Organic fertilizers for disease-resilient banana production

Project leader: Tomek de Ponti
Requested budget: Euro 36000
Countries: Costa Rica (main focus), Panama and/or Peru (data from those countries used)

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1 Motivation and project aims

1.1 Knowledge requirements for the target group

1) Does the application of the right amount of a well-balanced standardized (NPK ratios and other soil-enhancing substances) organic fertilizer contribute to controlling Panama disease and Black Sigatoka, by its contribution to soil health and resilience-enhancing growing conditions?
2) If so, is it economically feasible for plantation owners and/or individual (smallholder) farmers to purchase and apply these fertilizers, either by importing these or by the establishment of a local production facility?

1.2 Definition of the problem

Banana is one of the most important food crops in the world. Whereas in e.g. Europe banana is considered a fruit, in many countries it is one of the main staple crops. It is therefore a key crop in world food security. Simultaneously it is an important source of income for farmers and contributes to local, regional and national economies in banana-producing countries.
However, food security, income generation and the economies of banana-producing countries are at risk. Banana production is extremely vulnerable to disease outbreaks. Nearly all commercial banana plants are clones; genetically identical plants. Smallscale production uses a range of banana varieties but uses fewer inputs to control pests and diseases. Panama disease and Black Sigatoka are two of the major diseases that threaten banana production worldwide.

A lot of research effort is being invested in disease control. One of the areas which has not yet received as much attention is the role the organic (as opposed to mineral) fertilizers can play in disease control. And in particular the use of processed 'smart' organic fertilizers. The hypothesis is that the application of the right amount of a well-balanced standardized (NPK ratios and other soil-enhancing substances) organic fertilizer contributes to soil health and optimum growing conditions leading to enhanced crop resilience against diseases such as Panama disease and Black Sigatoka.

1.3 Aim(s) of the project

The aim of the project is to test the above hypothesis, both in the interest of banana producers, companies in the banana chain, and of the involved producer of organic fertilizers. And on the business side to determine if there is a good business case for the use of Ferm-O-Feed's organic fertilizers by banana producers (plantations and small-holder farmers) to increase crop disease resilience and overal productivity.

1.4 Target groups

Directly: Plantation owners and individual (smallholder) farmers. Indirectly: companies and traders in the banana chain.

1.5 Economic context

Banana production contributes to local, regional and national economies in banana-producing countries and in the worldwide banana production chain. At the same time it is an important source of income for individual farmers.
The control of major banana diseases, notably Panama disease and Black Sigatoka, and the loss of productivity as the result of disease outbreaks have a very significant economic effect on individual growers and on plantation owners. For instance in the Philippines, banana production is estimated to decline with 7% each year due to Panama disease. Moreover, the historical track-record of this disease is terrible; it wiped out the Gros Michel based export trade in Latin America in the previous century.
In Latin-America Black Sigatoka is already an affecting many banana cultivars, including the most widely used cultivar Cavendish. The Panama disease strains present in Latin-America are currently not yet affecting Cavendish varieties, while they do already affect non-Cavendish varieties. However, in other parts of the world there are already Panama disease strains present that do affect both Cavendish and non-Cavendish cultivars. It is generally believed that it is only a matter of time until these strains will also threaten Cavendish banana production in Latin America.
While the combined effect of Black Sigatoka and Panama disease is already a serious and costly problem in banana production in Latin America, the risk of an even more devastating economic impact in the future is very large.

Although the current project focuses on Latin America, its outcomes will also be useful for banana production elsewhere in the world, including those parts of the world where Cavendish-affecting Panama disease strains are already present. Thus the economic relevance both for large banana producers as well as smallholders across the globe is very large.

1.6 Economic Opportunities

The Dutch company Ferm-O-Feed offers a wide array of well-formulated, processed, standardized, and low-bulk (dry) organic fertilizers, both for use in conventional and in organic agriculture.
Chiquita, one of the leading companies in the banana production chain; TASTE (Technical Assistance for Sustainable Trade & Environment), a Dutch foundation / consultancy unit that acts as a service provider for small banana producers and promotes sustainable trade; Agrofair, a medium sized Dutch banana company, pioneer in fair-trade certified bananas, sourced from cooperatives and associations of small producers; and the National Banana Corporation of Costa Rica (Corbana), the national organization representing all banana producers in Costa Rica, have all expressed their interest in exploring the effectiveness of Ferm-O-Feed's organic fertilizers as a means of increasing crop resilience to Black Sigatoka and Panama disease.
If the product indeed proves effective at increasing the banana crops' resilience to Black Sigatoka and Panama disease and is cost-effective, this will create the following economic opportunities:

1) The use of organic fertilizer proves to be a cost-effective contribution to controlling diseases, increasing the overall profitability of the plantation/farm of plantation owners/farmers.
2) The above has a positive effect on the banana chain and on the local, regional, and national economies of banana-producing countries.
3) The threat of Black Sigatoka and Panama disease destroying large banana production areas, which otherwise have to be replanted or abandoned, is reduced, thus reducing economic risks to plantation owners and farmers, to other players in the banana chain, and to the local, regional, and national economies of banana-producing countries.
4) New economic opportunities are created for producers of organic fertilizers such as, but not limited to, Ferm-O-Feed. Not only in the countries in which this project will take place, but also in other banana-producing countries across the globe.
5) Positive results may also lead to the establishment of organic fertilizer plants in banana-producing countries, thus turning waste streams into valuable economic resources and contributing to the overall economy.

1.7 Economic Threats

1) The fertilizer product is not or insufficiently able to increase the banana crops' resilience to Black Sigatoka and Panama disease. There is no market for this product.
2) The product is effective, but the costs do not, under the current disease pressure, outweigh the benefits.
3) Another product / solution emerges that is better at controlling the diseases and/or cheaper. However, considering the large investments that have already been made in years past it is not likely that such a miracle solution/product will suddenly appear.

1.8 Desired expertise DLO (Wageningen UR):

1) Soil fertility expertise, designing and doing/coordinating the research to answer the above hypothesis.
2) Expertise on crop-pathogen interaction (phytopathology), to assess the effectiveness of using organic fertilizers to increase the crops' disease resilience.
3) Contributing to establishing whether there is a good business case for the use of Ferm-O-Feeds fertilizers by banana producers (plantations and small-holder farmers).

1.9 Expected results:

1) Scientifically based conclusions on the effectiveness of using well-formulated standardized organic fertilizers in enhancing crop resilience against diseases such as Panama disease and Black Sigatoka. (hypothesis proven or rejected)
2) Clarity whether there is a good business case for the use of Ferm-O-Feeds fertilizers by banana producers (plantations and small-holder farmers).
3) Commitment of consortium members to take the next step in collaboration and business. Depending on how the project will unfold, this may be in the form of a Letter of Intent (LOI), a first contract for delivery of the organic fertilizer to plantation owners and/or farmers' cooperatives, or further collaboration in another form aimed at uplifting barriers to business implementation.

2 Work plan

2.1 Approach and time schedule

The project 'Organic fertilizers for disease-resilient banana production' uses Costa Rica as a case-study for wider application of its results. Field trials are done to test the effect of organic fertilizers on resilience against Black Sigatoka and Panama disease.
Field trials are designed together with local partners, but at least include a Cavendish vs a non-Cavendish cultivar and a treatment with organic fertilizer, according to the matrix in table 1.

Table 1. matrix of field trials (e.g. COF = Cavendish with organic feritlizer)

	Cavendish	Non-Cavendish
With organic fertilizer	COF	NCOF
Without organic fertilizer	CNF	NCNF

At least one experiment is done, but options to repeat the experiment will be explored. At least one field trial with a *Cavendish* cultivar, assessing effect on resilience against *Black Sigatoka*. At least one field trial with a *non-Cavendish* cultivar, assessing effect on resilience against *Panama disease*. In addition a greenhouse trial under controlled conditions will be done at Wageningen UR to test the effect of the organic fertilizer on crop resilience to Panama disease.

Additional trials will be executed by partners in Peru and/or Panama. In those countries the field work will be done by local counterpart organizations (cooperatives in Peru, COOBANA in Panama) in line with the research protocol to be developed by Wageningen UR (as also applied in Costa Rica). Those data will be analysed together with the Costa Rican data by Wageningen UR.
No/limited business case development is envisaged in Peru and Panama within the scope of this project, but will be undertaken independently by partners in those countries.

A conceptual planning is provided in Table 2.

Table 2. General planning of activities.

	Jan.	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Inception phase and kick-off												
Designing field experiments												
Local organization												
preparation of experiments, including inputs												
Executing field experiments												
Greenhouse experiments												
Data analysis & Business case development												
Reporting & Dissemination												

2.2 Outputs

1) Concise technical report on effectiveness of using well-formulated standardized organic fertilizers in enhancing crop resilience against diseases such as Panama disease and Black Sigatoka.
2) Concise business plan, indicating whether there is business case for organic fertilizers in banana production in the context of disease control and overall performance of the crop.
3) Dissemination of technical and business potential via channels of the consortium.
4) Commitment of consortium members to take the next step in collaboration and business. Depending on how the project will unfold, this may be in the form of a Letter of Intent (LOI), a first contract for delivery of the organic fertilizer to plantation owners and/or farmers' cooperatives, or further collaboration in another form aimed at uplifting barriers to business implementation.

2.3 Dissemination to target groups

1) Presentation to target group in country/countries concerned in collaboration with local partners and consortium members.
2) Concise technical report including business case for *internal* (consortium) use.
3) Concise technical report including overall business case (without confidential information of consortium members) for *public* use, to be made available online.

3 Project organisation

3.1 Project team (Wageningen UR)

Name	Organisation	Role	Email address	Telephone No.
Tomek de Ponti	Environmental Sciences Group	Overall coordination	Tomek.deponti@wur.nl	+31-(0)6-22.090.147
Jetse Stoorvogel	Environmental Sciences Group	Design, coordination of trial Analysis of results Technical report	jetse.stoorvogel@wur.nl	+31-(0)317-484043
Hanneke Heesmans	Environmental Sciences Group	Design, coordination of trial Analysis of results	hanneke.heesmans@wur.nl	+31-(0)317-486497

Gert Kema	Plant Sciences Group	Technical report Phytopathology expertise Greenhouse trial	gert.kema@wur.nl	+31-(0)317-480632

All of the above team members will give input to the development of the business case. The lead for business case development, however, is with the other involved parties mentioned below.

3.2 Involved parties (besides Wageningen UR)

Name	Organisation	Role	Email address	Telephone No.
Dr. Jorge Sandoval	Corbana	Research director Field trials	jsandoval@corbana.co.cr	
Ing. Jorge Sauma	Corbana	General manager Coordinating input Corbana (business case Costa Rica)	JSauma@CORBANA.co.cr	
Dr Ronald Romero	Chiquita	R&D director Coordinating input Chiquita (field trials, business case Costa Rica)	rromero@chiquita.com	
Luud Clercx	TASTE	Senior consultant Coordinating input TASTE (field trials, business case Costa Rica)	luud.clercx@fairtaste.nl	+31 6 460 53 031
Hans-Willem van der Waal	AgroFair	Managing director Coordinating input AgroFair (field trials)	h.w.waal@agrofair.nl	+31 6 507 33 931
Peter Bakker	Ferm-O-Feed	Supplying organic fertilizers Expertise on those fertilizers Business case development	p.bakker@denoudengroep.com	+31 735431003

3.3 Monitoring and evaluation

During the kick-off workshop key performance indicators (KPI) are identified. The progress of the project is monitored against these KPIs and againt planning (see Table 2). Regular (skype) meeting secure timely identification of bottlenecks and actions to remedy possible delays in progress. Experimental data are published and stakeholder consultation is performed to assess acceptability of results among farmers.

4 Budget

Budgets 2014 (in Euros, including VAT/BTW)

Financial source	Budget
Project management and research costs	10000
Experimental design field trials (personnel costs)	3000
Field trials	5000
Greenhouse trial (all-in)	3000
Local partners costs	3500
International travel	5000
Inland travel	1000
Workshop/facilitation costs	2500
Transportation costs fertilizer	3000
Total	**36000**

Organic fertilizer will be supplied free of charge by Ferm-O-Feed, excl. transportation costs. Most work on business development is done by the partners listed under 3.2 and hence not specifically budgeted.

5 Summary

Banana is one of the most important food crops in the world. Simultaneously it is an important source of income for farmers and contributes to local, regional and national economies in banana-producing countries. However, banana-producing countries are at risk due to Panama disease and Black Sigatoka, which seriously threaten production, as nearly all commercial banana plants are clones. Organic (as opposed to mineral) fertilizers can contribute to disease control. The aim of the project is to test this hypothesis, both in the interest of banana producers, companies in the banana chain, and of the involved producer of organic fertilizers. And, on the business side, to determine if there is a good business case for the use of Ferm-O-Feed fertilizers by banana producers to contribute to controlling the diseases and improving the overal productivity of banana crops. The consortium that has formed represents many key players in the banana chain: Chiquita, TASTE (Technical Assistance for Sustainable Trade & Environment), Agrofair (FairTrade banana company), the National Banana Corporation of Costa Rica (Corbana), representing all banana producers in Costa Rica, and Ferm-O-Feed (organic fertilizers).

6 Project keywords:

Banana. Organic fertilizers. Disease control (Panama disease, Black Sigatoka). Business case. Producers. Plantation owners. Farmers. Traders. Chiquita. TASTE (service provider to producers). Agrofair (Fair-trade company). The National Banana Corporation of Costa Rica (Corbana; representing all banana producers in Costa Rica). Ferm-O-Feed.