From Science to Field
Banana Case Study – Guide Number 5

Banana production under Integrated Pest Management and organic production criteria: the Canary Islands case study

Juan **Cabrera Cabrera**, ICIA, Spain
Estrella **Hernández Suárez**, ICIA, Spain
Ángeles **Padilla Cubas**, ICIA, Spain
María **del Carmen Jaizme Vega**, ICIA, Spain
Javier **López Cepero**, COPLACA/ASPROCAN, Spain

Banana crops in the agricultural landscape in the Canary Islands. © Juan Cabrera Cabrera, ICIA, Espagne

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Banana production in the Canary Islands

In the Canary Islands, commercial production of bananas started at the end of the 19th century and today it is the largest banana producing region in Europe. Banana production structures the agricultural landscape and supports the economy. The banana growers are mostly smallholders with less than one hectare and have profound knowledge of crop management in subtropical conditions. Unlike bananas produced in the humid tropics, bananas from the Canary Islands are not affected by *Mycosphaerella* diseases, but other pests and diseases do require sustainable control.

The need for further adjustments to promote sustainability

New European Community directives restricting the use of synthetic agrochemicals, protecting the environment, and preserving food safety and human health mean that technical knowledge needs to be updated to maintain the economic viability of banana farms. With the support of different administrations, the banana growers' association of the Canary Islands (ASPROCAN, Asociación de Organizaciones de Productores de Plátanos de Canarias) decided to promote controlled production, chosen to fit their production and trading systems, to comply with the new European standards. As a result, banana growers have now adopted various certifications such as AENOR (UNE 155202), GLOBALGAP, Integrated Production and Ecological Production, thus offering consumers a safer fruit of higher quality. At the same time, they aimed to satisfy environmental considerations as well as improving traceability and working conditions throughout their production and trading processes.

In the Canary Islands, bananas are produced mainly by smallholders. © Juan Cabrera Ca-brera, ICIA, Spain

Integrated production/ecological production

The combined use of adapted cropping practices and spraying with alternatives to conventional synthetic pesticides has already allowed some growers to meet the standards of integrated or ecological production. However, to extend such innovative strategies and promote sustainable production of high quality bananas, new tools must be refined, validated and then transferred to growers to ensure harmlessness for the environment, producers and consumers.

Inputs of exogenous organic matter

This traditional practice in the Canary Islands is regaining importance in both integrated and ecological production systems. Inputs of organic matter during land preparation or periodically to the banana crop maintain a well balanced soil for nutrients and biota. Various studies in the Canary Islands have shown that organic inputs improve the biological activity in the rhizosphere zone, thus increasing populations of arbuscular and mycorrhizal fungi, favouring plant growth, promoting rhizobacteria, actinomycetes and beneficial free living nematodes, and inducing better plant tolerance to biotic or abiotic stresses.

Inputs of organic matter are critical for the banana crop in the Canary Islands. © Juan Cabrera Cabrera, ICIA, Spain

Use of banana vitroplantlets

Widely used by producers, healthy banana plantlets developed through tissue culture considerably reduce the spread of pests and diseases through planting material in new plantations. They also facilitate periodic renewal of banana crops and allow alternative production systems to be introduced, such as one-cycle cropping systems, new plantation arrangements and new plantation densities.

Soil mulching with plant residues

Once planting has been completed, covering the soil surface with plant residues reduces soil warming and thus helps reduce nematode damage and slow weed colonisation, without requiring intensive herbicide use. In addition, mulching the soil with plant residues favours moisture retention and reduces water evaporation, thus decreasing the need for irrigation.

New plantation spacing: crop mechanisation

New plantation spacing with broad alleys allows many cultural practices to be mechanised and consequently helps rationalise crop management. These alleys enable spraying machines to pass and facilitate bunch harvesting. In addition, following harvest, machines can cross over the banana fields to slice and chop pseudostems, thus strongly perturbing the habitat of *Cosmopolites sordidus*.

Selective removal of leaves and floral remnants

Selective deleafing (dead leaves and green leaves obstructing the emerging inflorescence) along with the removal of floral remnants improves the control of insect pests and diseases such as *Dysmicoccus grassii* (Leonardi), *Thrips florum* (Schumtz), *Opogona sacchari* (Coger), *Aleurodicus sp.,* and *Verticillium theobromae* (Turconi).

New plantation spacing allows mechanisation to be introduced.
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Cropping under greenhouse conditions

In bananas cropped in greenhouses, plastic sheets that cover greenhouses strongly reduce UV radiation and prevent invasions by the white flies *Aleurodicus dispersus* (Russell) and *Aleurodicus floccissimus* (Martin *et al.*). They also slow the entry of owlet moths into the greenhouses.

Release of pest natural enemies and conservation of native auxiliary fauna

Inundative releases of natural enemies and protection of the native auxiliary fauna are helpful for managing banana pests in the Canary Islands. For example, biological control of the spider mite *Tetranychus urticae* (Koch) is successfully achieved by releases of the predatory mite *Phytoseiulus persimilis* (Athias-Henriot) (see photograph on following page). In-depth knowledge of the lifecycles and population dynamics of the organisms involved allows for rational and efficient management of these processes.

Use of pitfall traps with attractants

These types of traps are designed for monitoring and controlling insect pests. They can be used with an aggregation pheromone for population monitoring and for mass trapping within plots of the black weevil *Cosmopolites sordidus* (Germar). They maintain populations under acceptable levels for the crop, thus reducing or even removing the need to spray with the specific synthetic insecticides which are used against this pest. Also, traps with sexual attractants are deployed to monitor caterpillars of the moths *Chrysodeixis chalcites* and *Spodoptera littoralis.* Coloured sticky traps capture white flies (yellow traps) or thrips (blue traps). Sticky paper strips are also laid on pseudostems or on bunch stalks for delaying ant walking, as an additional means to control the cotton mealy bug.

Spraying with alternatives to synthetic pesticides

A variety of products replacing conventional synthetic pesticides are currently used in the Canary Islands, including Azadirachtin, *Bacillus thuringiensis*, oils, sulphur, potassium salts of fatty acids from plants, and microorganisms from soil microbial flora which are antagonists of plant parasitic nematodes. Various strains of entomopathogenic fungi native to the Canary Islands are also being tested against white flies and the black weevil. These alternatives are expected to help manage banana pests, and some are already undergoing accreditation.

***Phytoseiulus persimilis*, a predator of phytophageous spider mites.**
© Estrella Hernandez Suarez, ICIA, Spain

Adult white fly parasi-tized by the fungus *Paecilomyces fumosoroseus*.
© Ángeles Padilla Cubas, ICIA, Spain.

Widespread alternative cropping practices and control measures contributing to the reduction and rationalisation of synthetic pesticides in the Canary Islands

Cropping practices/control measures	Targeted pests	Reduction of :
Inputs of exogenous organic matter	Banana parasitic nematodes	Nematicides
Use of banana vitroplantlets	Banana parasitic nematodes *Cosmopolites sordidus*	Nematicides Insecticides
New plantation spacing/ drop-by-drop irrigation/crop mechanisation	All in general	Nematicides Insecticides Acaricides
Soil cover with dead or living mulch	Banana parasitic nematodes	Nematicides Herbicides
Removal of floral remnants (terminal tapered bud, bracts etc)	Thrips spp., *Opogona sacchari*, *Verticillium theobromae*	Insecticides Fungicides
Selective deleafing (green and dead leaves)	*Dysmicoccus grassii, Aleurodicus dispersus, Aleurodicus floccissimus*	Insecticides
Cropping under greenhouses - UV	White flies (*Aleurodicus* spp.), moths	Insecticides
Slicing and chopping of banana plant residues	*Cosmopolites sordidus*	Insecticides
One-cycle cropping systems	*Cosmopolites sordidus*	Insecticides
Spreading of calcium amendments around banana pseudostems	*Cosmopolites sordidus*	Insecticides
Use of pitfall traps with attractants	*Cosmopolites sordidus,* moths, thrips, white flies (*Aleurodicus* spp)	Insecticides
Inundative releases and protection of natural enemies	*Tetranychus urticae, Dysmicoccus grassii, Chrysodeixis chalcites, Spodoptera littoralis, Aphis gossypii, Aspidiotus nerii*	Acaricides Insecticides
Spraying with alternatives to synthetic pesticides	All in general	Insecticides Acaricides Nematicides

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Summary

Pioneers in the cropping of commercial banana in Europe, the growers of the Canary Islands have more than a century of experience in banana production. Combining new cropping technologies and traditional practices gives them the opportunity to maintain productivity. Good agricultural practices that preserve the environment have evolved rapidly. With the support of various administrations, the banana grower associations of the Canary Islands (ASPROCAN) decided to promote controlled production, making the choice to fit their production and trading systems to the new standards of the European Community. The combined use of a variety of cropping practices and of spraying with alternatives to conventional synthetic pesticides is currently allowing various growers to successfully crop bananas under the standards of integrated or ecological production. These strategies are reviewed in the present guide. Some of the new tools still need to be refined, validated and then transferred to growers, in order to produce bananas of high quality that are harmless for producers, consumers and the environment.

For further information, please contact >
Juan Cabrera Cabrera. ICIA: jcabrera@icia.es
Estrella Hernández Suárez. ICIA: ehernand@icia.es
Ángeles Padilla Cubas. ICIA: mpadilla@icia.es
María del Carmen Jaizme Vega, ICIA: mcjaizme@icia.es
Javier López Cepero. COPLACA/ASPROCAN: cepero@coplaca.org

ICIA, Instituto Canario de Investigaciones Agrarias, 38200 Apdo 60, Tenerife, Spain
Telephone: (+34) 922476300

About ENDURE

ENDURE is the European Network for the Durable Exploitation of Crop Protection Strategies. ENDURE is a Network of Excellence (NoE) with two key objectives: restructuring European research and development on the use of plant protection products, and establishing ENDURE as a world leader in the development and implementation of sustainable pest control strategies through:

> Building a lasting crop protection research community

> Providing end-users with a broader range of short-term solutions

> Developing a holistic approach to sustainable pest management

> Taking stock of and informing plant protection policy changes.

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Website and ENDURE Information Centre

www.endure-network.eu

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