual representation on the internet.** Identifying all objects in this unique manner can enable us to effectively track, monitor and even control them.

INDUSTRY APPLICATION



CURRENT STAGE:

- Has the potential to create economic impact of USD 2.7 Trillion to USD 6.2 Trillion annually by 2025
- Currently around 8.7 Billion devices are connected to internet and the number is expected to touch 40 Billion by 2020
- The major challenge is to make use of the flood of the data that is provided by the sensors

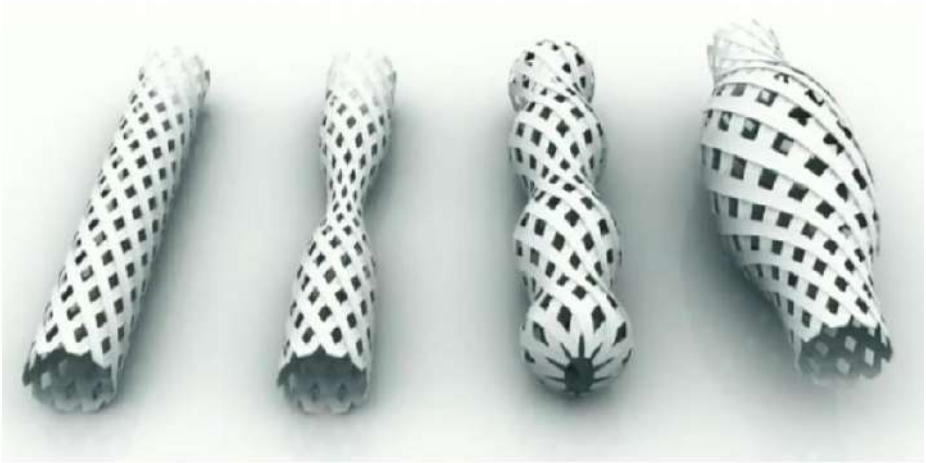
Source: McKinsey & Company, Cisco Systems, Cisco Internet Business Solutions Group

Source: Peter Haasnoot, 2014. The Speed of Technological Change, Sam Houd.

These 3D Printed Masks Are a Mugger's Dream Come True

For $4000, a Japanese company called Real-f will make a photorealistic mask of your face they call a three-dimensional photo form. Sure, you can tell it's fake if you look close enough. But what if you weren't looking so closely?

4D Printing: Adaptive Infrastructure



Fuente: Van Geest, Yuri. 2013. Singularity-Exponential. Disruptive Emerging Technologies. www.Slideshare.

#39: VERTICAL FARMING

CONCEPT: Cultivating crops on segments **vertically stacked** one over the other, mostly in indoor facilities, with artificial, user defined control over the light, water and nutrients needed by the plants to grow. Since vertical farming has stacks of crops growing upwards, this **reduces the actual land surface area** being used for agriculture; hence it is mostly associated with **urban farming**. Vertical farming uses **LED** light sources and **hydroponics** extensively for the development of the plants.

INDUSTRY APPLICATION

Agriculture

- With a burgeoning population, ever increasing demand for food, and rising costs of land, vertical farming can serve as a solution to increase crop production, while reducing the horizontal usage of land
- Growing crops indoors in controlled conditions can help us to grow crops all round the year, irrespective of weather conditions; and even reduce the usage of pesticides and insecticides
- With proper technology to supply light, water and nutrients to plants, there could be no physical limit to the number of stories we can build on top of one another, to cultivate crops

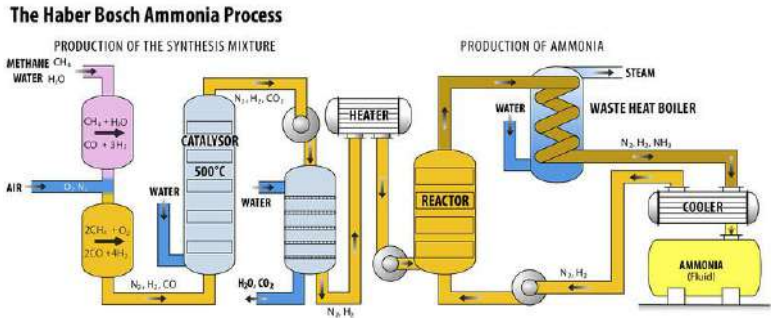
CURRENT STAGE:

- Commercial vertical farming has already started in places like **Singapore**
- A vertical farm is **Pennsylvania, USA** is set to be the world's largest farm using such technology
- Lighting systems for indoor farms, methods for supplying nutrients to plants; and ways of soil and water management in high storied vertical farms are current topics of research vis-à-vis vertical farming

Source: verticalfarm.com, theguardian.com, howstuffworks.com, newscientist.com

Tecnologías disruptivas en caña de azúcar

Evolución del proceso de fertilizantes nitrogenados.



1910 Carl Bosh, industrializa el proceso de Haber.

1930 Se genera los fertilizantes nitrogenados granulados, que revolucionan el mercado

1965 se crean los fertilizantes en suspensión (líquidos).

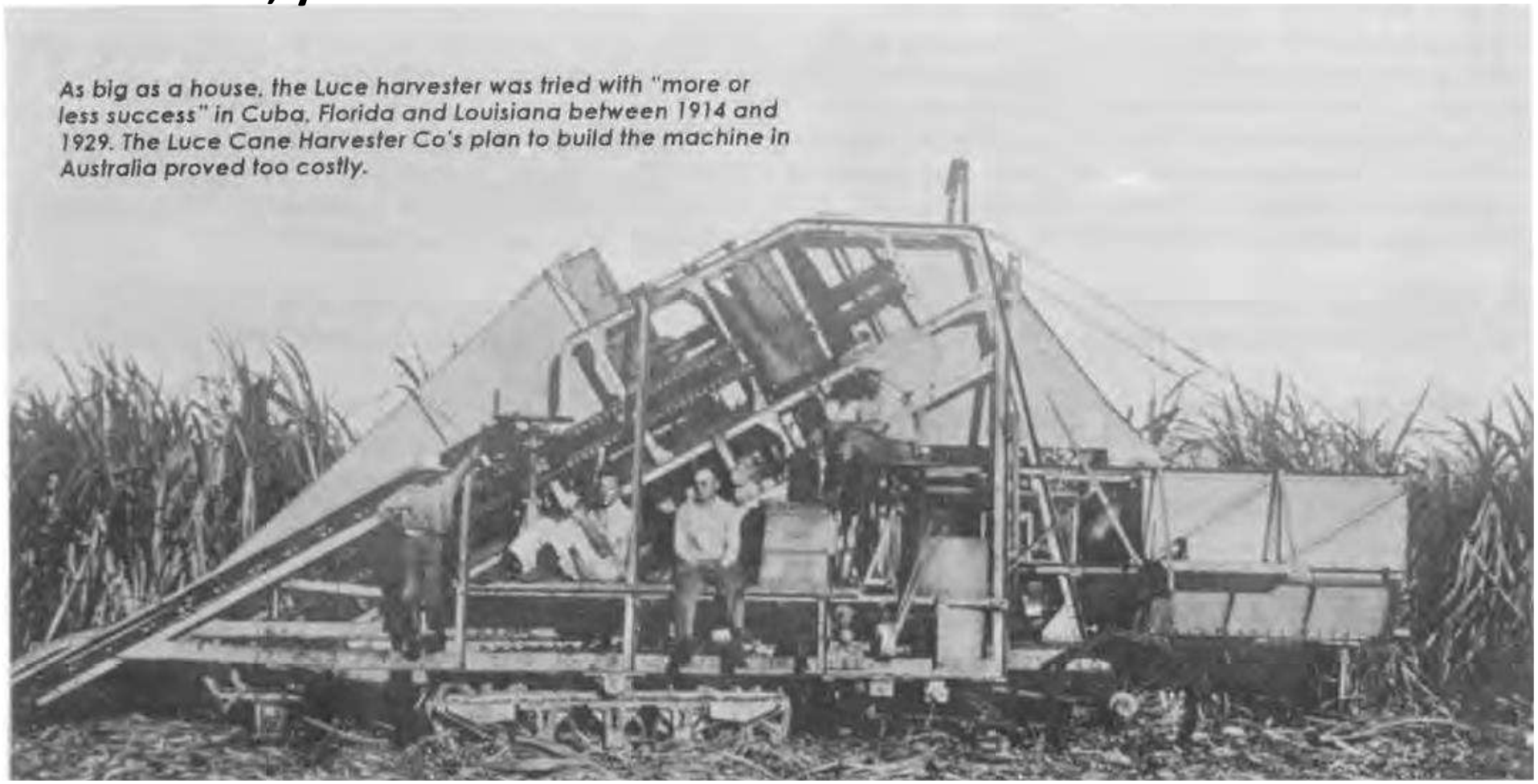
1894 Fritz Haber patenta el proceso de síntesis de amoniaco, con aplicación como fertilizante agrícola.

1931 se otorga premio Nobel de química, por el proceso Haber-Bosh

Actualidad (2000) se desarrolla la fertilización nitrogenada encapsulada de liberación lenta.
100 millones TM

- **Australia inicia con prototipos de cosechadoras entre 1880-1900.**

- **Entre 1914-1929 la Cosechadora “Luce” es el primer intento de cosechadora con resultados no satisfactorios en Cuba, Florida y Louisiana, y un fracaso financiero en Australia.**



Cosechadora comercial actual

Cruzas interespecíficas

Saccharum officinarum

Alta sacarosa
Tallos gruesos
Corteza suave

Innovación disruptiva, realizada por Fitomejoradores Holandeses en la Isla de Java, Indonesia en 1921 (Walker , 1893 - Jeswiet, 1921 con éxito)

X

Saccharum spontaneum

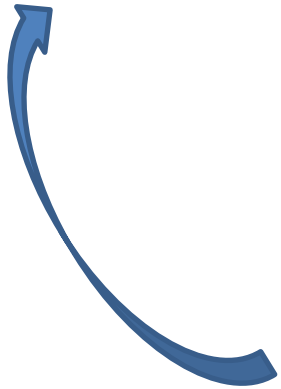
Baja sacarosa
Tallo delgado y fibroso
Macollamiento
Sistema radicular
Resistencia a enfermedades

Fuente: CENGICAÑA

DESARROLLO DE LA VARIEDADES MODERNAS

(alrededor de 1,921)

S. Officinarum **x** ***S. spontaneum***



Dr. Walker
1893

Híbridos Interespecíficos

POJ2878

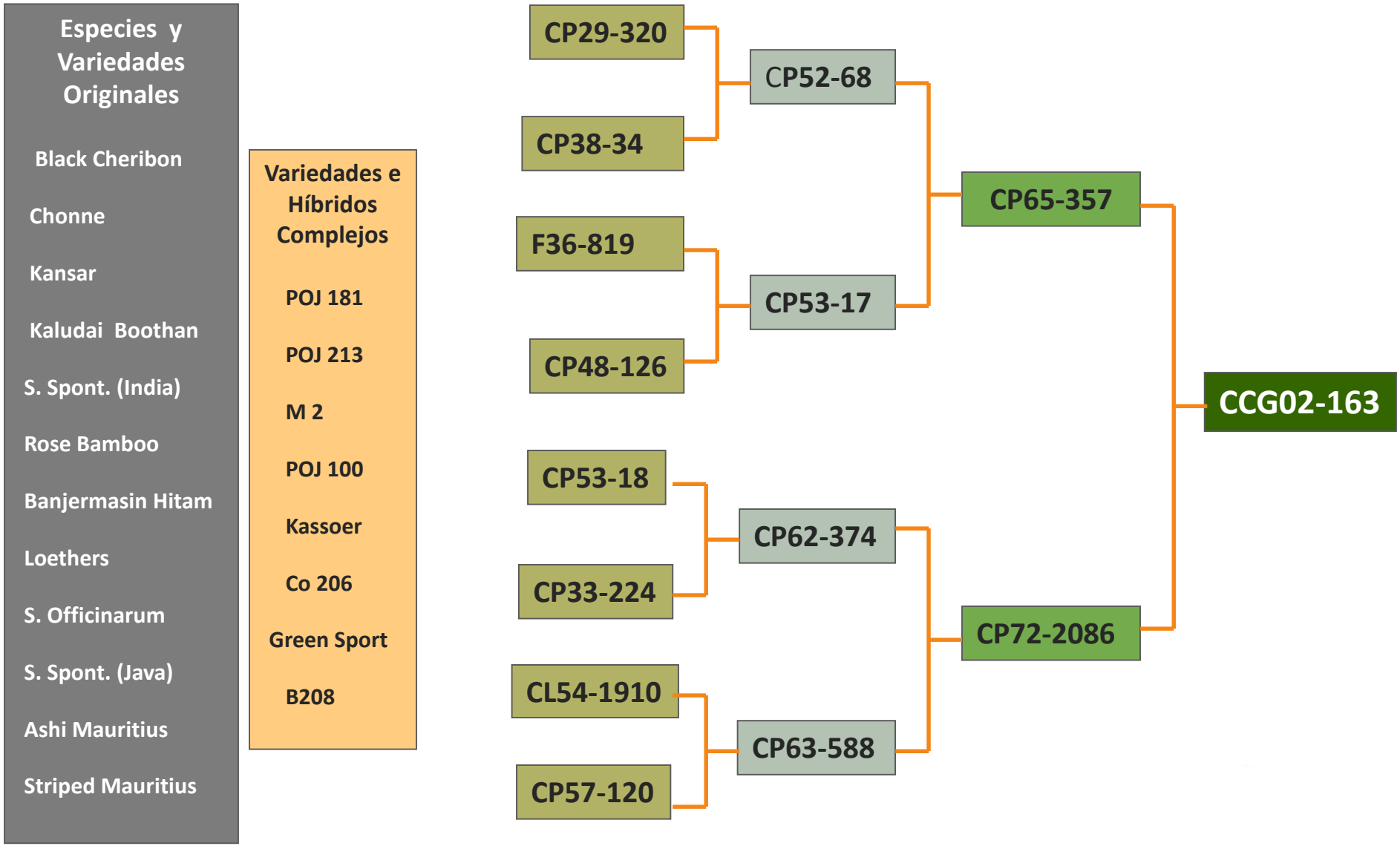
"Caña Maravillosa"

Dr Jacob Jeswiet
1921

Mejoradores holandeses en Java

Fuente: Jackson, P. A. 2005. Breeding for improved sugar contet in sugarcane

Pedigree de la variedad CG02-163 (CP65-357 x CP72-2086)



Fuente: Quemé J.L. Programa de Variedades CENGICAÑA

Tendencias tecnológicas en caña de azúcar

Área	Actualmente en desarrollo	Mediano plazo
Mejoramiento genético	Mejoramiento tradicional Cruzas insterespecíficas e intergenéricas Caña energética	Biotecnología: Selección asistida por marcadores moleculares Caña transgénica Ingeniería genética Biología sintética
Manejo de limitantes bióticos (Plagas, enfermedades y malezas)	Manejo Integrado de Plagas Diagnóstico de enfermedades Manejo de malezas Estrategias para los cambios en la evolución de plagas, enfermedades y malezas	Biocontrol Biología molecular Caña transgénica Paratransgénesis Diagnóstico molecular de enfermedades
Manejo de los recursos naturales (Ecoeficiencia)	Manejo del suelo Manejo integrado del agua Sistema de información agrometeorológico Cultivos complementarios para biocombustibles Mecanización (siembra, cosecha)	Fertilizantes inteligentes Cosecha de agua Agricultura 4.0 Agricultura 5.0

Evolución de las Tecnologías en la Agricultura

Agricultura 1.0 Antes de 1950	Agricultura 2.0 1950	Agricultura 3.0 1990	Agricultura 4.0 2010	Agricultura 5.0 2025
• Nitrógeno sintético • Mejoramiento genético • Maquinaria agrícola	• Llamada la revolución verde • Mejoramiento genético • Fertilizantes y pesticidas sintéticos • Maquinaria agrícola especializada	• Sistemas de Posicionamiento Global, GPS • Sistemas de Información Geográfica, GIS • Agricultura de Precisión • Agricultura Específica por Sitio • Biotecnología	• Redes de sensores • Sensores en maquinaria • Naves no tripuladas • Procesamiento de imágenes satelitales • Computación en la nube • Análisis de Big Data • Aplicaciones móviles • Tractores autónomos • Redes internas y externas para operaciones agrícolas	• Robótica • Inteligencia artificial • Impresión 3D y 4D • Nanotecnología • Biología sintética • Diseño de alimentos (carne artificial, proteínas) • Agricultura vertical para las "smart city"

Fuente: CEMA. 2017. Digital Farming: what does it really mean? And what is the vision of Europe's farm machinery industry for Digital Farming?. CEMA aisbl - European Agricultural Machinery

SOSTENIBILIDAD DE LA AGROINDUSTRIA AZUCARERA

DIMENSIONES DE SOSTENIBILIDAD EN LA PRODUCCIÓN DE AZÚCAR

Rentabilidad y distribución de los beneficios a lo largo de la cadena de valor.

Derechos de propiedad
Salud protegida, seguridad y derechos humanos para los trabajadores
No trabajo infantil
Seguridad alimentaria
Equidad de género

Uso eficiente del agua
Reducción de la contaminación y desechos
Uso apropiado de la tierra
Mitigación y adaptación al cambio climático

Source: Adapted from FAO. 2014. "Developing Sustainable Food Value Chains: Guiding Principles." Online at http://www.fao.org/3/a-i3953e.pdf (accessed September 25, 2014). Page 24.

Ejemplos de organizaciones que captan y estandarizan información de avances en sostenibilidad y/o certifican

Organización	Nivel	Tema
Organización de Naciones Unidas, ONU	Mundial	Informes de país
COP21	Mundial	Informes de país
Global Reporting Initiative, GRI	Mundial	Reportes de corporaciones o sectores
International Sustainability and Carbon Certification, ISCC	Mundial	Certificaciones a empresas
BONSUCRO	Mundial	Certificaciones a empresas
Smartcane BMP	Australia	Certificaciones a empresas
SUSFARMS	Sudáfrica	Certificaciones a empresas y productores

Buenas Prácticas Agrícolas

Best Management Practices

Buenos ejemplos

Smartcane Best Management Practice

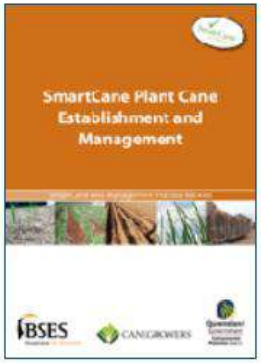
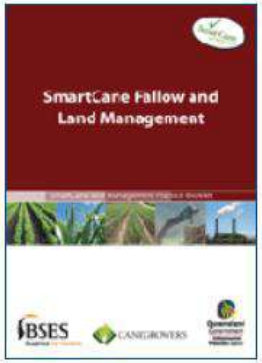
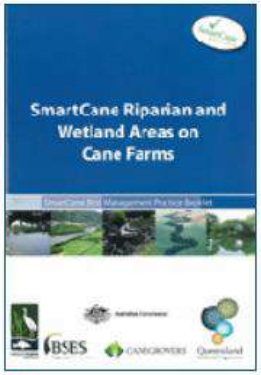
Es un programa desarrollado por la industria azucarera de Queensland, Australia, para apoyar la productividad, rentabilidad y sostenibilidad del cultivo de la caña de azúcar.

El programa Smartcane BMP incluye siete módulos que cubren las más importantes actividades agrícolas:

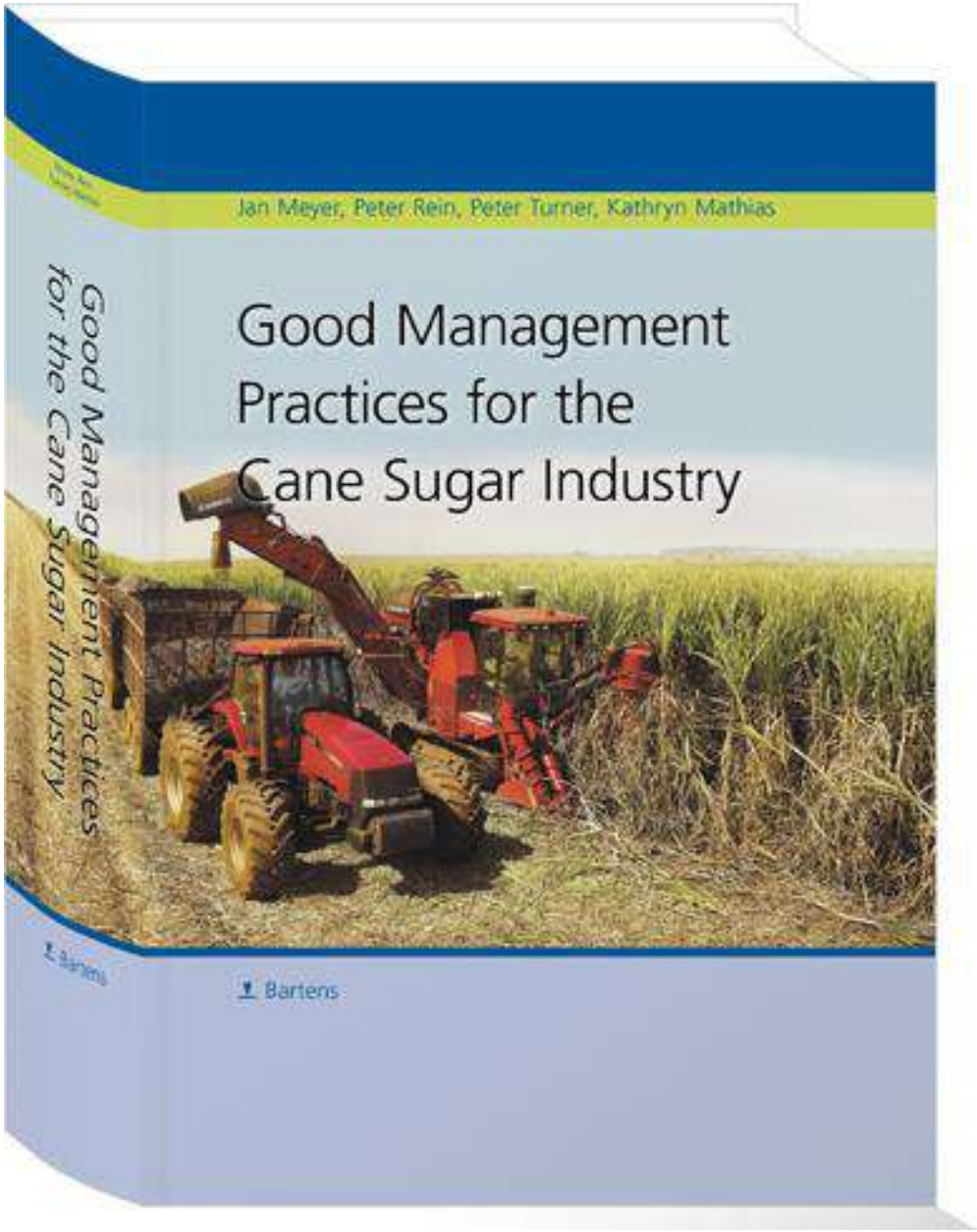
1. Principios de Mejores Prácticas de Manejo
2. Establecimiento de plantaciones
3. Manejo de suelos y fertilización
4. Manejo de enfermedades, plagas y malezas
5. Manejo de riegos y drenajes
6. Manejo de cosecha
7. Manejo de sistemas naturales

Sugarcane BMP Booklets

Best Management Practice for the Sugarcane Industry: Click on the links below to download an electronic version.

PRINCIPLES	BUSINESS	PLANT CANE
		
Principles of BMP (3.2 MB)	Business Management (3.2 MB)	Plant Cane (3.2 MB)
FALLOW & LAND	**RATOON**	**WETLAND**
		
Fallow & Land management (3.2 MB)	Harvesting & Ratoon (3.2 MB)	Riparian & Wetland (3.2 MB)

+ scroll down for a



2013

http://www.ifc.org/wps/wcm/connect/486cf5004953685e8586b519583b6d16/IFC_GMP_ManualCaneSugarIndustry.pdf?MOD=AJPERES

Guía de Buenas Prácticas Agrícolas en Caña de Azúcar

Esta versión fue elaborada con el Comité Técnico Agrícola de CENGICAÑA y los Comités específicos de Variedades, CAÑAMIP, Fertilización, Riegos, Malezas y Madurantes y Cosecha.

Guatemala, abril de 2017

AZÚCAR DE GUATEMALA

DESARROLLO PARA TODOS

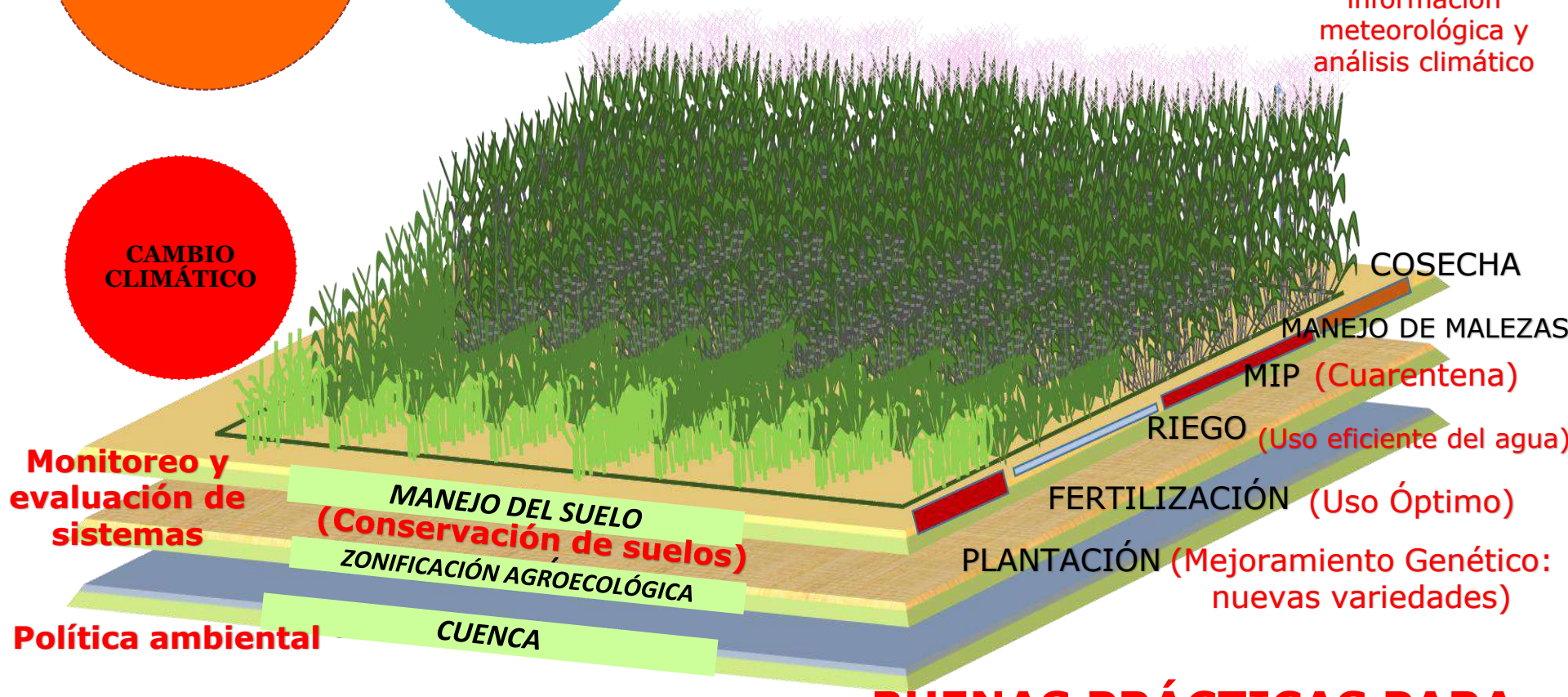
engicaña 25 Años

BUENAS PRÁCTICAS AGRÍCOLAS

COMUNIDADES

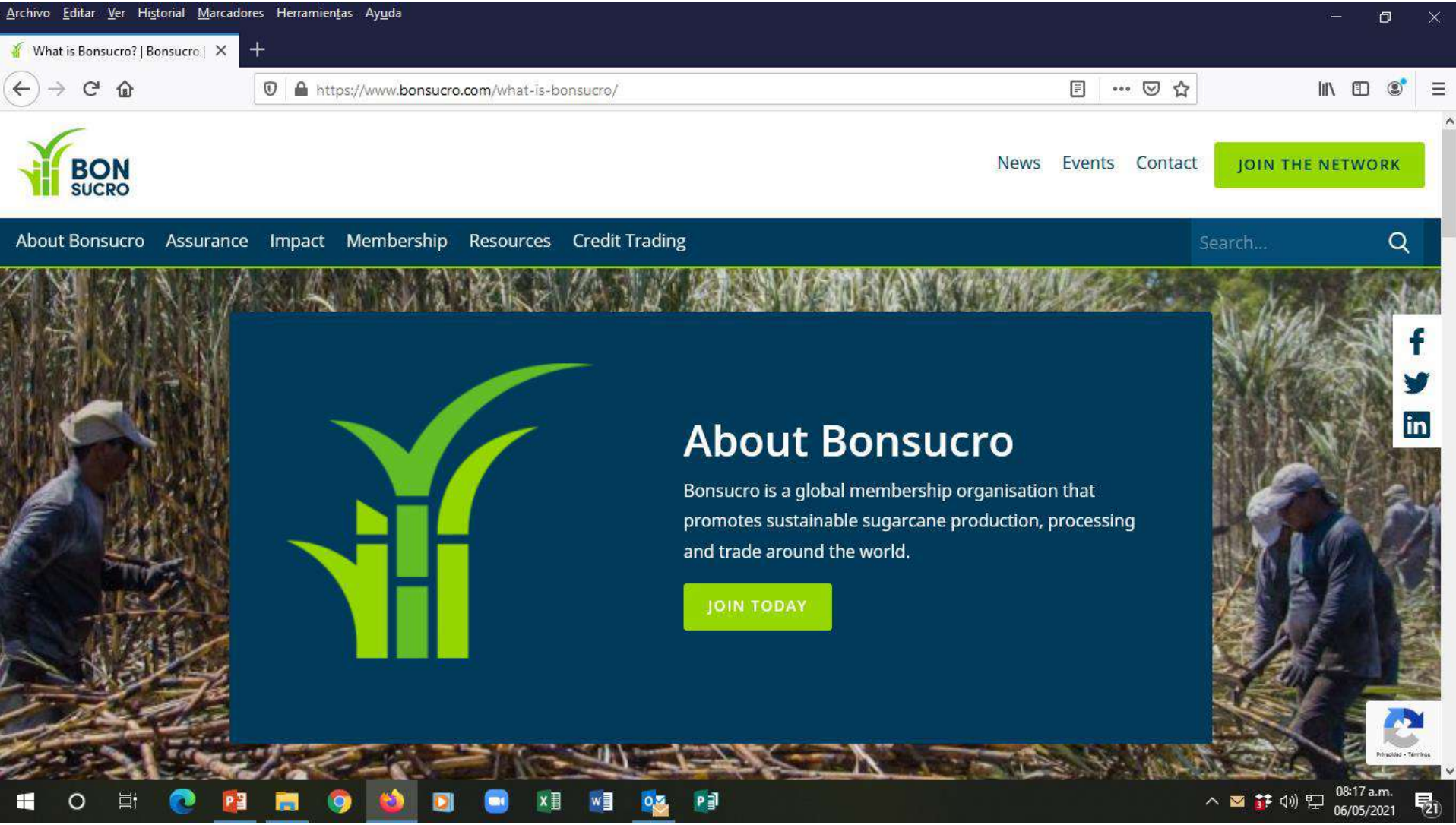
MANEJO AMBIENTAL

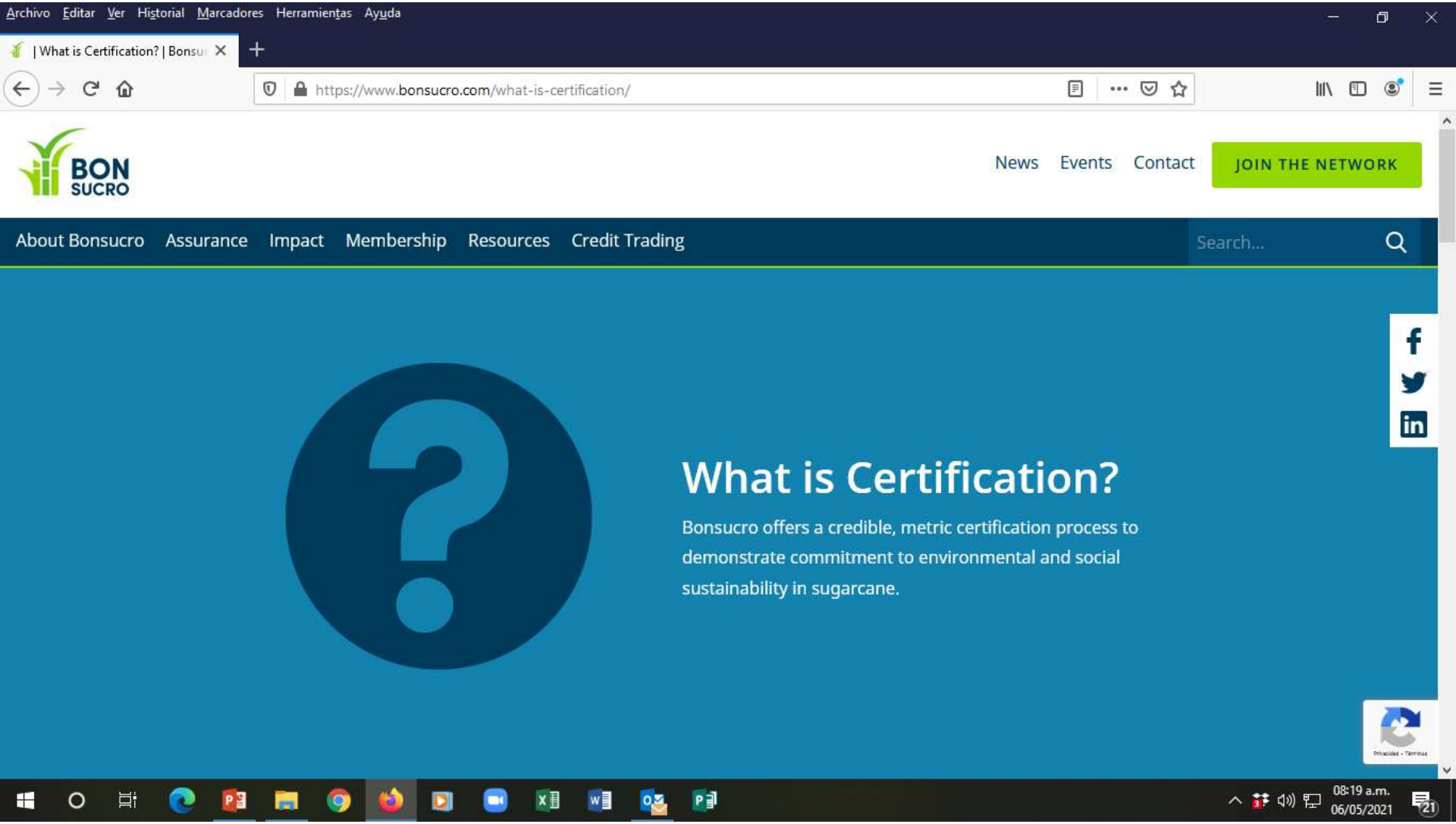
CAMBIO CLIMÁTICO



BUENAS PRÁCTICAS PARA ADAPTACIÓN AL CAMBIO CLIMÁTICO

Fuente: Melgar, M.; Quemé, J. Sugarcane Crop Adaptation to Climate Change in Guatemala. Sugar-Journal. (USA) January 2015 Volume 77. Number 8. pp 11-19.


Archivo Editar Ver Historial Marcadores Herramientas Ayuda
What is Bonsucro? | Bonsucro
https://www.bonsucro.com/what-is-bonsucro/
BON SUCRO
News Events Contact
JOIN THE NETWORK
About Bonsucro Assurance Impact Membership Resources Credit Trading
Search...
About Bonsucro
Bonsucro is a global membership organisation that promotes sustainable sugarcane production, processing and trade around the world.
JOIN TODAY
08:17 a.m.
06/05/2021


Archivo Editar Ver Historial Marcadores Herramientas Ayuda
| What is Certification? | Bonsu
https://www.bonsucro.com/what-is-certification/
BON SUCRO
News Events Contact
JOIN THE NETWORK
About Bonsucro Assurance Impact Membership Resources Credit Trading
Search...
What is Certification?
Bonsucro offers a credible, metric certification process to demonstrate commitment to environmental and social sustainability in sugarcane.
08:19 a.m.
06/05/2021

Why Bonsucro Certified Sugar?

The Standard's principles and indicators address the three pillars of sustainability

Environmental

Water management
- Efficiency of water use

Conservation
- Biodiversity loss & High Conservation Value (HCV) Areas

Environmental Impact Agrochemicals
- Total amount and Banned agrochemicals

Impacts management
- Greenfield expansion

Social

Legal Compliance
Land rights
Labour Rights
- ILO conventions

Salary and contracts
- Minimum wage
- Existence of contract

Health & Safety
- Drinking water
- Safety assessments
- First aid & emergency provision

Vocational training

Economic

Efficiencies & Profitability
- Management tool for improved performance
- Improved technical knowledge
- Investment in R&D
- Use of Bonsucro Calculator
- Recovery of sugar
- Industrial efficiency

BONSUCRO WORLDWIDE

SUMMARY PER REGION/COUNTRY

Brazil

- **70** Certified Mills
- **58** Members
- **2,981,282.41** tonnes (Certified Volume)

The Americas without Brazil

- **18** Certified Mills
- **66** Members
- **664,399.39** tonnes (Certified Volume)

Middle East and Africa

- **1** Certified Mill
- **22** Members

Asia

- **22** Certified Mills
- **88** Members
- **122,662.71** tonnes (Certified Volume)

Pacific

- **12** Certified Mills
- **12** Members
- **376,498.78** tonnes (Certified Volume)

Europe

- **37** Members

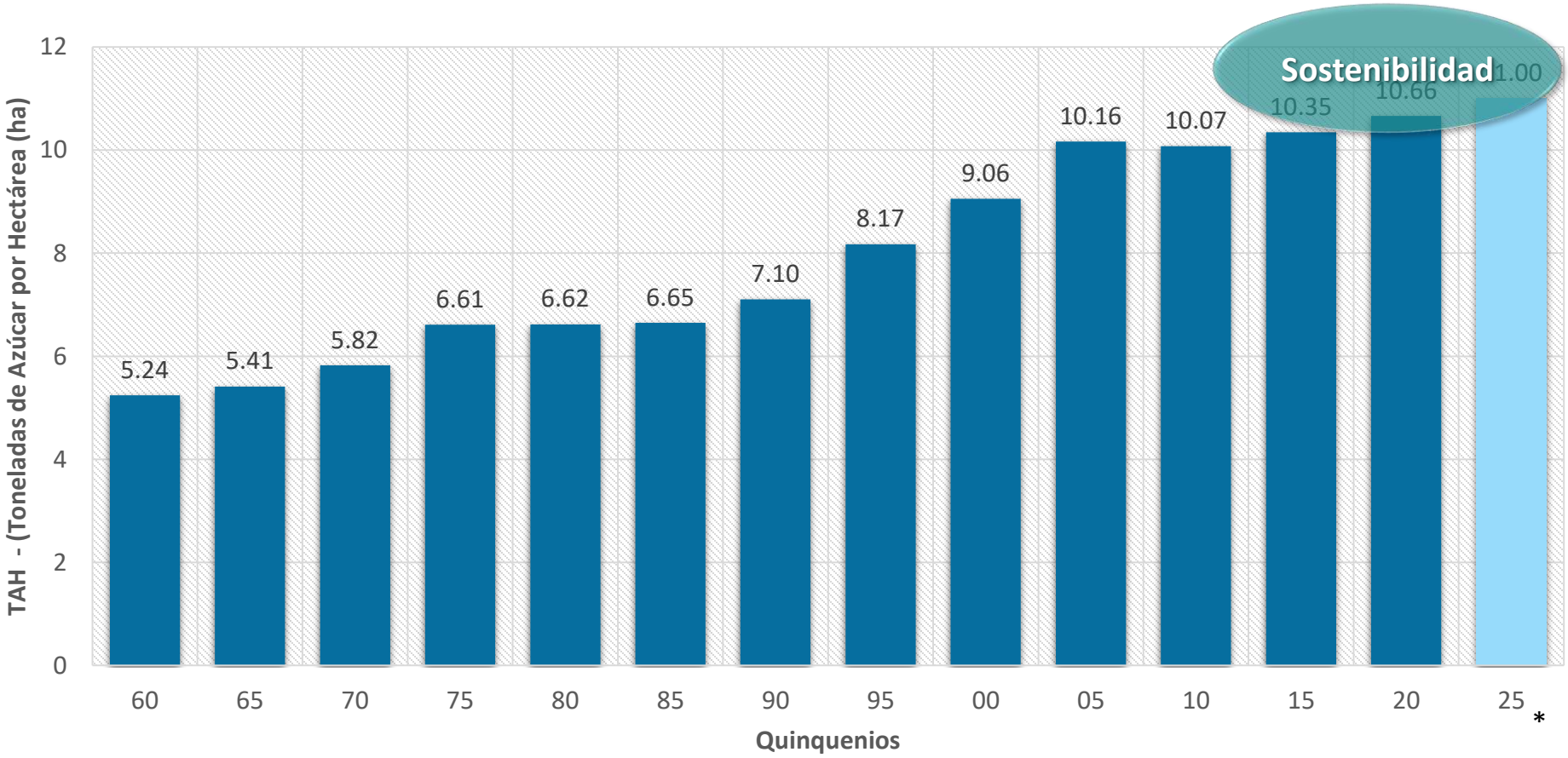
Ingenios de Guatemala que se han certificado BONSUCRO

Ingenios	Certificados
La Unión	Certificado
Magdalena	Certificado
Pantaleón	Certificado
Santa Ana	Certificado
Madre Tierra	En proceso
Trinidad	En proceso

Evolución de la productividad

Evolución de la productividad en la Agroindustria Azucarera de Guatemala y Meta 2025

(Promedio Agroindustria)



Fuente : Boletín Estadístico Series Históricas, año 21, no. 1, CENGICAÑA,

** Dato Proyectado.*

“El desarrollo tecnológico nos permitirá aspirar a la abundancia respetando los límites del planeta con un enfoque de desarrollo sostenible”.

Mario Melgar

“La mejor herencia que podemos dejarle a nuestros hijos es: Amor, Conocimiento y un Planeta en el que puedan vivir”.

Maneka Gandhi

Nadie puede hacerlo todo, pero todos podemos hacer algo.

Foto: Dr. Mario Melgar